
# Cat 1 Tanker

## Appliance Operating Manual

## (2003 to 2007 Models)

THE NEW SOUTH WALES GOVERNMENT

For use by driver/operators of
Category 1 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

Prepared by:

Learning and Development Systems
NSW Rural Fire Service
15 Carter Street
Homebush Bay NSW 2142

(Locked Bag 17
Granville NSW 2142)

Tel: 02 8741 5555, Fax: 02 8741 5195

Co-authored by:
Ian Hall – Engineering Services
Terry Brownlow – Engineering Services
Phil Robeson – Learning and Development Systems

# Contents

# 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

A Category One (Cat 1) Tanker is a four wheel drive, heavy, multi-purpose appliance with a water tank in the 3300 to 4000 litre range, a pump with a nominal capacity of either 600 or 1000 litres per minute, and a gross vehicle mass (GVM) of about thirteen tones.

Category One tankers come in three types:

- **Cat 1 Village** – crew cab – 4 lockers – fitted with a class 4 pump (e.g. MK300) – with option for fitting breathing apparatus (BA) locker with 2 BA sets and 2 spare cylinders.
- **Cat 1 Multi-Purpose** – crew cab – 4 lockers – fitted with a class 3 pump (e.g. MK253).
- **Cat 1 Grassland** – single cab – 2 lockers – fitted with a class 3 pump (e.g. MK253) – fitted with front grass sprays as standard equipment.

Cat 1 tankers are designed to convey a crew and equipment to the fireground and deliver water or foam using tank, open source or reticulated water supply. Its large size makes it particularly suitable for protracted and complex firefighting operations in suitable terrain, or operations requiring a large water tank capacity and/or large equipment carrying capacity.

The Cat 1 tankers described in this manual are constructed on an Isusu FTS 750, four wheel drive, diesel powered single or crew cab chassis, with either a GAAM MK253 or a GAAM MK300 centrifugal pump, powered by a separate 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.

Note: Some Cat 1 appliances may occasionally have been built on a different cab chassis (e.g. Hino). If so, specific information about the vehicle is not included in this manual.

## 2.2 – Weights and Dimensions

| | |
|---|---|
| Height | 3.20 metres (nominal) |
| Length | 7.80 metres |
| Width | 2.47 metres |
| Wheelbase | 4.25 metres |
| Turning Circle | 17.70 metres |
| Gross Vehicle Mass (GVM) | 13.0 tonnes |
| Max. Axle Loading | |
| - Front | 4.7 tonnes – (max oper. – Crew cab 4.42 t, Single 4.66 t) |
| - Rear | 9.2 tonnes – (max oper. – Crew cab 8.27 t, Single 7.65 t) |

## 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 1 appliances must have at least a Medium Rigid (MR) heavy vehicle driver's licence. Unless specifically exempted, persons driving Cat 1s 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 <u>not</u> 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 an Isuzu FTS 750 series, four-wheel drive, crew cab or single cab chassis. Both versions have a 'tilt-cab' that can be tilted forward to expose the engine bay. On single cab vehicles the tilting is done manually, on crew cab vehicles the tilting is electro-hydraulically powered.

Caution: The front of the vehicle is fitted with a brush protection bar which must to be tilted forward before tilting the cab itself forward.

Cab Tilting and Lowering (General Precautions)

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. The cab tilting mechanism is located on the left hand side of the vehicle, just behind the cab. Detailed instructions for tilting a (manual) single cab or a (powered) crew cab are given further below.

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. After lowering, the brush protection bar should 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 secured correctly before the vehicle is driven. Any items previously removed from the cabin should then be returned to their proper stowage positions before the vehicle is operated.

Manual Tilting and Lowering (Single Cab Models)

Manual tilting on single cab models is a 'two person lift' (one on each side of the cab). The person on the right hand side assists, while the person on the left hand side is to:

- Unlock the cab tilt lever by pulling out the lock pin and pulling the lever towards the ground.
- Pull the safety lever towards you while holding the assistant handle to prevent the cab from rising abruptly.
- Raise the cab up to the stop, check the cab stay is locked, and insert the lock pin into the hole. (The other person then double checks the correct positioning of the lock pin.)
- Caution: Do not allow anyone to get under the cab until the safety pin is inserted.

A similar two person operation is also used to manually lower a single cab, as follows:

- Unlock the cab stay while holding the lock lever with the hand.
- Pull the stay rearward so the cab begins to lower.
- Release the lock lever and lower the cab fully by holding the assistant handle.
- Lock the cab in place by pushing the tilt lever upwards and inserting a lock pin into the tilt lever. Double check that the lock pin is positioned securely.
- Ensure the tilt cab and the brush protection bar are correctly positioned and secured.

Powered Tilting and Lowering (Crew Cab Models)

Powered tilting on crew cab models uses an electro-hydraulic pump system, with controls mounted under the left hand rear side of the cab. It is performed as follows:

- Unlock the cab tilt lever by pulling out the lock pin and pulling the lever towards the ground. At this time a warning buzzer will sound.
- Turn the pump lever until it is held at the 'up' position. (Keep the lever in the 'up' position during cab tilting operations).
- Remove the tilt switch cover. Press the tilt switch until the cab stops moving up. (Note: The cab will stop rising if you stop pressing the tilt switch.)
- Caution: When moving under the cab after tilting, avoid touching the pump lever.
- Use the cab stay to support the cab.

To lower a (power-tilted) crew cab:

- Lift the cab slightly and remove the cab stay. At this time a warning buzzer will sound.
- Turn the pump lever until it is held at the 'down' position.
- Press the tilt switch until the cab stops moving down.
- Lock the cab in place by pushing the tilt lever upwards (the warning buzzer that has been sounding should now stop) and inserting a lock pin into the tilt lever. Double check that the lock pin is positioned securely.
- Ensure the tilt cab and the brush protection bar are correctly positioned and secured.

Note: If the electro-hydraulic system does not work, remove the boot on the right side of the pump lever. Insert a lever (such as a suitable size screwdriver) into the manual pump and move it up and down to operate the tilting mechanism.

Vehicle recovery hooks (normally coloured yellow) are located at the front and rear of the vehicle. They 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

The vehicle is powered by a 7.8 litre, 6 cylinder, overhead cam, turbo-intercooled diesel engine, developing a maximum torque of 668 Nm at 1500 RPM and a maximum net power of 164 kW at 2400 RPM.

The vehicle's air cleaner is located under the rear of the cab on the left hand side of the vehicle. It should be checked regularly (at least daily during severe, dusty conditions). Depending on the model, a red warning disc may show on the air filter duct indicator (on the rearward side of the filter) and/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 a 200 litre diesel 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 means of the dipstick, accessible on the right hand side of the engine under the cab, (normally just above and behind the batteries). Oil should be topped up if the 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 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 coolant is an ethylene glycol based anti-freeze and anti-corrosive fluid of a type specified in the Owner's Manual (or equivalent), mixed at a 30% concentration with 'soft' water (do not use 'hard' water from wells or rivers). The coolant level can be determined by visually checking the level indicated on the coolant surge tank on the right hand side of the chassis behind the cab. 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 an Isuzu MLD-6Q series six speed, (including overdrive), manual gearbox, with air assisted gear selection, synchromesh on 2$^{nd}$ to 6$^{th}$ gear, and a single reverse gear. The vehicle has a two speed transfer case, effectively providing twelve (12) forward and two (2) reverse gears. The clutch is of single, dry plate design and operated hydraulically with air assistance ('air over hydraulic').

The vehicle uses full time 4WD with a driver activated centre differential lock (used only for driving on slippery surfaces) and a no-spin differential on the rear axle. The gearshift selection lever is mounted to the left of the driver's leg. The centre differential lock and 'high-low' transfer case ratio selection switches are located on the centre dashboard to the left of the driver. 'Low ratio' is typically only used in difficult terrain.

The front axle has a capacity of 4.7 tonnes (maximum operational – crew cab 4.42 tonnes, single cab 4.66 tonnes). The rear axle has a capacity of 9.2 tonnes (maximum operational – crew cab 8.27 tonnes, single cab 7.65 tonnes) and is fitted with a no-slip differential.

Caution: A no-spin 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. Note: It is not unusual for a no-spin differential to unlock and relock with a loud bang when negotiating a very tight curve.

The single front and dual rear W22.5 x 7.50 eight stud wheels are fitted with 10R22.5-14PR tyres. (Note: These wheels are painted white and cannot be interchanged with older types of wheels, painted black, even for short periods of time.) 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 (normally from the left hand side of the vehicle) and turning it to lower the spare tyre down.

The recommended tyre pressures are: front 700 kPa, rear 675 kPa, and spare 700 kPa. Check the vehicle's correct tyre inflation pressure sticker (usually positioned on the left hand front door frame) for confirmation. Note: Correct tyre pressures are essential for good vehicle handling and safety: check them regularly and top up the pressure 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, recirculating ball type steering system is fitted. The vehicle has a turning circle of 17.7 metres.

An 'air over hydraulic', dual circuit, braking system acts on all four wheels. When the brakes are applied, illumination of a brake system indicator light warns if the system has leaks, or the hydraulic fluid level is low, or if there is excess clearance between the brake linings and drums.

Caution: The brake system warning light might indicate a serious brake system fault. If it activates, stop the vehicle immediately and follow the instructions in the Owner's Manual.

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 air assistance system includes air tanks and an air compressor located low on the right hand side of the vehicle behind the cab. A brake low air pressure warning light and buzzer activates if the braking assistance system pressure falls below a safe level. If this warning activates, stop the vehicle as soon as possible and run the engine at medium speed to increase the air pressure.

Caution: Repeated application of brakes could cause temporary lowering of air pressure. Continuing to drive with a low brake air pressure warning illuminated and/or warning buzzer sounding may be dangerous. Further loss of brake air pressure will also result in the parking brake being applied; and it will not be able to be released until sufficient air pressure has been restored. Loss of air pressure from a leak while a tanker is parked may result in the parking brake remaining 'on' until sufficient air pressure is achieved.

The parking brake operates on the rear wheels. It is operated by a knob located to the left of the driver's leg. The knob is operated by placing the left palm on top of it and squeezing the locking mechanism under the knob with two fingers of the same hand. The knob is then either pulled back (up) fully to engage the parking brake or pushed forward (down) fully to release it. Note: The parking brake control has two positions only and there is no 'proportional' control of the park brake.

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. Pressing either the accelerator or clutch pedal will also deactivate the exhaust brakes and releasing the pedal will reactivate the system.

## 3.5 – Electrical and Ancillary Systems

A common 24 volt, negative earth electrical system provides electrical power for the vehicle, the pump engine and the appliance's lighting systems.

Current is supplied by two 12 volt, 75 amp-hour automotive batteries (connected in series for 24 volts), recharged by a 90 amp vehicle engine driven alternator and a 40 amp pump engine driven alternator. (Note: A 90 amp alternator is fitted to RFS Cat 1s, instead of the standard 60 amp unit, due to their higher demand for electrical power.)

A battery isolation switch is provided externally, behind the cab, on the right hand side of the vehicle (normally under the batteries). The main fuse panel is located inside the vehicle's left hand side dashboard, accessible via a lid panel. The pump fuse panel is located on the pump control panel.

The pump engine alternator can be used to supply electrical power when the vehicle is stationary for long periods. Tests indicate that, when operating alone at a fast idle, it can provide sufficient electrical power for the simultaneous operation of all the appliance's lighting systems, except for the vehicle's headlights.

Note: In the event of batteries going flat it is likely that insufficient electrical power will be available to start the vehicle's engine. However, sufficient power may be available to start the pump engine. Running the pump engine at a fast idle for about five (5) minutes may provide sufficient battery recharging to enable the vehicle's engine to then be started.

## 3.6 – Instrumentation Systems

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

- **Speedometer and odometer** – indicates vehicle speed in kilometres per hour (kph) and distance traveled in kilometres (km), respectively. The speedometer is also fitted with a trip meter with a reset knob.
- **Engine tachometer** – indicates engine rotational speed in revolutions per minute (rpm). The red coloured zone indicates a critical engine speed.

  Caution: The vehicle should never be operated with RPM in the red zone.

  Note: If the vehicle is to be idled for protracted periods, the idle speed should be increased to about 1200 rpm.
- **Pressure gauge** – indicates the level of air pressure in the braking assistance system. Repeated rapid brake operation may cause a loss of brake air pressure even with the engine running; in such cases stop the vehicle and run the engine at a medium speed until a satisfactory pressure level is restored.

  Caution: Low air pressure may cause the parking brake to activate. Driving with a low brake air pressure warning light illuminated or buzzer sounding may be dangerous.
- **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.
- **Temperature gauge** – indicates the engine coolant temperature. Should the gauge enter the red overheating range (marked "H"), the vehicle should be stopped and the engine run at a fast idle until the temperature lowers to a normal level.
- **Engine hour meter** – indicates time (in hours) that the engine has been operating. It is normally located near the centre of the overhead brow in the cabin.

- **Oil pressure/level warning light** – warns of low engine oil pressure. This light 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.

  Caution: Running the engine with low oil pressure or a low oil level may lead to rapid and extensive engine damage.
- **Brake air pressure warning light and buzzer** – warns if the braking assistance system pressure falls below a safe level. If this warning activates, stop the vehicle as soon as possible and run the engine at medium speed to increase the air pressure.
- **Brake system indicator light** – when the brakes are applied, it warns if the braking system has leaks, or the hydraulic fluid level is low, or there is excess clearance between the brake linings and drums.

  Caution: This light might indicate a serious brake system fault. If it activates, stop the vehicle immediately and follow the instructions in the Owner's Manual.
- **Charge warning light** – 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, it indicates the generator system is malfunctioning.
- **Parking brake warning light** – warns if the parking brake lever is pulled up ('on') when the starter switch is 'on'. (Note that it indicates the parking brake lever position, not the application of the parking brake itself).
- **Air cleaner warning light** – warns if the engine air cleaner has become fouled. If it operates, the air cleaner needs to be serviced as indicated in the Owner's Manual.
- **Stop/tail light bulb warning light** – warns if the stop or tail light bulbs have failed.
- **Indicator lights** – The instrument panel is also fitted with a range of lights indicating the operation of turn indicators, exhaust brakes, centre differential lock engagement, high headlight beam and glow plug, and 'engine service due' and 'seat belts' reminder lights. (The seat belts light illuminates for four to eight seconds as a reminder for seat belts to be fastened. A buzzer will also operate if the driver's seat belt is not fastened.)

  Note: A bulb check button is located on the top left side of the instrument panel. Press and hold this button with the engine running to check operation of the indicator lights.

## 3.7 – Driving Controls

The vehicle has conventional driving controls apart from exhaust brakes, engine idling controls, and a centre differential lock. The exhaust brakes are described in section 3.4.

The engine idling controls are mounted low to the right of the steering column. A fast idle may be selected during warm-up by pressing the 'up' side of the switch. Before driving it should be reset to normal idling by pressing the 'down' side of the switch.

An idling control knob is also fitted. Turning the knob clockwise increases engine speed and turning it anti-clockwise decreases it. It should be returned anti-clockwise to the 'home' position before driving away after fast idling. The engine idling control knob should be used to increase rpm manually when the vehicle is stationery with warning lights and other electrical equipment operating for an extended period.

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.

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

The centre differential lock is operated by a switch on the centre panel to the left of the driver. It should be engaged ('on') when operating on slippery surfaces (e.g. mud, sand, snow or ice). To engage or disengage the differential lock, the vehicle must be at a complete standstill. Check the indicator light on the instrument panel for correct indication (it will illuminate when the differential lock is selected 'on'). Note that the turning circle of the vehicle will be greater when the centre differential lock is engaged 'on'.

Caution: Do not operate the differential lock switch while the vehicle is moving. Do not drive on hard surfaces with the differential lock engaged 'on' as it may cause wear and damage to the vehicle. Never have the vehicle towed or jacked up with the centre differential lock engaged 'on'.

## 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 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 windshield washing fluid tank is located under an external panel below the windshield. The front brush bar needs to be lowered to open it fully. The panel is opened by operating a release catch below the idling controls on the lower right hand side of the driver's instrument 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. It's normally recommended that vehicle tools are stored low in the lockers on the right hand side of the vehicle. If space is not available there, storage space for them may be available under crew seats. Storage for fire protection blankets for all crew members is provided within the cabin.

Between the driver and the front passenger seats is a centre console containing a pump on/off switch, pump start button, pump throttle control buttons, pump prime warning light, pump tachometer, rear (radio) speaker switch, work light switch, flood (spot) light switch, a stalk mounted map light, controls for the warning lights and sirens, and the appliance radio controls/microphone.

# 4. Operational Systems

## 4.1 – Main Pump

The appliance may be fitted with either a GAAM MK253 or MK300 pump. The unique features and performance of each are detailed under separate headings below. Both pumps have 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.

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.

Both the MK253 and MK300 pump engines use a 24 volt electrical system, connected with the vehicle's electrical system. See section 3.5 for more details. Fuses for the pump engine electrical system are located on the pump control panel.

An electric fuel pump supplies fuel to the pump engine fuel injection system from the vehicle's main diesel fuel tank. The fuel pickup for the pump is set higher in the fuel tank than the pickup for the vehicle's engine. If the pump runs out of fuel, the vehicle can still be driven a short distance to refuel.

If the pump engine fuel supply runs out, the fuel system can be reprimed using the electric fuel pump when the ignition is turned on. The fuel system is self-priming and will bleed any trapped air out of the system while priming.

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.

### GAAM MK253

The GAAM MK253 is a three (3) stage centrifugal pump, driven by two (2) cylinder, four stroke, air cooled, Hatz diesel engine, delivering up to 24 kW.

The GAAM MK253 pump has a nominal performance of 600 litres per minute at 1000 kPa. Its maximum flow is 1000 litres per minute at 100 kPa and its maximum pressure is 1200 kPa (against a closed outlet).

This makes it suitable for operating hose-reels, pumping water via 25mm, 38mm or 65 mm hose lines, or supplying two 38mm triple action branches (directors) or a 38mm fog nozzle, or similar. However, it is not suitable for supplying a ground monitor, 65mm fog nozzles, or more than one 38mm fog nozzle.

### GAAM MK300

The GAAM MK300 is a two (2) stage centrifugal pump, driven by a three (3) cylinder, four stroke, air cooled, Deutz diesel engine, delivering up to 36 kW.

The GAAM MK300 pump has a nominal performance of 1000 litres per minute at 1000 kPa. Its maximum flow is 1400 litres per minute at 150 kPa and its maximum pressure is 1400 kPa (against a closed outlet).

This makes it suitable either for operating hose-reels, pumping water via 25mm, 38mm or 65 mm hose lines, or supplying a small ground monitor, a 65 mm fog nozzle, or two 38mm or 65mm triple action branches (directors), or two 38mm fog nozzles, or similar.

### Priming Pump

Both pumps are fitted with a Hale ESP rotary vane electric priming pump operated by a pull handle mounted in the pump bay area, to the left of the main pump control panel. An isolation valve is fitted to the priming system, which must be opened in order to operate the primer. The primer should not be operated for more than 30 seconds at a time.

### Pump (Rear) Control Panel

The pump control panel is mounted on 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. (Note: Some pumps may also have a supplementary manual throttle mounted on the pump engine itself.)

Note: While the pump engine gauges are not marked with colour coded bands, pump operators should be alert for low oil pressure or excessively high temperature indications, (especially if associated with abnormal pump operation, smells or noises) and shut down the pump if imminent damage is suspected.

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.

### Pump (Cabin) Control Panel

The main pump can also be started and its throttle setting adjusted using controls on the centre console in the cabin. These include a pump on/off switch, pump start button, pump throttle buttons, a pump prime warning light (indicates if priming has been lost) and a pump tachometer. Note that it is not possible to observe pump pressures, open valves (apart from operating the emergency cabin spray and wheel protection spray systems) or operate the primer from within the cabin.

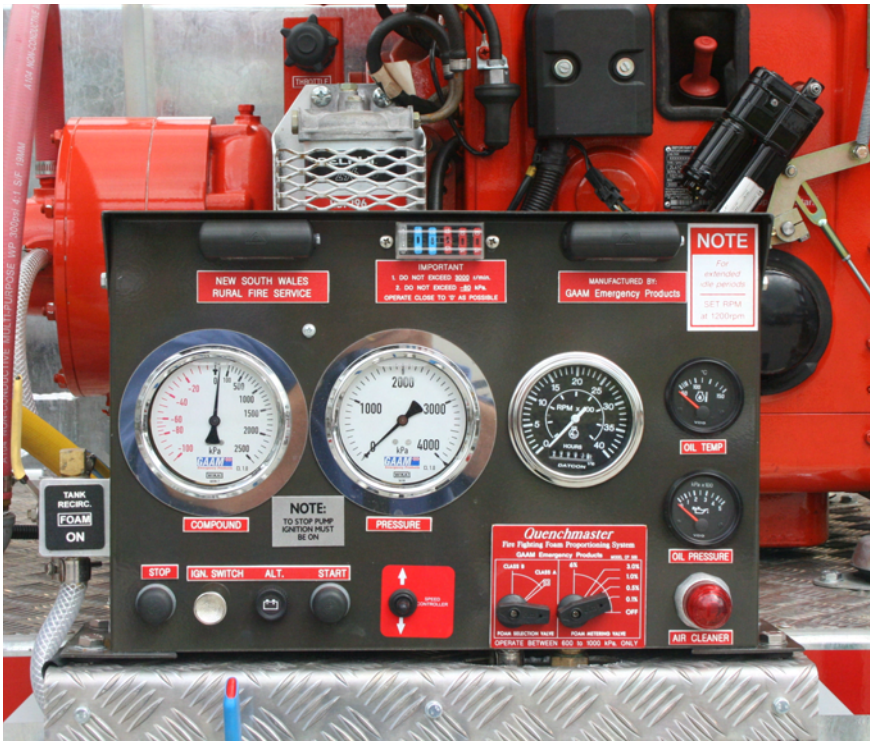
## 4.2 – Water Reticulation System

The water reticulation system includes a galvanised steel water tank of about 4000 litres (single cab) or 3300 litres (crew cab) capacity. It has one longitudinal and three lateral baffles, forming eight baffled compartments to minimise tank water surge.

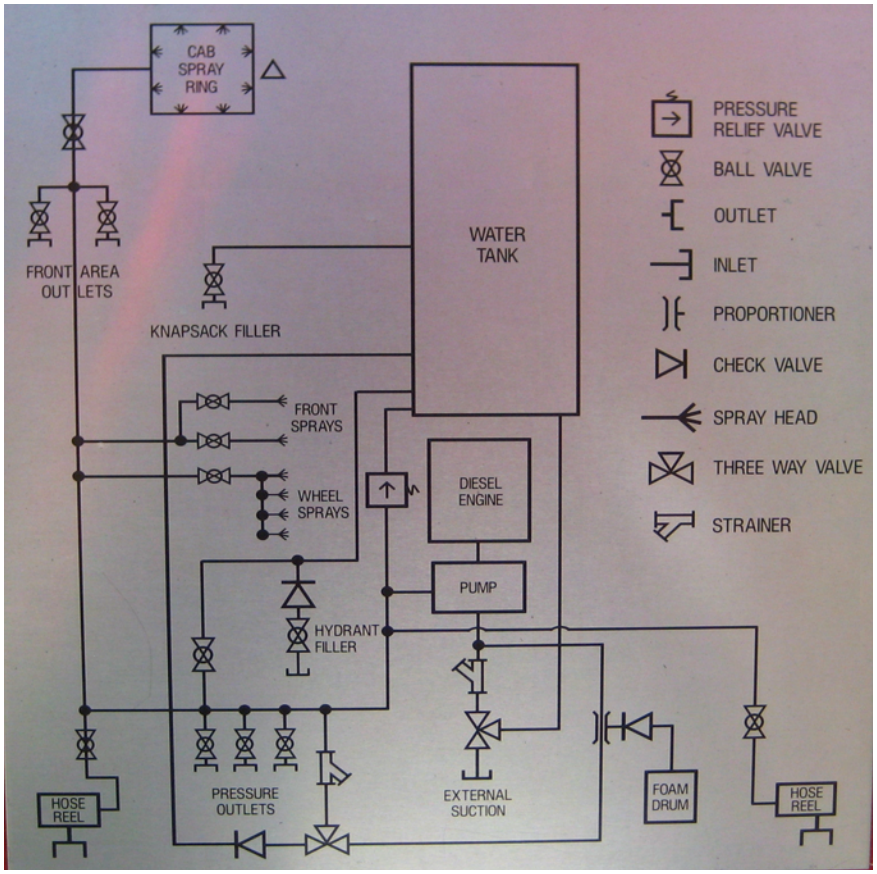
The water tank has a lid to allow top access to the tank and an isolation valve to allow cleaning of the strainer located under the tray frame. Water tank level sight gauges are fitted at the front and at the rear of the tank. They are fitted with an isolation valve in case the sight tube develops a leak. In time they may become opaque or dirty; if so they should be replaced with new tubing.

The reticulation system includes a 75mm pump inlet control valve connected into the pump inlet (suction) manifold. It enables water supply to be selected from either the tank or an external supply. A hydrant-to-tank inlet and control valve is also fitted to the right hand side of the pump area. The pump outlet (delivery) manifold supplies a 65mm delivery outlet, two 38mm delivery outlets, a 25mm hose reel and a 19mm hose reel (or two 19mm hose-reels on some models).

## A typical Cat 1 Tanker pump control panel




## A schematic diagram of typical Cat 1 Tanker water reticulation system



The 25mm hose-reel (if fitted on the left hand rear of the appliance) contains 50 metres of 25mm hose fitted with a fog nozzle or a Dial-a-jet nozzle. 19mm hose-reels contain 60 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 crank can be inserted into either the high or low socket 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. Hose-reels on some appliances may be fitted with a powered rewind mechanism consisting of an isolation switch and an operating button.

A supply line also runs to the 25mm outlets in the forward work area, and to the wheel and cabin spray systems. Their operation is controlled by valves low to the left of the driver in the cabin. A knapsack filling point is fitted under the tray on the rear left hand side of the appliance,

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 one of three 20 litre foam concentrate containers 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/s should be checked, topped up or replaced if needed, and the foam supply hose and caps 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.)

The ‘class selection’ valve controls water flow to the proportioner. The ‘% valve’ controls foam concentrate flow to the proportioner. 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.

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. If 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 (a) – Portable Pump

The appliance carries a lightweight, portable pump (e.g. an 'Aussie Quik-Prime' QP205S powered by a 4 kW, four stroke, GX160 Honda petrol engine). It can typically supply water at about 200 litres per minute at 350 kPa for nozzle operation, or at about 400 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. Do not place anything on top of the pump and operate it at least one metre clear of any walls to ensure adequate engine cooling. Operation for protracted periods at above ¾ throttle may lead to excessive engine wear.

Most pump engines will have an ignition switch, a choke and throttle controls, and a recoil start mechanism. Some engines (e.g. Honda GX160) incorporate an 'Oil Alert' system that will stop the engine if it has insufficient oil or is positioned on a steep slope. Use 4 stroke detergent oil only (SAE 10W-30 grade oil is recommended). 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 2 hours of portable pump operation. A 20 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.

## 4.4 (b) – Portable Generator

The appliance carries a Powerlite PH33RFS 3.3 kVA portable generator. It is driven by a 6.5 HP Honda petrol engine with a recoil start, and is capable of producing up to 2700 watts of 240 volt AC power.

Caution: The portable generator unit weighs about 40 Kg and require a multi-person carry. It should not be carried by one person alone.

The 3.6 litre fuel tank allows about 90 minutes of operation under a full load. A 20 litre jerry can of unleaded petrol and a funnel are usually carried on the appliance.

Caution: The generator 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, complete with external (rear) speakers which can be switched 'on' from inside the cabin by means of a switch on the centre console. Note: In some areas radios enabling communications with other organizations and/or UHF-CB may also 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 (2) work areas. The flood lights can be oriented in a wide variety of directions and left locked in a selected direction. Power to the work and flood (spot) lights is controlled by switches on the cabin centre console, and additional individual switches on each of the flood lights. A map light mounted on a flexible stalk is also fitted to the centre console

## 4.7 – Warning Systems

The appliance warning systems consist of rotating red and blue lights mounted on the top of the cabin and at the rear of the vehicle, 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 cab protection bar immediately behind the cabin, emergency fire protection blankets in the cabin for all crew members, wheel protection sprays and a vehicle cabin spray protection system. In early model vehicles the latter may have a single point spray nozzle. Later models will have multiple spray outlets discharging water directly onto critical areas of the cabin.

The wheel spray and cabin spray protection systems use water pumped from the appliance tank and are activated by operating valves on the floor of the cabin near the driver's side while the pump is running. The pump can be started and the throttle adjusted using controls and a tachometer mounted on the centre console in the cabin.

The cabin spray system applies water at a rate of about 140 litres per minute at an optimum operating pressure of about 350-400 kPa. The wheel sprays have a combined rate of flow of about 60 litres per minute. Used together they consume water at a total rate of about 200 litres per minute. The operating duration of the combined systems with a full tank of water is therefore around 15 to 20 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 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 accessible on the left hand side of the appliance at the front of the crew work area is used for the storage of suction hose.

Two auxiliary storage bins are fitted to the top of the water tank and holders are fitted for the storage of two axes. A combination ladder is normally secured on top of the lockers on the left hand side of the roof area. The open roof area should not be used to store items that may be damaged by water or by exposure to the air or sunlight.

Standpipes may be stored in two (2) holders, one on either side of the appliance, behind the cabin and just forward of the work area. Two (2) knapsack sprays may be stowed in holders on the left hand side of the appliance near the work area access point.

In or around the pump bay area at the rear of the water tank, provision has been made for the storage of two (2) 20 litre jerry cans of fuel (drip-torch fuel and unleaded petrol), three (3) 20 litre containers of foam concentrate, two (2) fire lighting drip torches, and two (2) fire extinguishers.

The appliance's pump, water tank, hose-reels 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 1 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 65mm hoses carried might depend on whether it was likely to be used only for tank filling, for supplying firefighting water from hydrants spaced 90m apart (typical of urban fringes), for supplying water from hydrants spaced 180m apart (typical of some country areas), or for both supply lines and heavy attack lines.

**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 (no BA). 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 |
| | • Stationery kit (pens, report forms, notebook) | set | set | set |
| | • Grid roamer and compass | set | set | |
| | • Fireground and Comms SOPs | set | set | |
| | • Pre-incident plans (PIPs) and hazmat cards | set | set | |
| | • T-Cards (incident management) | set | set | |
| | • Portable RFS fireground radios | 4 | 2 | |
| | • Global positioning system (GPS) | 1 | 1 | |
| | • RFS fire protection blankets | 6 | 6 | 6 |
| **Location** | **Equipment** | **Max.** | **Typ.** | **Min.** |
| RH Side Locker/s | • Vehicle tool kit | 1 | 1 | 1 |
| | • Vehicle jacking kit | 1 | 1 | 1 |
| | • Tyre pressure gauge | 1 | 1 | 1 |
| | • Main fire pump tool kit | 1 | 1 | 1 |
| | • Portable pump tool kit | 1 | 1 | 1 |
| | • Traffic warning triangles | set | set | set |
| | • Set of booster cables (jumper leads) | set | set | set |
| | • Vehicle tow rope | 1 | 1 | 1 |
| | • Wheel chocks | 2 | 2 | 2 |
| | • Sunscreen SPF15+ (tubes) | 2 | 2 | 1 |
| | • First aid kit (brigade) | 1 | 1 | 1 |
| | • Oxygen resuscitation kit | 1 | | |
| | • Wet weather gear | 6 | 2 | |
| | • Safety vests | 6 | 2 | |
| | • Spare helmets | 2 | 2 | |
| | • Spare ear muffs | 2 | 2 | |

| | | | | |
|---|---|---|---|---|
| **RH Side Locker/s (con't.)** | • Spare eye goggles | **4** | **2** | |
| | • Spare pairs gloves | **2** | **2** | |
| | • Surgical gloves (pack) | **1** | **1** | |
| | • Dust filter masks (pack) | **1** | **1** | |
| | • Insect repellant (tubes) | **2** | **1** | |
| | • Rolls of toilet paper | **2** | **1** | |
| | • Bolt cutters | **1** | **1** | |
| | • Halligan / Hooligan tool | **1** | | |
| | • Barrier tape (rolls) | **1** | **1** | |
| | • Lightweight salvage tarpaulin | **1** | | |
| | • General purpose tool kit | **1** | | |
| | • Standard rope lines | **2** | **1** | |
| | • Torches c/w spare batteries | **6** | **4** | |
| | • Non-perishable day ration packs | **6** | **5** | |
| | • Drinking water (Min. 2 litres / person) | **12 L** | **10 L** | **6 L** |
| | • Floodlights, leads and power boards | **set** | | |
| **Location** | **Equipment** | **Max.** | **Typ.** | **Min.** |
| **Side Stowage Areas** | • Standpipes | **2** | **2** | |
| | • Hydrant bars | **2** | **2** | |
| | • McLeod tools | **5** | **3** | |
| | • Portable pump | **1** | **1** | |
| | • Knapsack sprays | **2** | **2** | |
| | • Portable generator | **1** | | |
| | • 20 litre pails foam (Class A or Forexpan) | **3** | **3** | |
| **Location** | **Equipment** | **Max.** | **Typ.** | **Min.** |
| **Pump Bay Area** | • Fire lighting drip torches (2) | **2** | **2** | **1** |
| | • 20 litre jerry can of drip torch fuel (1) | **1** | **1** | **1** |
| | • 20 litre jerry can of unleaded petrol (1) | **1** | **1** | |
| | • Extinguisher (9 Kg dry powder) | **1** | **1** | |
| | • Extinguisher (9 Litre foam) | **1** | **1** | |
| **Location** | **Equipment** | **Max.** | **Typ.** | **Min.** |
| **BA Locker (if fitted)** | • Breathing apparatus (BA) sets (incl. DSUs) | **2** | | |
| | • BA Distress signal units (DSUs) | **2** | | |
| | • BA Operator hand torches | **2** | | |
| | • BA Operator guide lines | **2** | | |
| | • BA Spare air cylinders | **2** | | |
| | • BA control officer kit (BACO board, etc.) | **1** | | |
| **Location** | **Equipment** | **Max.** | **Typ.** | **Min.** |
| **LH Side Locker/s** | • Rolled lengths of 25mm lay-flat hose | **4** | **2** | **2** |
| | • Rolled lengths of 38mm lay-flat hose | **8** | **6** | **2** |
| | • Rolled lengths of 65mm lay-flat hose * | **4** | **4** | **2** |
| | • Controllable nozzle for 25mm hose | **2** | **1** | |
| | • Controllable nozzle for 38mm hose | **4** | **2** | **1** |
| | • Controllable nozzle for 65mm hose * | **1** | **1** | |
| | • Fog nozzle for 25mm hose | **2** | | |

| | | | | |
|---|---|---|---|---|
| **LH Side Locker/s (con't)** | • Fog nozzle for 38mm hose | **2** | **1** | |
| | • Foam branch for 25mm hose | **1** | **1** | |
| | • Foam branch for 38mm hose | **2** | **1** | |
| | • 25mm/25mm x 2 breeching | **1** | **1** | |
| | • 38mm/25mm x 2 breeching | **1** | | |
| | • 38mm/38mm x 2 breeching | **1** | **1** | |
| | • 65mm/38mm x 2 breeching * | **1** | **1** | |
| | • 65mm/65mm x 2 breeching * | **1** | | |
| | • 75mm/65mm reducer * | **1** | **1** | **1** |
| | • 65mm/38mm reducer * | **2** | **2** | **1** |
| | • 38mm/25mm reducer | **2** | **2** | |
| | • 25mm blanking cap | **1** | **1** | |
| | • 38mm blanking cap | **1** | **1** | |
| | • 65mm blanking cap * | **1** | **1** | |
| | • 75mm blanking cap * | **1** | **1** | |
| | • Coupling spanners | **4** | **4** | **2** |
| | ** Note: If fitted, a BA locker is usually on the RH side of the appliance. However, if fitted on the LH side, then 65mm hoses and associated equipment may need to be transferred to an extra RH side locker.* | | | |
| **Location** | **Equipment** | **Max.** | **Typ.** | **Min.** |
| **Headboard Locker** | • Main pump suction hose (75mm) - lengths | **4** | **4** | **4** |
| | • Main pump suction hose strainer - on hose | **1** | **1** | **1** |
| | • Port. pump suction hose (38mm) - lengths | **3** | **3** | |
| **Location** | **Equipment** | **Max.** | **Typ.** | **Min.** |
| **Work Area Stowage** | • Broom | **1** | **1** | |
| | • Shovel | **1** | **1** | |
| | • Large axes | **2** | **1** | |
| | • Brush hook | **1** | **1** | |
| | • Wheel chocks | **2** | **2** | **2** |
| | • Roof safety kit | **1** | | |
| | • Funnel (for fuel) | **1** | **1** | |
| | • 30 litre Esky cooler | **1** | **1** | |
| | • Traffic warning cones | **6** | **4** | |
| | • Traffic stop/slow signs | **2** | **2** | |
| | • Folding access ladder (180 Kg) | **1** | **1** | |
| | • Portable pump suction strainer/float | **1** | **1** | |
| | • Short lengths of 19mm or 25mm hose | **2** | **2** | |
| | • Controllable nozzle for 19mm or 25mm hose | **2** | **2** | |
| | • Chain saw and kit (PPE, wedges, oil & fuel) | **1** | **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 (typically 70 Kg) 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.

# 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 1 appliances must have at least a current Medium Rigid (MR) heavy vehicle driver's licence. Persons driving Cat 1 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 no-spin 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 no-spin differential provides positive drive to both wheels of the axle in which it is installed in such circumstances. 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.

Note: It is not unusual for a no-spin differential to unlock and relock with a loud bang when negotiating a very tight turn.

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)<br>2. Open throttle slightly<br>3. Push start button until engine fires<br>4. Adjust throttle to appropriate power setting |
| 2. Shut down the pump | 1. Decrease rpm to idle (Minimum 900 rpm) for ½ to 1 minute<br>2. Close delivery valve (s)<br>3. Pull stop control (Note: Ignition switch must still be 'on')<br>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 pump inlet (suction) valve should be set to use water from the tank, the foam system valve set to 'recirc' (foam off), and all other valves should be 'closed'.<br>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 pump inlet control valve set for 'tank to pump' supply<br>2. Check tank fill (pump-to-tank) valve closed |
| 2. Start engine | See Table A above – Operating the Pump |
| 3. Deliver water | 1. Open required delivery valve/s<br>2. Adjust throttle to provide required pressure (consider optimum nozzle pressure, height and friction loss)<br>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)<br>2. Flush hydrant until water is clear, then close<br>3. Connect hose to hydrant<br>4. Connect other end of hose to appliance suction inlet |
| 2. Supply water | 1. 'Water On' at the hydrant (when pump operator is ready)<br>2. Fill the supply hose with water (but avoid 'water hammer')<br>3. Set pump inlet (suction) control valve to external supply *<br>4. Adjust throttle to supply required pressure *<br>5. Open/check required delivery valve/s |
| 3. Shut down | 1. Decrease to idle rpm<br>2. 'Water Off' at hydrant (gradually, to avoid water hammer)<br>3. Allow pressure to relieve through open deliveries<br>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 pump inlet valve operated 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<br>2. Apply the parking brake and chock the wheels |
| 2. Set up suction hose and strainer | 1. Remove suction hose and strainer from appliance<br>2. Lay out and connect suction hose and strainer together<br>3. Ensure pump inlet valve is set to external supply and blanking cap removed<br>4. Connect suction hose to suction inlet<br>5. Use a rope line to support the suction hose/strainer<br>6. Lower the suction hose/strainer into position in the water |
| 3. Prime the pump | 1. Check pump inlet (suction) valve set to external supply<br>2. Close all delivery (outlet) and tank fill valves<br>3. Open priming valve<br>4. Operate primer until water flows constantly (max 45 secs)<br>5. Close the priming valve<br>6. Start the pump, if not already operating<br>7. Adjust pump pressure and allow water to flow or recirculate<br>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<br>2. Adjust throttle to achieve and maintain required pressure<br>3. Monitor pressure readings and engine operation on gauges |
| 5. Shut down supply | 1. Reduce pump engine rpm to idle setting<br>2. Close delivery valves and reset pump inlet (suction) valve<br>3. Shut down the pump, if needed<br>4. Check valves are reset 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<br>2. Deploy relay hose line/s from outlet/s to next relay appliance<br>3. Connect supply hose from previous relay appliance to inlet/s |
| 2. Pump in relay | 1. Start pump (Note: Recirculate water until relay pumping)<br>2. When ready, signal 'water on' to previous appliance in relay<br>3. Ensure supply hose charges properly with water<br>4. Open pump inlet (suction) valve gradually as water arrives<br>5. Monitor supply pressure and adjust supply if needed<br>6. Monitor the next appliance in the relay for signals<br>7. Supply water to the next appliance when it signals ready<br>8. Gradually increase throttle to pump at about 700 kPa<br>9. Monitor delivery pressure and adjust if needed or requested<br>10. Monitor pump, hoses and gauges and correct any problems |
| 3. Shut down relay | 1. Set throttle to idle and close delivery outlet/s<br>2. Signal 'water off' to previous appliance in relay<br>3. Relieve pressures, and close pump inlet and delivery valves<br>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<br>2. Deliver water from tank supply or an open water source |
| 2. Make foam | 1. Check foam containers in place, connected and caps vented<br>2. Set main foam valve to the fully (foam) 'on' position<br>3. Select class of foam (use 'Class A' setting for FOREXPAN S)<br>4. Select required % proportioning rate<br>5. Maintain delivery pressure in the 600 to 1000 kPa range<br>6. Monitor foam production and level of concentrate supply<br>7. Turn foam % valve off if nozzles are shut down for a time |
| 3. Shut down foam | 1. Set foam % proportioning control to 'off'.<br>2. Flush all lines until no foam is present<br>3. Re-set foam class valve to 'off''<br>4. Re-set main foam valve to 'water' or 'recirc'<br>5. Shut down the pump, if needed<br>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 or RFS 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
- Fuel and oil levels in portable pump and generator, if used
- 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**

Typically done weekly in village brigades, but may be less often in rural and rural remote brigades. The vehicle 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.<br>▪ Check tilt cab / brush bar secure. Check windscreens / windows clean.<br>▪ Check for water (red float visible) in the fuel/water separator (filter).<br>▪ Check tyre pressures (incl. spare). Check tyres for wear / damage.<br>▪ Check pump for damage, correct valve settings and pump oil level.<br>▪ Check / top up hydraulic oil, coolant and engine oil levels.<br>▪ Check / top up windscreen washer fluid level. |
| **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).<br>▪ Check parking brake is 'on', gearshift is in 'neutral', and all lights, accessories and ignition switches are 'off'.<br>▪ Check cabin equipment (e.g. directory/maps and fire protection blankets) and test radios.<br>▪ Start vehicle, check instrument panel warning indications, and check operation of vehicle lights, wipers, washers and accessories.<br>▪ Switch locker lights and exterior flood light switches 'on'. |
| **RH Side** | ▪ Inspect and re-secure equipment in RH side lockers / external stowage. |
| **Rear area** | ▪ Check water tank full, pump controls 'off', and valves correctly set.<br>▪ Check foam concentrate container/s full, foam system valves are 'off'.<br>▪ Check extinguishers, drip torches and fuel containers.<br>▪ Check for water/contamination in the pump fuel filter bowl.<br>▪ Start pump from rear panel and check controls and gauges.<br>▪ Allow pump to idle during other checks with water recirculating to tank.<br>▪ Visually check pump, valves and plumbing for any leaks or damage.<br>▪ Inspect hose-reel hoses/spindles/winders; test nozzles and re-secure.<br>▪ Run pump until warm, shut down and ensure all valves are correctly set. |
| **LH Side** | ▪ Inspect and re-secure equipment in LH side lockers / external stowage, including portable generator and portable pump fuel and oil levels. |
| **Work area** | ▪ Inspect and re-secure equipment in area, and secure access doors. |
| **Fwd locker** | ▪ Inspect suction hoses and re-secure. |
| **Test drive** | ▪ Advise Firecom of OIC, crew and other details regarding test drive.<br>▪ Test drive the vehicle (a minimum of 30 km is recommended).<br>▪ Check vehicle performance during normal driving conditions.<br>▪ Note any unusual sounds or abnormalities in operation or handling.<br>▪ Start, check operation and shut down pump using cabin centre console.<br>▪ 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.<br>▪ Record the test drive (and any comments) in the vehicle log book.<br>▪ Record short inspection and report/correct any faults/problems.<br>▪ Conduct a general check and ensure appliance is ready to respond.<br>▪ Secure station/shed, as appropriate. |

## Full Inspection

Should be done at least monthly in village brigades, but may be less often in rural and rural remote 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.<br>▪ Place gearshift in 'neutral' and apply the parking brake.<br>▪ Remove any loose items from the cabin, exit cabin and close doors.<br>▪ Tilt the brush bar and the cab forward, and insert tilt cab safety pin. *<br>▪ Inspect all engine drive belts for tension, damage and wear.<br>▪ Inspect all wiring and cables for loose connections or damage.<br>▪ Inspect engine for loose or damaged hoses or components.<br>▪ Inspect radiator core is free of foreign material.<br>▪ Ensure engine bay is free of any tools, rags or similar.<br>▪ Restore cab / brush bar to normal position and check they are secure. |
| **Tests** | Carry out any tests or servicing of equipment that are due, such as:<br>▪ Replacing street-directories, maps or pre-incident plans (as needed).<br>▪ Replacing batteries in torches and radios (e.g. annual).<br>▪ Replacing 'stale' spare fuel in fuel containers if needed (e.g. annual).<br>▪ Pump and foam system operation tests (e.g. quarterly).<br>▪ Portable pump engine run and pump test (e.g. monthly).<br>▪ Portable generator engine run and test (e.g. monthly).<br>▪ Inspection and pressure testing of hoses (e.g. annual).<br>▪ Inspecting, testing and servicing of knapsack sprays (e.g. annual).<br>▪ Arranging for replacement / servicing of extinguishers (e.g. annual).<br>**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.<br>▪ Record the test drive in the vehicle record book, if appropriate.<br>▪ Record full inspection and report/correct any faults/problems.<br>▪ Conduct a general check and ensure appliance is ready to respond.<br>▪ Secure station/shed, as appropriate. |

## 6.3 – Tests

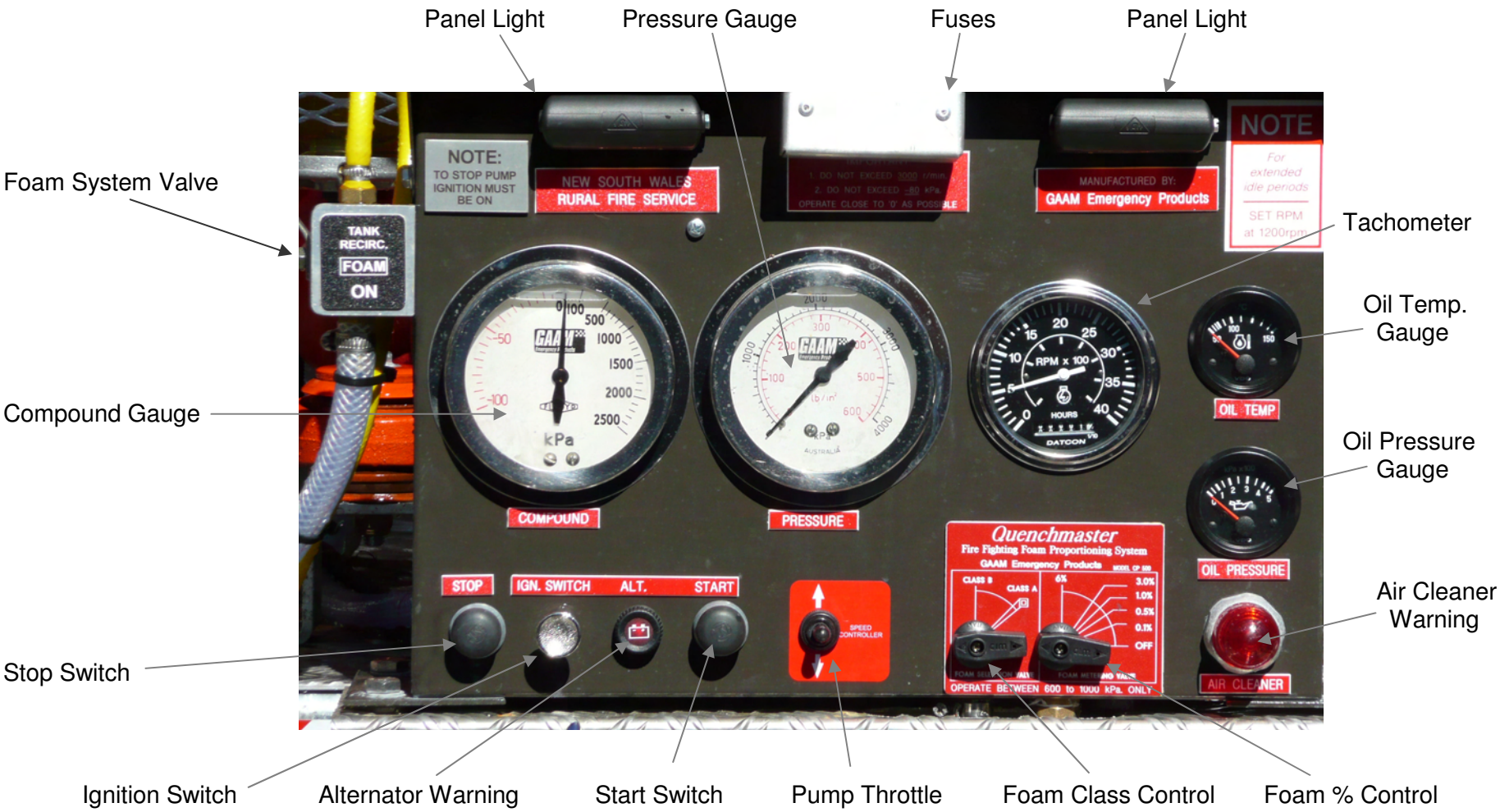
No tests are specified other than those already included in the preceding inspections. For information about tests for individual items of equipment refer to the relevant RFS Equipment Operating Procedure or the Equipment Officer's (EQO) Manual.

## 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)