Cat 7 Tanker

Appliance Operating Manual

(2003 to 2008 Models)

THE NEW SOUTH WALES GOVERNMENT

For use by driver/operators of
Category 7 Tankers in the
NSW Rural Fire Service

To be used in association with the:
RFS Rural Fire Driving (RFD) and
Equipment Officers (EQO) manuals

Recommended distribution:

One copy supplied with each tanker of this type
One reference copy to each District Operations Officer
Electronic copy on the www.MyRFS.nsw.gov.au website

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1. Foreword

Appliance Operating Manuals are designed to provide users of appliances (e.g. tankers and pumpers) in the NSW Rural Fire Service (RFS) with relevant technical information about driving and operating specific types of vehicles.

They are not the same as the equivalent vehicle owner's manual, pump or pump engine manufacturer's manuals, although there will be some overlap and much of the information in this manual is derived from them. Each Appliance Operating Manual only contains information likely to be of use in driving and operating the appliance in the RFS, whereas the others contain detailed information about many other items and about servicing above and beyond what would normally be conducted by RFS members.

Appliance Operating Manuals are not training manuals as such, but should be used in association with the relevant training publications, such as the *Rural Fire Driving* (RFD), *Operate Pumps* (AF/5) and *Equipment Officers* (EQO) manuals. In essence, training manuals are generic in nature while Appliance Operating Manuals are specific to particular types of appliances.

Training manuals are used to help learn how to drive, operate and maintain operational appliances in general, whereas Appliance Operating Manuals are to help familiarise members with the specifics of a particular type of vehicle. For example, the RFD training manual will suggest the engine oil level in all vehicles should be checked regularly, whereas the Appliance Operating Manual will tell you where and how to check the oil on a specific type of vehicle. The Operate Pumps training manual will explain how pumps and foam systems work in general, but the Appliance Operating Manuals will describe how to operate the specific type of pump and foam system fitted to a particular appliance.

Most of the information in the Appliance Operating Manuals has been gathered from technical material produced by the manufacturer of the vehicle, pumps, foam systems and other equipment involved. It has been 'filtered' by RFS staff to take out any unnecessary information so that the manual contains only information of direct operational relevance to appliance drivers and operators, but still provides a comprehensive reference.

Copies of Appliance Operating Manuals (when available) are supplied with new appliances and are available on the www.MyRFS.nsw.gov.au website.

2. General Information

2.1 – Purpose and Description

The Category Seven (Cat 7) Tanker is a four wheel drive, light multi-purpose appliance with a water tank in the 1000 to 1600 litre range, a firefighting pump with a nominal capacity of 300 litres per minute at 700 kPa, a gross vehicle mass (GVM) of approximately six tonnes, and may be supplied with either a single cab or a crew cab layout.

It is designed to convey a crew and equipment to the fireground and deliver water or foam using tank, open source or reticulated water supply. Its light weight and comparatively small size make it particularly suitable in areas with narrow and/or mountainous tracks, or in locations where bridge load limits or low clearances would preclude the use of larger appliances. It is less suitable for use where high water pumping rates (e.g. for village firefighting), large water tank capacity, or large equipment carrying capacity are needed.

The Cat 7 Tankers described in this manual are constructed on a Mitsubishi Canter, four wheel drive, diesel powered cab chassis, with a GAAM MK125 pump powered by a Ruggerini MD191 diesel engine and fitted with a Quenchmaster CP500 round-the-pump foam proportioning system.

Note: Some aspects of vehicle systems and firefighting equipment may vary from model to model and are detailed in the relevant sections of this manual. The exact engine model and other details may vary from time to time; check the pump, pump engine and vehicle owner's manuals issued with the appliance for specific details when needed.

2.2 – Weights and Dimensions

Height	2.70 metres (nominal, over crew protection spray)
Length	5.25 metres (single cab) and 6.15 metres (crew cab)
Width	2.10 metres (body 2.40 metres (mirrors)
Wheelbase	2.78 metres (single cab) and 3.38 (crew cab)
Turning Circle	13.1 metres (single cab) and 15.8 metres (crew cab)
Gross Mass	6.0 tonnes
Axle Loadings	2.6 tonnes (front axle) 4.3 tonnes (rear axle)

2.3 – Approval for Modifications

Modifications and additions must be considered and approved by the RFS Manager, Engineering Services, through a written application submitted through the RFS chain of command. Officers in charge of brigades and districts are to ensure this requirement is strictly observed. Failure to comply with this requirement may lead to unsafe overall vehicle weight or axle loading, or other issues that could seriously compromise the safe operation of the vehicle.

2.4 – Driver/Operator Familiarisation

Drivers of Cat 7 appliances must have at least a Light Rigid (LR) heavy vehicle driver's licence. Unless specifically exempted in the local district, persons driving Cat 7 appliances under operational conditions shall have RFS Rural Fire Driving (RFD) certification.

Prior to driving or operating a new type or model of RFS appliance under operational conditions, it is essential that the driver familiarise themselves with the systems, features, operation and limitations of the appliance.

Experienced persons may be able to do this quite quickly, especially if they have operated a range of different types of appliances in the past. However, drivers converting onto a 'new' type or model of appliance for the first time may need a more structured familiarisation process, and mentoring from an already experienced driver/operator.

As a guideline the familiarisation process should normally include:

- Studying the contents of this operating manual and the manufacturer's pump, pump engine and vehicle owner's manuals.
- Conducting a familiarisation 'walk-around' of the appliance.
- Sitting in the driver's position and becoming familiar with all features and controls.
- Driving the appliance under normal conditions, on and off road, day and night.
- Maneuvering the vehicle through simulated obstructions or in 'tight' locations.
- Participating in drills or exercises where the vehicle is positioned for operational use.
- Operating the vehicle's illumination, warning and protection systems.
- Operating the appliance pump using water from the tank, open and reticulated supply.
- Deploying and operating a representative range of equipment carried on board.

An evaluation of the driver's readiness to operate the appliance under operational conditions may be conducted during the above activities and may include:

- Questions relating to the systems, features, operation and limitations of the appliance.
- Demonstration of safe and effective driving of the appliance in typical conditions.
- Demonstration of safe and effective operation of the appliance's firefighting systems.
- Demonstration of typical checks, inspections and tests associated with the appliance.

Notes:

- 'Under operational conditions' means in direct association with activities at a fire, incident or prescribed burning activity.
- Conversion familiarisation onto a new type or model of appliance does not involve obtaining a new RFS qualification.
- The depth and duration of conversion familiarisation activities should be matched to individual needs.
- It is recommended that it be recorded as a local activity on training records.
- Persons mentoring or evaluating conversion familiarisation do not have to be qualified trainers or assessors, but need to be familiar with the appliance involved.

3. Vehicle Systems

3.1 – Cab Chassis

The appliance is based on a Mitsubishi Canter FG series, four-wheel drive, crew cab or single cab chassis. The crew cab version has a fixed cabin with panels to allow access to the engine bay. The single cab version has a 'tilt-cab' that can be tilted forward manually to expose the engine bay. The front of the vehicle is fitted with a brush protection bar which must to be tilted forward before tilting the cab forward.

When tilting the cab, the vehicle must be on level ground, the engine must be off, the gearshift must be in neutral, the hand brake must be applied (and the wheels preferably chocked), all loose items in the cabin should be removed or secured, the cabin must not be occupied, and all cabin doors must be shut. Check that no aerials or other fittings will interfere with tilting the cab. The brush protection bar must then be tilted forward manually after first undoing the securing eye-bolts on the front of the bar.

A two person lift (one on each side of the cab), should be used when tilting the cab. The cab tilting latch mechanism is located on the left hand side of the vehicle, just behind the cab. The cab can be unlatched by pulling the locking device with the left hand while raising the latch handle up fully with the right hand. While holding the cab grip with your left hand, pull on the locking lever with your right hand so that it releases. Then push the cab up slowly until it stops against the cab stay, and insert the safety pin into the cab stay.

Caution: Do not allow anyone to get under the cab until the safety pin has been inserted.

Before lowering the cab ensure all tools, rags and other items have been removed from the engine compartment and that there are no heavy items in the cabin or on the roof that may cause the cabin to lower too quickly. While holding the cab grip, remove the safety pin and return it to its stowage position. While supporting the cab, push the locking lever on the cab stay up to release it and lower the cab slowly. (Caution: Always lower the cab using the grip; do not use the handle.) Ensure the locking lever engages properly, then lower the latch handle down until it also locks into place. The brush protection bar should then be returned to its normal position and re-secured with the eye-bolts. The protection bar and the cab should be cross-checked by a second person to ensure they are locked in the correct position. Any items previously removed from the cabin should be returned to their proper stowage positions before the vehicle is operated.

The front vehicle recovery point is a hook located on the right hand side chassis rail. The rear recovery bar and pin system shall only be used for recovery purposes and only by personnel trained and qualified in recovery operations.

3.2 – Engine, Fuel, Oil and Cooling Systems

Early models of the vehicle are powered by a 4.2 litre, 4 cylinder, conventional diesel engine, developing a maximum torque of 305 Nm at 1800 RPM and a maximum net power of 85 kW at 3200 RPM. From 2003, vehicles are powered by a 3.9 litre, 4 cylinder, turbo-intercooled diesel engine, developing a maximum torque of 365 Nm at 1600 RPM and a maximum net power of 103 kW at 2900 RPM.

The vehicle's air cleaner should be checked regularly (at least daily during severe, dusty conditions). Depending on the model, a warning indicator may show on the air filter or a warning light may display on the instrument panel when the filter needs servicing. Refer to the Vehicle Owner's Manual for more details about air filter maintenance.

The fuel system consists of fuel tank fitted under the right hand side of the vehicle. Only diesel fuel should be used. An engine driven fuel pump supplies fuel to the engine fuel injection system via lines lagged to provide supplementary protection against unexpected fire exposure. The fuel level can be observed visually with the fuel cap removed or by checking the gauge on the driver's instrument panel. A water separator (filter) is fitted just forward of the fuel tank. It incorporates a red float that will rise with the water level, if water is present. If so, follow the instructions in the Owner's Manual.

The engine has a conventional lubrication system. The oil level can be checked by operating the oil level check button on the instrument panel when the engine is stopped. If the indicator light is 'green' the oil level is correct. If it is 'red' the oil level is low and needs to be topped up. Note: When the starter switch is 'on' the oil level lamp will show 'red' until the oil test button is pressed. Alternatively the oil level can be checked by means of the dipstick, accessible on the right hand side of the engine by tilting the cab or (in crew cab models) through the opening under the front passenger seat.

Oil should be topped up if the indicator light shows red when the check button is pressed or if the oil level is at or below the lower notch on the dipstick. Oil should be topped up with the grade of oil already used in the engine. If in doubt check with the local RFS district mechanic or Operations Officer. The Owners Handbook for the vehicle indicates the types of oil acceptable for use: A minimum of API classification CD oil should typically be used (CC is not acceptable) and a grade of SAE 15W-40 is usually recommended.

The engine uses a conventional liquid cooling system including a radiator fitted at the front of the engine bay. The recommended coolant is typically Fuso Diesel Longlife Coolant, an ethylene glycol based anti-freeze (SAE J814-C) and anti-corrosive, mixed with 'soft' water (do not use 'hard' water from wells or rivers) at a 30% concentration. The coolant level can be determined by visually checking the level indicated on the coolant surge tank in the engine compartment. If the coolant level is low, contact the local RFS district mechanic or Operations Officer. If they indicate for you to top up the coolant system, follow the instructions in the Owner's Manual for the vehicle.

Caution: Ethylene glycol based coolant is toxic and flammable. Keep out of reach of children and away from flames. Induce vomiting and seek medical attention if it is swallowed. If splashed in eyes, flush eyes with plenty of water for at least 15 minutes and seek medical attention. Follow the instructions in the relevant material safety data sheet.

Caution: When operating the appliance in stubble, or in dusty and ash laden areas, the radiator core can become blocked with foreign material, causing the vehicle's engine to overheat. To prevent this from occurring, regularly check the radiator core for any blockages during and after any such operations. If needed, hose the radiator (from the back to front) with a hose.

3.3 – Transmission and Driveline

The transmission is a Mitsubishi MO35S5 series five speed, direct drive, manual gearbox with synchromesh on 2nd to 5th gear, and a single reverse gear. The clutch is of single, dry plate design and operated hydraulically.

Caution: Do not double-shuffle when changing gears on vehicles with a synchromesh gearbox as it may lead to damage and voiding of warranty.

A two speed constant mesh transfer case provides for selection of high and low ratio gears and the selection of either two-wheel or four-wheel drive. The gearshift and range/drive selection levers are mounted to the left of the driver. The instrument panel contains indicator lamps that illuminate when 4WD and/or low range is selected.

The front axle has a rated capacity of 2.6 tonnes and is fitted with manually operated locking hubs. The hubs are locked by turning the control on the hub to the “Lock” position and unlocked by turning the controls to the “Free” position.

Caution: The hubs may be unlocked for protracted operations on hard surfaces, but the vehicle may be damaged if both hubs are not locked for four-wheel drive operations. RFS policy is that hubs must be engaged (‘locked’) at all times; the only exception being during long distance road deployments for ‘out of area’ firefighting or similar.

The rear axle has a capacity of 4.3 tonnes and has a single reduction drive through a Thornton Power-Lock Type, limited slip differential.

Caution: A limited slip differential may continue to drive with a broken axle. However, driving it with a broken axle will lead to serious damage to the differential and the vehicle must not be driven or towed until it has been inspected by appropriate mechanical maintenance personnel. Indications of a broken axle may include the vehicle pulling to one side under normal straight line acceleration or deceleration and unusual bumping or grinding sounds from the axle while the vehicle is moving.

The single front and dual rear 16 x 6.00GS-127-9T wheel rims are fitted with 7.50R16LT 114/112L Traction Tread tyres. A spare tyre is suspended from a carrier under the rear of the vehicle and can be removed by inserting the spare tyre handle into the carrier and turning it anti-clockwise to lower the spare tyre down. The normally recommended tyre pressures are: front 475 kPa, rear 300 kPa, and spare 475 kPa. Check the vehicle’s correct tyre inflation pressure sticker (usually positioned on the driver’s door frame).

Note: Correct tyre pressures are essential for good vehicle handling and safety: Check the vehicle’s tyre pressures regularly and have them topped up if needed.

Caution: Special safety precautions are required during wheel changing – refer to the Owner’s Manual for the vehicle for details.

3.4 – Steering and Braking Systems

A power assisted, integral ball and nut steering system is fitted. The vehicle has a turning circle of 13.1 metres (single cab) or 15.8 metres (crew cab).

A vacuum assisted, dual circuit, hydraulic braking system operates internally expanding brakes with two leading shoes, acting on all four wheels. The brake fluid level is indicated on the side of the reservoir tank on the right hand end of the instrument panel. If the level is at or below ‘MIN’, contact the local RFS district mechanic or Operations Officer. If they indicate for you to top up brake fluid reservoir, follow the instructions in the Owner’s manual for the vehicle.

Caution: Use of the incorrect brake fluid, or contamination of brake fluid, can result in a malfunction or serious damage to the braking system.

The braking vacuum assistance system consists of a vacuum tank located low on the right hand side of the vehicle behind the cab and a vacuum pump. A warning light will illuminate on the driver’s instrument panel if the vacuum falls below a safe level. If this warning illuminates, stop the vehicle as soon as possible and follow the directions given in the vehicle Owner’s Manual.

Caution: If attempting a stall recovery procedure, there may be insufficient vacuum to hold the tanker on a very steep grade. Stopping distance and required brake pedal pressure may be increased when the vacuum pressure is inadequate, Continuing to drive with a low vacuum warning illuminated may be dangerous.

The parking brake is mounted on the transmission and operates on the rear tail shaft. It is operated by a pull handle located to the left of, and below, the steering column.

Caution: The parking brake meets the Australian Design Rules requirements, but might not hold a fully laden tanker on a steep grade.

An exhaust brake system is also fitted as an aid for heavy braking and long downhill grades. It is an electro-pneumatic system operating a butterfly valve in the vehicle's exhaust pipe. The exhaust braking system may be selected on or off using a control on the left hand side of the steering wheel. When selected on, the exhaust brakes operate automatically when the accelerator is retarded. Note: The exhaust brakes will not operate while the vehicle is in neutral gear.

3.5 – Electrical and Ancillary Systems

Early model vehicles use a 24 volt electrical system. From 2003 a 12 volt system became standard. Current is supplied by two 12 volt, 65 amp-hour automotive batteries (connected in series in 24 volt systems, but in parallel in 12 volt systems), recharged by a 65 amp engine driven alternator.

The electrical system provides power for all normal vehicle electrical functions and lighting on the appliance body. A battery isolation switch is provided externally, behind the cab, on the right hand side of the vehicle. The main fuse panel is located in the vehicle's centre panel. 12 volt communications equipment is supplied by a 12 volt circuit drawing power from two 12 volt converters in vehicles with 24 volt systems.

In vehicles with a 24 volt system, a separate 12 volt electrical system is fitted to the pump system, comprising a 600 cold cranking amps, maintenance free battery, recharged by a 20 amp alternator driven by the pump engine. A 12 volt system isolation switch is provided at the rear of the pump tray area and fuses are located in the pump control panel.

In vehicles with a 12 volt system, the pump's electrical system is connected with that of the vehicle and has no separate isolation switch. This means it is possible to use the pump engine to charge the vehicle's battery. This might enable a battery not capable of starting the vehicle's engine to be charged up, to provide power for lights, radios and accessories without running the vehicle's main engine, and to allow the vehicle's engine to be switched 'off' and left parked in gear on a steep slope while using the pump engine to provide 12 volt power.

3.6 – Instrumentation Systems

The driver's instrument panel consists of the following gauges and warning lamps:

- **Speedometer and odometer** – indicates vehicle speed in kilometres per hour (kph) and distance travelled in kilometres (km), respectively.
- **Engine tachometer** – indicates engine rotational speed in revolutions per minute (rpm). The maximum permitted is 3200 rpm and maximum torque is delivered at 1800 rpm. The engine normally idles at 650-700 rpm. If the vehicle is to be idled for protracted periods, the idle speed should be increased to 1200 rpm.
- **Fuel gauge** – indicates the level of fuel in the vehicle's fuel tank. As the vehicle fuel tank also supplies the pump engine, it also indicates fuel remaining for its operation.
- **Water temperature gauge** – indicates the engine coolant temperature. Should the gauge enter the red overheating range (marked "H"), the vehicle should be stopped, the engine allowed to cool and the coolant levels checked.

- **Engine hour meter** – indicates time (in hours) that the engine has been operating.
- **Oil pressure/level warning lamp** – warns of low engine oil pressure and for checking the oil level. This lamp should illuminate when the ignition is switched on, but go out once the engine is started. If it illuminates when the engine is running, stop the vehicle and check the level of oil in the engine and the lubrication system for failure. The oil level can be checked by operating the oil level check button on the instrument panel when the engine is stopped. If the indicator light is 'green' the oil level is correct. If it is 'red' the oil level is excessively low and needs to be topped up. Note: When the starter switch is 'on' the oil level lamp will show 'red' until the oil test button is pressed.

  Caution: Running the engine with low oil pressure or a low oil level may lead to rapid and extensive engine damage.
- **Vacuum pressure warning lamp** – warns if the braking assistance system vacuum falls below a safe level. If this warning illuminates, stop the vehicle as soon as possible and follow the directions given in the Vehicle Owner's Manual.

  Caution: Stopping distance and required brake pedal pressure may be increased when the vacuum pressure is low, Driving with a low vacuum warning illuminated may be dangerous. Repeated rapid brake operation may cause a loss of brake vacuum even with the engine running; in such cases stop the vehicle until a satisfactory brake vacuum level is restored.
- **Charge warning lamp** – warns if the alternator is not charging the battery. This warning will normally be illuminated when the starter is switched on until the engine is running. If it illuminates when the engine is running, stop the vehicle and engine and check the fan belt and other parts of the alternator drive system.
- **Parking brake warning lamp** – warns if the parking brake is applied or the brake fluid level falls below the safe limit. If it remains illuminated after the brake fluid level has been checked as OK and the park brake fully released, stop the vehicle, pull off the road and perform the specified checks in the Vehicle Owner's Manual.
- **Fuel filter warning lamp** – warns if water is present above the acceptable limit in the fuel filter and needs to be drained. If it illuminates, stop the vehicle, pull off the road and contact the local RFS district mechanic or Operations Officer. If they indicate for you to drain the filter, follow the instructions in the Owner's manual for the vehicle.

3.7 – Driving Controls

The vehicle has conventional driving controls apart from exhaust brakes, an engine idling control and a warm-up switch. The exhaust brakes are described in section 3.4.

The engine idling control is mounted just to the right of the steering column. Pushing it in engages the automatic mode where it adjusts the idling speed so that it decreases as the engine coolant warms up. Pulling it out engages the manual mode in which turning the knob anti-clockwise decreases engine speed and turning it clockwise increases it.

The engine idle control should be used to increase rpm manually when the vehicle is stationery with warning lights and other electrical equipment operating for an extended period. Alternatively, in vehicles with a combined 12 volt vehicle/pump engine electrical system, the pump engine can be run to maintain sufficient power for such use.

Caution: The vehicle should not be driven with a high engine speed set on the idling control, as it will make controlling vehicle speed with the accelerator impossible.

The warm-up switch on the left side of the instrument panel allows rapid warming up of the vehicle's engine. Turning the switch 'on' shortly after starting increases the engine speed and operates the exhaust brakes, causing the engine to warm up faster than usual.

It also illuminates an indicator lamp on the panel. The system can be switched 'off' manually and will switch 'off' automatically once the coolant temperature rises sufficiently.

Caution: the engine should not be raced while it is still cold, otherwise excessive engine wear, and possible engine damage, may result

3.8 – Cabin Systems

Entry and exit from the cab should be assisted by using the foot plates and hand grips provided, while facing towards the vehicle. The cabin has adjustable seating and an adjustable steering column, and the driver should adjust them before moving the vehicle.

Seatbelts are fitted to all crew positions. These must be correctly adjusted and used whenever the vehicle is mobile, except for crew members operating in the work area during grassland firefighting operations as provided for in Fireground SOP 14.

A rear view mirror and external side mirrors are installed and should be checked/adjusted manually before operating the vehicle. Conventional controls are provided for windscreen wipers/washers, heating, ventilation, air conditioning and cabin lighting.

Central door locking and power window features are removed from RFS vehicles to reduce the risk of a malfunction at a critical time. Doors and windows are all operated manually using conventional handles/controls.

The (three litre) window washing fluid tank is behind the lower panel in front of the front passenger's position and the fluid level is visible through a window in the panel. Note: Do not substitute soapy water for window washing fluid as it will clog the washer nozzles.

Storage for small items is provided in glove compartments. Storage for vehicle tools is provided behind the seat (single cab) or under the rear seat (crew cab). Storage for fire protection blankets for all crew members is provided within the cabin.

4. Operational Systems

4.1 – Main Pump

The appliance is fitted with a GAAM MK125 single (1) stage centrifugal pump driven by a 0.85 litre, two cylinder, four stroke, Ruggerini MD191, air cooled diesel engine, delivering 13.2 kW at 3600 rpm. The oil level and air filter of the pump engine should be checked regularly; the latter especially should be checked in severe dusty conditions. Excessive black smoke from the pump engine exhaust may indicate that the air filter needs servicing. Refer to the Pump Engine Manual for more details about air filter maintenance.

The GAAM MK125 pump has a nominal performance of 325 litres per minute at 700 kPa. Its maximum flow is 600 litres per minute (at minimal pressure) and its maximum pressure is 1100 kPa (against a closed outlet). This makes it suitable for operating a hose-reel, pumping water via 25mm or 38mm hose lines, or supplying a 38mm triple action branch (director) or similar. However, it is not suitable for supplying 38mm fog nozzles (e.g. Akron Turbojet 1715, 1720 or similar) or larger size branches or hoselines.

The pump has an aluminium body, a bronze impeller and a stainless steel shaft. Shaft sealing uses carbon and ceramic wear faces and nitrile 'O' rings. The pump seals require no adjustment and use water as a lubricant.

The pump is fitted with a GAAM Series 500, manually operated diaphragm primer. An isolation valve is fitted to the priming system, which must be opened in order to operate the primer.

Caution: The pump must not be run dry as this will result in damage to the seals. When the pump is running with outlets closed, the 'tank recirc' position on the main foam system valve should be selected to facilitate pump cooling.

The pump panel is mounted on the right hand side of the rear pump bay area. Instruments on the pump panel include a (delivery) pressure gauge, a compound (inlet) pressure gauge, a tachometer (rpm), pump engine oil pressure and temperature gauges, an engine hour meter and an alternator/battery charge warning light. Controls on the pump panel include a pump engine ignition switch, starter button, a throttle, an engine stop switch, foam system controls, and pump engine electrical system fuses.

Caution: The pump gauges are designed to 'breathe' at the rear and water may render them inoperative. They must be protected from excess water, particularly water directed at them under pressure, during any cleaning of the pump area.

Fuel is supplied to the pump engine fuel injection system from the vehicle's main diesel fuel tank. If the fuel supply runs out, the fuel system can be reprimed using the electric fuel pump on the engine's fuel system when the ignition is turned on. The fuel system is self-priming and will bleed any trapped air out of the system while priming.

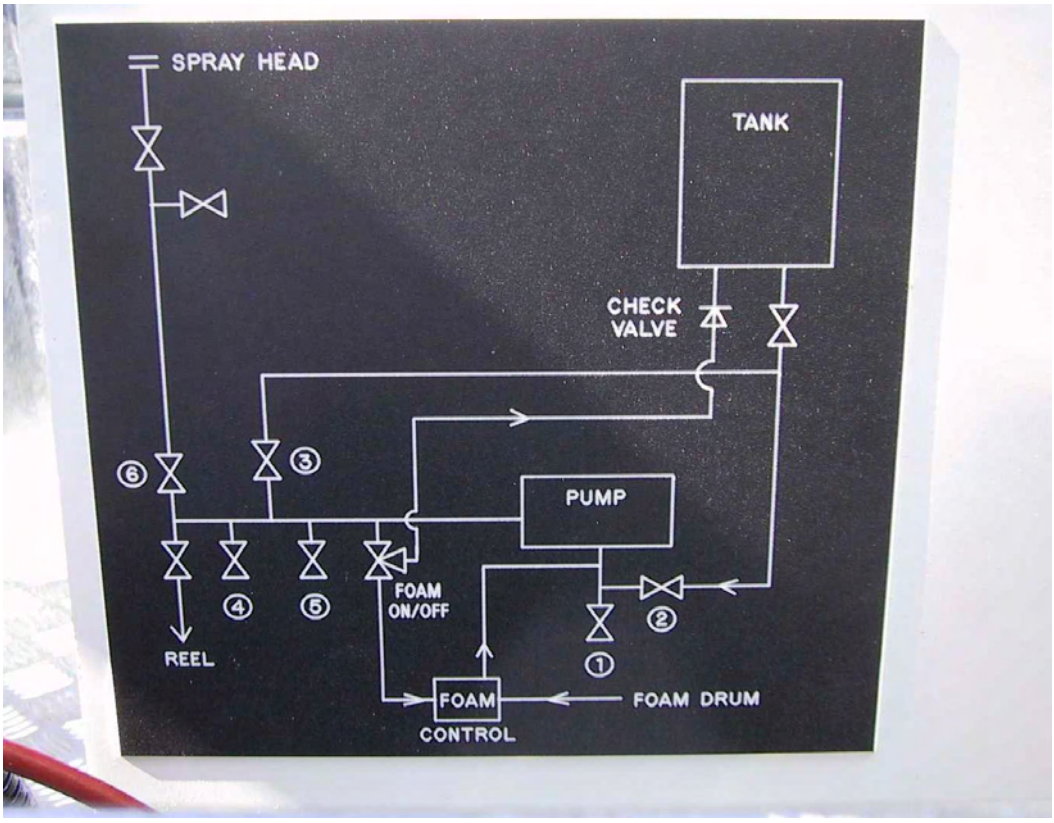
In vehicles with a 24 volt system, a separate 12 volt electrical system is fitted to the pump system, comprising a 600 cold cranking amps, maintenance free battery, recharged by a 20 amp alternator driven by the pump engine. A 12 volt system isolation switch is provided at the rear of the pump tray area and fuses are located in the pump control panel.

In vehicles with a 12 volt system, the pump's electrical system is connected with that of the vehicle. This means it is possible to use the pump engine to charge the vehicle's battery. This might enable a battery not capable of starting the vehicle's engine to be charged up, to provide power for lights, radios and accessories without running the vehicle's main engine, and to allow the vehicle's engine to be switched 'off' and left parked in gear on a steep slope while using the pump engine to provide 12 volt power.

4.2 – Water Reticulation System

The water reticulation system includes a galvanised water tank of about 1500 litres (single cab) or 1000 litres (crew cab) capacity (varies between models). It has one longitudinal and one lateral baffle, forming four baffled compartments to minimise tank water surge.

A typical Cat 7 Tanker pump control panel



A schematic diagram of typical Cat 7 Tanker water reticulation system

The water tank has a removable lid to allow access for tank cleaning and maintenance, and an isolation valve to allow cleaning of the strainer located under the tray frame. A water tank level sight gauge is fitted so as to be visible to the pump operator at the rear of the appliance. It is fitted with an isolation valve in case the sight tube develops a leak. In time it may become opaque or dirty; if so it should be replaced with new tubing.

The rear reticulation system includes a 65mm suction inlet and control valve, and a tank-to-pump supply line and control valve. Both of these are connected into the pump inlet (suction) manifold. The pump outlet (delivery) manifold supplies a 38mm delivery outlet, a 25mm delivery outlet, a 19mm hose reel, a tank fill/recirculation line, and a supply line running to the front reticulation system. Each of these is fitted with its own control valve.

The front reticulation system supplies water to a knapsack filling point under the tray on the left hand side of the appliance near the spare wheel, and to front wheel spray nozzles controlled by a valve low to the left of the driver in the cabin. The front reticulation system control valve is normally left 'open' to allow the sprays to be operated from within the cabin when needed.

A single 19mm hose-reel is fitted at the rear of the appliance. It contains 30 metres of 19mm hose fitted with a Dial-a-Jet nozzle. The hose reel is wound up manually using a crank handle normally stowed in a holder on the hose-reel. The hose is to be wound to and from the top of the reel (not from underneath). When stowed, the reel is to be in the locked position with the nozzle secured in the holder provided.

Note: The operating procedures for the pump, water reticulation system and foam system are given in section 5. See the appendices for a labeled diagram.

4.3 – Foam System

The pump is normally fitted with a GAAM Quenchmaster CP500 'round-the-pump' foam proportioning system, with most of its controls mounted on the pump control panel. It also includes a separate water recirc. / foam system 'on/off' valve that controls water flow into the system from the pump outlet manifold. When this valve is 'on', some of the water from the pump outlet flows through the foam system. There it induces foam concentrate into the water flow which is then fed back into the inlet side of the pump. When 'off', the water is recirculated back to the appliance's water tank instead of it going to the foam system.

Foam concentrate is drawn to the foam system through a supply hose from a 20 litre foam concentrate container located on the right hand side of the vehicle. Class A or a multi-purpose foam concentrate (e.g. FOREXPAN S) is typically carried. The container's cap needs to be vented during use; either by a small breather hole in the cap, or by loosening it a quarter turn. The foam concentrate container should be checked, topped up or replaced if needed, and the foam supply hoses and cap refitted correctly, after each use.

The foam system can proportion foam solution from 0.1% up to 6.0%, for rates of flow up to 400 litres per minute. To produce good quality foam, the pump delivery pressure must be in the 600-1000 kPa range. (Caution: Do not exceed 1000 kPa.) When set to 'Class A', proportioning is possible in the 0.1% to 1.0% range. When set to 'Class B', proportioning is possible in the 3% to 6% range. (The class selection valve controls water flow to the proportioner. The % valve controls foam concentrate flow to the proportioner.)

If using FOREXPAN S (or Bush Fire Fighting Foam) on bush or other class A material fires, use 0.1% for mopping up and 0.5% for general firefighting. If using FOREXPAN S on petrol or diesel (or similar) spillages or shallow spill fires, a 1% setting should be used.

In the unusual event of a Cat 7 tanker using NIAGARA foam on flammable liquid fires, use 1% proportioning for shallow petrol or diesel (or similar) spill fires, and 3% for severe flammable liquid fires, or fires involving alcohol or other flammable polar solvents.

Note: As in all 'round-the-pump' proportioning systems, the pump inlet pressure (on the compound gauge) must be no more than + 50kPa for the system to work effectively. This usually means that water needs to be drawn from either an open source or the appliance's tank. Water being supplied from a hydrant or delivered under pressure from another tanker directly into the pump will usually exceed 50kPa and prevent foam production.

Note: Ensure the foam (foam/recirc.) valve is moved to the fully 'on' position when foam is required. After using foam, set the foam % proportioning metering valve to 'off', (Note: leave the foam class control selected to Class A or B) and then flush all delivery lines until no foam remains in the system. Then select the foam valve to the 'off' ('tank/recirc') position. (Failure to follow this procedure may result in ineffective flushing and/or foam being pumped into the water tank.)

Note: Diagrams of the pump control panel and the water reticulation and foam systems are shown in section 4.2 and a labeled diagram is given in the appendices. Pump, water reticulation and foam system operating procedures are given in section 5.

4.4 – Portable Pump

The appliance carries a lightweight, portable pump (e.g. an 'Aussie Ultralight' powered by a 2 kW GXH50 Honda petrol engine). It can typically supply about 100 litres per minute at 350 kPa for nozzle operation, or about 200 litres per minute at low pressure for tank filling.

The pump is normally carried into position, set up and supplied with water from an open source, such as pool, dam or private water tank. Three lengths of 38mm suction hose and a suction strainer and float are carried on the appliance for use with it. The pump is usually 'self-priming'; that is, it will pump effectively once the pump case has been filled with water, usually by removing the top pump casing cap, pouring in water from a hose, bucket, helmet or other container until the pump is full, then replacing the cap. Caution: The pump should not be run dry.

Most pump engines will have an ignition switch, a choke and throttle controls, and a recoil start mechanism. Some engines (e.g. Honda GXH50) incorporate an 'Oil Alert' system that will stop the engine if it has insufficient oil or is positioned on a steep slope. The pump and engine should be operated and maintained according to the manufacturer's instructions. The air cleaner should be checked regularly especially in dusty conditions.

The fuel tank allows up to about 90 minutes of portable pump operation. A 10 litre jerry can of unleaded petrol and a funnel are usually carried on the appliance. Caution: The pump engine should not be refueled when it is hot or where ignition hazards are present.

4.5 – Communications Systems

The appliance is normally fitted with a vehicle mounted RFS network radio, fitted with an external speaker which can be switched 'on' from inside the cabin. Note: In some areas UHF-CB radios may be fitted.

The RFS radio is normally set to the local RFS channel, but is capable of communicating on all RFS channels, except those assigned for strategic use by senior officers. Depending on the channel selected, the RFS radio may operate on GRN (Government Radio Network – a trunked system), PMR (Private Mobile Radio – an RFS system using repeaters) or Simplex ('car to car') working. Some of the simplex channels are RFS only, while others allow shared communications with units of the NSW Fire Brigade, Ambulance, SES and Department of Health, if needed.

4.6 – Illumination System

Apart from the normal headlights, cabin and warning lights, the illumination system includes locker and pump lights, and flood lights mounted high on the front (2) and rear (1) work areas. The flood lights can be oriented in a wide variety of directions and left locked in a selected direction. Power to the locker, pump and flood lights is supplied via switches on the cabin centre console, and additional individual switches on each of the flood lights.

4.7 – Warning Systems

The appliance warning systems consist of rotating red and blue lights mounted on the top of the cabin, a flashing red light at the rear, flashing red and blue lights on the front of the vehicle and an electronic siren system providing 'wail' and 'yelp' tones. The warning systems should be used in accordance with RFS Fireground SOP #4.

The switches for the warning lights and the audible warning system are mounted on the cabin centre console. When the headlights are switched on, they will operate normally when warning lights and sirens are used. However, if the headlights are switched off, they (and/or other lights) will pulsate on and off when warning lights and sirens are used.

4.8 – Protection Systems

The appliance is fitted with a vehicle roll over protection system bar immediately behind the cabin, and emergency fire protection blankets in the cabin for all crew members. A vehicle spray system is fitted, consisting of a single spray outlet mounted above the front work area which applies water to the cabin and body of the appliance.

The spray protection system uses water pumped from the appliance tank and is activated by operating valves on the floor of the cabin near the driver's side while the pump is running. The spray system applies water at a rate of about 130 litres per minute at an optimum operating pressure of about 350-400 kPa. Its operating time with a full tank of water is therefore around 7 to 10 minutes, depending on the exact size of tank. Crew leaders and appliance operators should ensure sufficient water remains in the tank at all times to enable operation of the protection system for as long as is likely to be needed in the conditions prevailing at a fire. The system should be operated so that it provides protection during the impact phase of a fire overrun. Operating it prematurely may mean that the system will be out of water by the time the fire impacts.

Caution: Tanker spray systems provide supplementary protection only. They are unlikely to be successful in protecting a vehicle not located in a safe refuge area during extreme fire overrun conditions. They are not a guarantee of safety in the event of fire overrun and should not be relied upon as the sole means of controlling that risk. Safe operations are primarily ensured by planning and implementing operations in a manner that deliberately avoids the risk of fire overrun and by always using the LACES checklist.

4.9 – Stowage and Operating Areas

The chassis has been fitted with a galvanised steel section tray frame fitted with aluminium checker-plate floor panels. Removable metal side panels and lockers provide radiant heat protection for persons operating in the crew work area. The work area is accessible through doors and steps on both sides of the appliance. Crew members should not be in this work area when the vehicle is moving, except when fighting grassland fires in accordance with Fireground SOP 14.

Lockers have been provided on each side of the appliance for the storage of firefighting and ancillary equipment. A headboard locker at the front of the crew work area is used for the storage of suction hose. An auxiliary storage bin is fitted to the top of the water tank. This area should not be used to store items that may be damaged by water or by exposure to the open air or sunlight.

In the pump bay area, at the rear of the water tank, provision has been made for the storage of two (2) 10 litre jerry cans of fuel (drip-torch fuel and unleaded petrol), one (1) 20 litre container of foam concentrate, two (2) knapsack sprays (one either side of the vehicle), one (1) fire lighting driptorch, a fire extinguisher and a hydrant bar and standpipe.

The appliance's pump, water tank, hose-reel and foam system are described in earlier sections of this manual.

4.10 – Portable Equipment

The table overleaf indicates typical equipment allocation and stowage for a Cat 7 Tanker. The exact equipment carried is determined by the District Manager. It will vary from place to place depending on the nature of local fire risks.

For example, the number of 38mm hoses carried might depend on whether it was likely to be used only for tank filling, for relaying water, for firefighting adjacent to the vehicle, for property protection behind houses, or for both a supply line and a property protection line.

Note that:

- The "**Max**." column indicates a typical maximum load that should be carried. If this level of equipment is carried in total, the vehicle would be at its maximum GVM. To load it with any more weight of equipment would dangerously compromise the vehicle's stability, handling and safety. Other items of equipment may be carried, but only if items of an equivalent weight in similar storage locations are removed.
- The "**Typ**." column indicates the equipment that might be loaded on a vehicle in a fairly typical brigade in a village / rural area. It is not meant to specify exactly what should be carried, but to indicate what might be regarded as reasonably "typical".
- The "**Min**." column indicates the bare minimum acceptable equipment level to be carried. A typical remote rural brigade in a grassland area might carry the "Min." items, plus a few extra "Typ." items based on local needs.

Location	Equipment	Max.	Typ.	Min.
Cabin	• Logbook	**1**	**1**	
	• Fuel cards	**2**	**2**	
	• Binoculars	**1**	**1**	
	• Waterproof matches (boxes)	**2**	**1**	
	• Local access keys	**set**	**set**	
	• Weather instruments	**set**	**set**	
	• Fire danger/spread meters	**set**	**set**	**set**
	• Local maps / street directory	**set**	**set**	**set**
	• Grid roamer and compass	**set**	**set**	
	• Stationery kit (pens, report forms, notebook)	**set**	**set**	**set**
	• Fireground and Comms SOPs	**set**	**set**	
	• Pre-incident plans (PIPs) and hazmat cards	**set**	**set**	

Cabin (con't)	• T-Cards (incident management)	**set**	**set**	
	• Portable RFS fireground radios	**2**	**2**	
	• Global positioning system (GPS)	**1**	**1**	
	• Vehicle tool kit	**1**	**1**	**1**
	• Vehicle jacking kit	**1**	**1**	**1**
	• Tyre pressure gauge	**1**	**1**	**1**
	• Wet weather gear	**4**	**2**	
	• RFS fire protection blankets (dual / single cab)	**6/3**	**6/3**	**6/3**
Location	**Equipment**	**Max.**	**Typ.**	**Min.**
RH Side Locker	• Traffic warning triangles	**set**	**set**	**set**
	• Set of booster cables (jumper leads)	**set**	**set**	**set**
	• Wheel chocks	**2**	**2**	**2**
	• First aid kit (brigade)	**1**	**1**	**1**
	• Sunscreen SPF15+ (tubes)	**2**	**1**	**1**
	• Insect repellant (tubes)	**2**	**1**	
	• Safety vests (dual / single cab)	**6/3**	**2**	
	• Spare helmets	**2**	**2**	
	• Spare ear muffs	**2**	**2**	
	• Spare eye goggles	**4**	**2**	
	• Spare pairs gloves	**2**	**2**	
	• Surgical gloves (pack)	**1**	**1**	
	• Dust filter masks (pack)	**1**	**1**	
	• Rolls of toilet paper	**2**	**1**	
	• Barrier tape (rolls)	**1**	**1**	
	• Lightweight salvage tarpaulin	**1**	**1**	
	• General purpose tool kit	**1**	**1**	
	• Standard rope lines	**1**	**1**	
	• Torches c/w spare batteries	**2**	**2**	
	• Non-perishable day ration packs	**6/3**	**3**	
	• Drinking water (Min. 2 litres / person)	**12 L**	**6 L**	**6 L**
Location	**Equipment**	**Max.**	**Typ.**	**Min.**
Side Stowage Areas	• McLeod tools	**3**	**2**	
	• Portable pump	**1**	**1**	
	• Knapsack sprays	**1**	**1**	
	• 20 litre pails foam (Class A or Forexpan)	**1**	**1**	
Location	**Equipment**	**Max.**	**Typ.**	**Min.**
Pump Bay Area	• Standpipe	**1**	**1**	
	• Hydrant bar	**1**	**1**	
	• Fire lighting drip torch	**1**	**1**	**1**
	• 10 litre jerry can of drip torch fuel	**1**	**1**	**1**
	• 10 litre jerry can of unleaded petrol	**1**	**1**	
	• Extinguisher (9 Kg dry powder or foam)	**1**	**1**	

Location	Equipment	Max.	Typ.	Min.
LH Side Locker	• Rolled lengths of 25mm lay-flat hose	2	2	2
	• Rolled lengths of 38mm lay-flat hose	2	4	2
	• Rolled lengths of 65mm lay-flat hose	1	1	
	• Controllable nozzle for 25mm hose	2	1	
	• Controllable nozzle for 38mm hose	2	1	1
	• Foam branch for 25mm hose	1	1	
	• 65mm/38mm reducer (may be on standpipe)	1	1	1
	• 38mm/25mm reducer	1	1	
	• 38mm blanking cap	1	1	
	• Main pump suction float	1	1	1
	• Portable pump suction float	1	1	
	• Pinch bar	1	1	
	• Bolt cutters	1	1	
	• Coupling spanners	2	2	2
Location	**Equipment**	**Max.**	**Typ.**	**Min.**
Headboard Locker	• Main pump suction hose (65mm) - lengths	4	4	4
	• Main pump suction hose strainer - on hose	1	1	1
	• Portable pump suction hose (38mm)	3	3	
	• Portable pump suction strainer – on hose	1	1	
Location	**Equipment**	**Max.**	**Typ.**	**Min.**
Work Area Stowage	• Broom	1	1	
	• Shovel	1	1	
	• Large axe	1	1	
	• Brush hook or branch lopper	1	1	
	• Funnel (for fuel)	1	1	
	• 30 litre Esky cooler	1	1	
	• Traffic warning cones	3	3	
	• Short length of 19mm or 25mm hose	1	1	
	• Controllable nozzle for 19mm or 25mm hose	1	1	
	• Chain saw and kit (PPE, wedges, oil & fuel)	1		

Note**:** Some equipment may be stowed in different locations on some models of the appliance (e.g. McLeod tools may be kept in the Work Area Stowage in earlier models).

Caution: Unlike most vehicles, firefighting appliances spend most of their life in a fully laden condition. The total weight of the vehicle (GVM) is critical. The weight limit for each locker should not be exceeded and additional items cannot be carried without weight reduction in another suitable area. Do not place additional items on the tanker, particularly heavy items such as additional foam containers, without observing weight limitations.

(E.g. In the above example in the “Typ.” column the appliance is not carrying a chain saw, due it being carried on other appliances in the brigade, but is carrying two extra lengths of 38mm hose to enable a property protection line to be extended easily into back yards behind houses in the brigade’s locality. (i.e. The equipment carried has been varied slightly to take account of local needs, while still observing relevant weight limitations.)

5. Operating Procedures

5.1 – General

The appliance shall be driven and operated in accordance with the Australian Road Rules, the relevant manufacturer's instructions, the procedures given in this section, and the relevant RFS Standard Operating Procedures (SOPs), notably:

- Fireground SOP #4 En-route Procedures
- Fireground SOP #5 Approach and Size-Up
- Fireground SOP #11 Procedures for Specific Incidents
- Fireground SOP #12 Emergency Procedures
- Fireground SOP #14 Grassland Firefighting from Moving Vehicles
- Fireground SOP #16 Use of Water and Water/Chemical Mixes
- Fireground SOP #31 Use of Radio at Incidents
- Fireground SOP #40 Fireground Health Safety and Welfare
- Fireground SOP #42 Use of Fire Trails

Note: Drivers of Cat 7 appliances must have at least a current Light Rigid (LR) heavy vehicle driver's licence. Persons driving Cat 7 appliances under operational conditions (i.e. in direct association with activities at a fire, incident or prescribed burn) must have RFS Rural Fire Driving (RFD) certification, except in remote rural brigades (i.e. grassland, self-protection type brigades) or if members in the area have been specifically exempted from that requirement by the local district RFS Manager.

5.2 – Driving

Drive the vehicle as specified in the vehicle Owner's Handbook and RFS driving training material. Keep the fuel tank as full as possible at all times. Only diesel fuel should be used. Other types of fuel may cause damage to the vehicle.

Firmly drive the vehicle through each gear range, but do not either over-rev or labour the engine. Do not leave the vehicle idling for long periods of time. If the vehicle is required to be at idle for extended periods, use the vehicle's idling control to advance the engine speed to 1200 rpm, and return the engine speed to a normal idle before driving.

The vehicle is fitted with a limited slip differential. In a conventional differential, if one wheel is off the ground, applying power may cause that wheel to spin while no power is transmitted effectively to the wheel still on the ground. A limited slip differential provides positive drive to both wheels of the axle in which it is installed in such circumstances, but still allows differential rotation of the wheels when needed. This feature, however, may also allow a wheel to have drive when an axle is broken. Continuing to drive the vehicle with a broken axle will cause serious damage to the differential. The signs that could indicate a broken axle include:

- Under straight line acceleration and deceleration, pulling of the vehicle to one side.
- Unusual grinding or bumping sounds from within the axle while the vehicle is moving.

Confirmation may require a person to walk beside the vehicle while it is moving slowly. If any foreign noises are detected, the vehicle should be stopped, the matter reported to the officer in charge and the vehicle not driven or towed (except to remove it from the path of a more serious hazard) until inspected by maintenance staff.

The free wheeling hubs must be kept 'locked' at all times; the only exception being during long road deployments associated with 'out of area' firefighting or similar.

Vehicle recovery should only be undertaken by trained persons, either trained RFS personnel or suitably accredited contractors. The front recovery point is the chassis manufacturer's hook on the right hand chassis front rail. The rear recovery bar and pin system shall only be used for recovery and not for any other purpose.

5.3 – Pump Operation

The following tables detail the procedures for operating the pump and reticulation system in various modes of operation. Normally the valves should be set up so as to enable water to be pumped to the deliveries from the tank with the minimum possible fuss, as this is the most common mode in which the appliance is operated.

Caution: Hearing protection is needed if working very close to the pump (e.g. within about a metre) for extended periods (e.g. more than an hour per day, over multiple days).

A - OPERATING THE PUMP

STAGES	KEY POINTS
1. Start the engine	1. Pull ignition switch on (Warning light will illuminate) 2. Open throttle slightly 3. Push start button until engine fires 4. Adjust throttle to appropriate power setting
2. Shut down the pump	1. Decrease rpm to idle (Minimum 900 rpm) 2. Close delivery valve (s) 3. Pull stop control (Note: Ignition switch must still be 'on') 4. When the engine stops, set the ignition switch to 'off'
Note: When the pump is not in use, the reticulation system should normally be set to allow quick operation in the 'tank-to-pump' mode. The 'tank-to-pump' valve should be 'open', the foam system valve set to 'recirc' (foam off), and all other valves 'closed'. In most cases the pump will therefore already be primed with water gravity fed from the appliance tank. If not, prime the pump (open priming valve, operate primer until pump is primed with water (max 45 secs), then close priming valve.	

B - OPERATING FROM TANK WATER SUPPLY

STAGES	KEY POINTS
1. Set / check valves	1. Check suction valve closed 2. Check tank fill (pump-to-tank) valve closed 3. Check tank suction (tank-to-pump) valve is open
2. Start engine	See Table A above – Operating the Pump
3. Deliver water	1. Open required delivery valve/s 2. Adjust throttle to provide required pressure (consider optimum nozzle pressure, height and friction loss) 3. Monitor use of water using tank sight gauges
When pumping against closed outlets, ensure that cool water is circulating through the pump from and to the tank by ensuring the main foam system valve is set to 'tank recirc.'. Do not select the main foam system valve 'on' while pumping against closed outlets.	

C - OPERATING FROM HYDRANT WATER SUPPLY

STAGES	KEY POINTS
1. Connect supply	1. Locate hydrant (Ship standpipe for an underground hydrant) 2. Flush hydrant until water is clear, then close 3. Connect hose to hydrant 4. Connect other end of hose to appliance suction inlet
2. Supply water	1. 'Water On' at the hydrant (when pump operator is ready) 2. Fill the supply hose with water (but avoid 'water hammer') 3. Open suction valve * 4. Close tank suction (tank-to-pump) valve 5. Adjust throttle to supply required pressure * 6. Open/check required delivery valve/s
3. Shut down	1. Decrease to idle rpm 2. 'Water Off' at hydrant (gradually, to avoid water hammer) 3. Allow pressure to relieve through open deliveries 4. Close delivery valve/s
* Note: When changing from tank to hydrant supply, anticipate a sudden increase in delivery pressure as the extra pressure of the incoming water from the hydrant is added to the system. The throttle may need to be backed off and the suction valve opened gradually to avoid high pressures being transmitted to firefighters operating nozzles. Sudden increases in pressure (water hammer) may lead to nozzle operators being injured, or pump casings, hoses, hose clamps and pump seals being seriously damaged.	

D – OPERATING FROM OPEN WATER SUPPLY

STAGES	KEY POINTS
1. Position appliance	1. Choose a suitable area near the water source 2. Apply the parking brake and chock the wheels
2. Set up suction hose and strainer	1. Remove suction hose and strainer from appliance 2. Lay out and connect suction hose and strainer together 3. Ensure suction valve is closed and blanking cap removed 4. Connect suction hose to suction inlet 5. Use a rope line to support the suction hose/strainer 6. Lower the suction hose/strainer into position in the water
3. Prime the pump	1. Close tank suction (tank-to-pump) valve 2. Close all delivery (outlet) and tank fill valves 3. Open suction valve and priming valve 4. Operate primer until water flows constantly (max.45 secs) 5. Close the priming valve 6. Start the pump, if not already operating 7. Adjust pump pressure and allow water to flow or recirculate 8. If priming fails, repeat or use alternative priming techniques

D – OPERATING FROM OPEN WATER SUPPLY (continued)

4. Supply water	1. Identify and open required delivery valves 2. Adjust throttle to achieve and maintain required pressure 3. Monitor pressure readings and engine operation on gauges
5. Shut down supply	1. Reduce pump engine rpm to idle setting 2. Close delivery valves and then close the suction valve 3. Shut down the pump, if needed 4. Restore valve settings to pump from tank supply
* Note: If the appliance's tank is to be filled, open the tank fill valve. Ensure water is always circulating through the pump, do not run the pump 'dry'. Avoid filling the tank with dirty or contaminated water.	

E – PUMPING WITHIN A CLOSED WATER SUPPLY RELAY

- If acting as the first pump in the relay, refer to table 'C' or 'D', as applicable.
- Relay pumps should normally pump water out at about 700 kPa (delivery pressure gauge) and receive water in at about 100 kPa residual pressure (compound gauge).
- At a nominal friction loss of 100 kPa per length, the typical relay should have about six (6) lengths of hose between each pump.
- Friction loss can be minimised by using large diameter hose and/or multiple lines.
- Delivery pressure should be adjusted to take height loss or gain into account (as a rule of thumb, allow 10 kPa per metre of height difference between pumps).
- Pressure should <u>always</u> be increased gradually to avoid water hammer damage.
- Remain alert and be prepared to throttle back and shut down deliveries at any time

STAGES	KEY POINTS
1. Set up relay	1. Position the appliance in a suitable location 2. Deploy relay hose line/s from outlet/s to next relay appliance 3. Connect supply hose from previous relay appliance to inlet/s
2. Pump in relay	1. Start pump (Note: Recirculate tank water until relay pumping) 2. When ready, signal 'water on' to previous appliance in relay 3. Ensure supply hose line/s charge properly with water 4. Close tank suction (tank to pump) valve before water arrives 5. Open suction valve gradually as relayed water arrives 6. Monitor supply pressure and adjust supply if needed 7. Monitor the next appliance in the relay for signals 8. Supply water to the next appliance when it signals ready 9. Gradually increase throttle so as to pump at about 700 kPa 10. Monitor delivery pressure and adjust if needed or requested 11. Monitor pump, hoses and gauges and correct any problems
4. Shut down relay	1. Set throttle to idle and close delivery outlet/s 2. Signal 'water off' to previous appliance in relay 3. Relieve pressures, and close suction and delivery valves 4. Shut down pump, reset valves and make up equipment

5.4 – Foam System Operation

STAGES	KEY POINTS
1. Deliver water	1. Start the pump 2. Deliver water from tank supply or an open water source
2. Make foam	1. Check foam containers in place, connected and caps vented 2. Set main foam valve to the fully (foam) 'on' position 3. Select class of foam (use 'Class A' setting for FOREXPAN S) 4. Select required % proportioning rate 5. Maintain delivery pressure in the 600 to 1000 kPa range 6. Monitor foam production and level of concentrate supply 7. Turn foam % valve off if nozzles are shut down for a time
3. Shut down foam	1. Set foam % proportioning control to 'off' 2. Flush all lines until no foam is present 3. Re-set foam class valve to 'off'' 4. Re-set main foam valve to 'water' or 'recirc' 5. Shut down the pump, if needed 6. Replenish the foam concentrate supply, if needed

Note: "Round-the-pump' foam proportioning systems require a low pump inlet pressure to operate correctly. Effectively this means water for foam production can be from either tank supply or an open water source, but must not from a pressurised source such as directly from a hydrant or delivered directly into the pump from another tanker.

Note: If the lines are not flushed before changing the foam valve back to 'water' (or 'recirc'') after foam is used, foam may be pumped into the water tank through that valve.

Caution: Operating the foam system against closed pump outlets (e.g. when standing by as a fire is approaching) is not recommended. It will lead to excessive foam in the pump casing, and may cause over-heating of the pump (as water is not recirculating back to the tank when the main foam system valve is set to 'on'). This overheating may also vaporise the water/foam in the pump inlet, indicated by a sudden increase in pump speed (rpm) and loss of discharge pressure. In such circumstances:

- Pump engine speed (rpm) should be reduced immediately
- Check there is sufficient water in the tank to flush the pump
- Do not operate the primer
- Open the largest outlet fully without a hose attached (the foam should discharge and the pump should reprime itself with water from the tank).
- Close the outlet and observe that pressure in the hose line is restored
- Set the foam system percentage control to 'off' or '0%'
- Clear foam from the system
- Set the main foam system valve to 'off' ('tank recirc.')
- Do not use foam again until the cause of excessive foam has been determined.

5.5 – Portable Equipment Operation

Portable equipment carried on the appliance shall be operated as indicated in the relevant RFS Equipment Operating Procedure or, in the absence of a relevant procedure, in accordance with the applicable RFS training material and the manufacturer's instructions.

6. Maintenance Procedures

The maintenance procedures follow the four levels of preventative maintenance described in national fire service training material, namely:

Checks Consist of simple (e.g. visual) confirmations by suitable brigade members that items of equipment are ready for service.

Inspections Consist of a more detailed examination, by suitable brigade members, of equipment for its readiness for use, and for any wear or damage. It might sometimes also include actions like cleaning or lubricating items, but does not involve any detailed disassembly of components.

Tests Consist of operating items of equipment in a reasonably challenging way to ensure that they still perform to specification.

Servicing Consist of maintenance involving the disassembly of components of items of equipment and/or which requires actions to be done by a person with specific technical competence (e.g. an auto mechanic) and in accordance with the equipment manufacturer's instructions.

Note: "Inspections" as described above should not be confused with annual inspections of vehicles required for roadworthiness purposes.

Each RFS district should have a system for scheduling preventative maintenance, and prompting it to be done, reporting that it has been completed, and for reporting and/or repairing or replacing any defective equipment found.

The preventative maintenance specified for this appliance and its equipment is as follows:

6.1 – Checks

General Check

Should be done after use at an incident, and before (unless a short inspection has just been done) and after its use at a training session, operational exercise or similar activity:

- Vehicle positioned in suitable location (e.g. station/shed) and egress not obstructed
- Parking brake on, gearshift in 'neutral', and lights, accessories and ignition off
- Water tank full, pump controls 'off', and valves set to use water from the tank.
- Foam concentrate container full, and foam system valves 'off'
- Fuel levels (vehicle tank and in fuel containers) satisfactory
- Air filter warning indications (vehicle and pump engines)
- Condition and inflation of tyres (visual check only)
- All equipment on board and stowed securely
- General cleanliness (especially windscreen).

Note: If the vehicle needs to be washed, use only mild car washing detergent in warm water for cleaning (i.e. not harsh truck washing detergent). Rinse off with water and wipe down with a chamois. Do not wash the appliance in direct sunlight during hot weather.

6.2 – Inspections

Short Inspection

Should be done at least weekly in village brigades, but may be done less often in rural and remote rural brigades. The test drive is not necessarily required if the vehicle has already been driven a similar distance in preceding days:

Exterior	▪ Check body and chassis for damage. Check under for oil or water leaks. ▪ Check tilt cab / brush bar secure. Check windscreens / windows clean. ▪ Check for water (red float visible) in the fuel/water separator (filter). ▪ Check tyre pressures (incl. spare). Check tyres for wear / damage.
Cabin	▪ Position vehicle in suitable, level and safe location for running engine and pump (i.e. not inside station/shed or other poorly ventilated area). ▪ Check parking brake is 'on', gearshift is in 'neutral', and all lights, accessories and ignition switches are 'off'. ▪ Check cabin equipment (e.g. directory/maps, fire protection blankets and vehicle tools) and test radios and torches. ▪ Check hydraulic oil and engine oil levels (from within cabin only). ▪ Start vehicle, check instrument panel warning indications, and check operation of vehicle lights, wipers, washers and accessories. ▪ Switch locker lights and exterior flood light switches 'on'.
RH Side	▪ Inspect and re-secure equipment in RH side locker / external stowage.
Rear area	▪ Check pump for any obvious damage and check pump oil level. ▪ Check water tank full, pump controls 'off', and valves correctly set. ▪ Check foam concentrate container/s full, foam system valves are 'off'. ▪ Check standpipe / bar, extinguisher, drip torch and fuel containers. ▪ Check for water/contamination in the pump fuel filter bowl. ▪ Start pump and check operation of controls and gauges. ▪ Allow pump to idle during other checks with water recirculating to tank. ▪ Visually check pump, valves and plumbing for any leaks or damage. ▪ Inspect hose-reel hose, spindle and winder, test nozzle and re-secure. ▪ Run pump until warm, shut down and ensure valves are correctly set.
LH Side	▪ Inspect and re-secure equipment in LH side locker / external stowage.
Work area	▪ Inspect and re-secure equipment in area, and secure access doors.
Fwd locker	▪ Inspect portable pump and suction hoses and re-secure.
Test drive	▪ Advise Firecom of OIC, crew and other details regarding test drive. ▪ Test drive the vehicle (a minimum of 30 km is recommended). ▪ Check vehicle performance during normal driving conditions. ▪ Note any unusual sounds or abnormalities in operation or handling. ▪ Combine the test run with a training / familiarisation exercise if possible.
Clean	▪ Clean/wash the appliance, or relevant components of it, if needed.
Return	▪ Refuel and return the appliance to station/shed, and advise Firecom. ▪ Record the test drive in the vehicle log book. ▪ Record short inspection and report/correct any faults/problems. ▪ Conduct a general check and ensure appliance is ready to respond. ▪ Secure station/shed, as appropriate.

Full Inspection

Should be done at least monthly in village brigades, but may be done less often in rural and remote rural brigades. The test drive is not necessarily required if the vehicle has already been driven a similar distance in preceding days:

Short Insp.	▪ Carry out a short inspection, except for the 'Clean' & 'Return' sections.
Engine Bay	▪ Position vehicle in suitable, level location and switch off the engine. ▪ Place gearshift in 'neutral' and apply the parking brake. ▪ Check hydraulic oil and window washing fluid levels (top up if needed). ▪ Remove any loose items from the cabin; exit the cabin and close doors. ▪ Tilt the brush bar and the cab forward, and insert tilt cab safety pin. * ▪ Check engine oil level using dipstick (arrange for top up if needed). ▪ Check engine coolant level (arrange for top up if needed). ▪ Inspect all engine drive belts for tension, damage and wear. ▪ Inspect all wiring and cables for loose connections or damage. ▪ Inspect engine for loose or damaged hoses or components. ▪ Inspect radiator core is free of foreign material. ▪ Ensure engine bay is free of any tools, rags or similar. ▪ Restore cab / brush bar to normal position and check they are secure. ** Note: In crew cab vehicles (no tilting cab) carry out the relevant parts of the inspection using the engine access panels in the cabin.*
Tests	Carry out any tests or servicing of equipment that are due, such as: ▪ Replacing street-directories, maps or pre-incident plans (as needed). ▪ Replacing batteries in torches and radios (e.g. annual). ▪ Replacing 'stale' spare fuel in fuel containers if needed (e.g. annual). ▪ Pump and foam system operation tests (e.g. quarterly). ▪ Portable pump engine run and pump test (e.g. monthly). ▪ Inspection and pressure testing of hoses (e.g. annual). ▪ Inspecting, testing and servicing of knapsack sprays (e.g. annual). ▪ Arranging for replacement/servicing of extinguishers (e.g. annual). **Note:** These tests are usually scheduled so as to be spread out over the year, and/or ensure all equipment is fully serviceable before the beginning of the bush fire season each year.
Clean	▪ Clean/wash the appliance, or relevant components of it, if needed
Return	▪ Refuel and return the appliance to station/shed, and advise Firecom. ▪ Record the test drive in the vehicle record book, if appropriate. ▪ Record full inspection and report/correct any faults/problems. ▪ Conduct a general check and ensure appliance is ready to respond. ▪ Secure station/shed, as appropriate.

6.3 – Tests

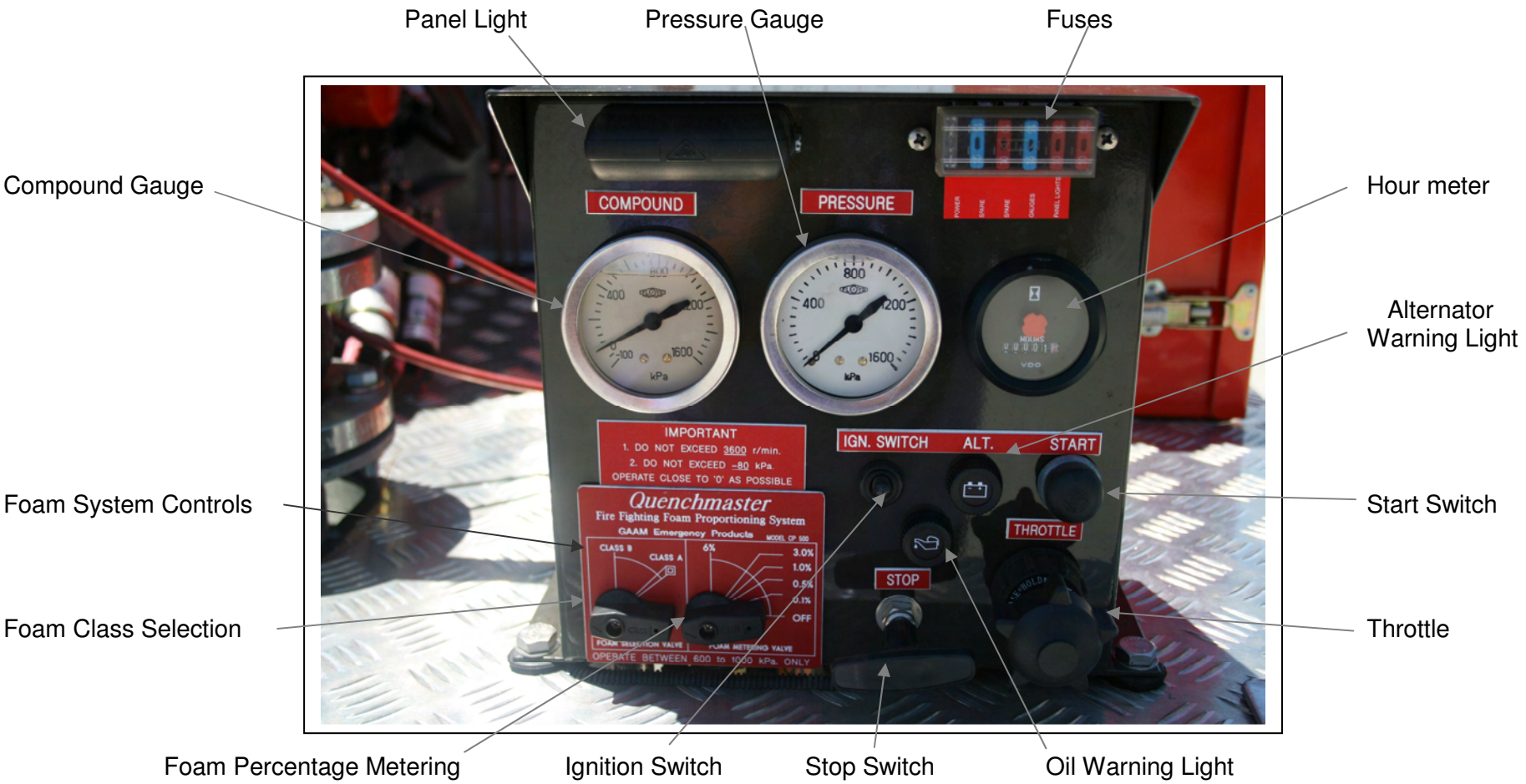
No tests are specified other than those already included in the preceding inspections. For information about tests for individual items of equipment refer to the relevant RFS Equipment Operating Procedure or the Equipment Officer's (EQO) Handbook.

6.4 – Servicing

The vehicle, pump and other powered equipment should be serviced as specified by the RFS (or as recommended by the manufacturer, if not specified by the RFS). See the Pump, Pump Engine, Portable Pump, Portable Generator and Vehicle Owner's manuals for more details. Servicing shall only be carried out by the local district RFS mechanic or Operations Officer, or a person, unit or organisation specifically authorised by them.

Appendices

Typical Pump Control Panel (models may vary)



Typical Water Reticulation System (models may vary)