THE ALVIS SALAMANDER FIRE CRASH TENDER CHASSIS

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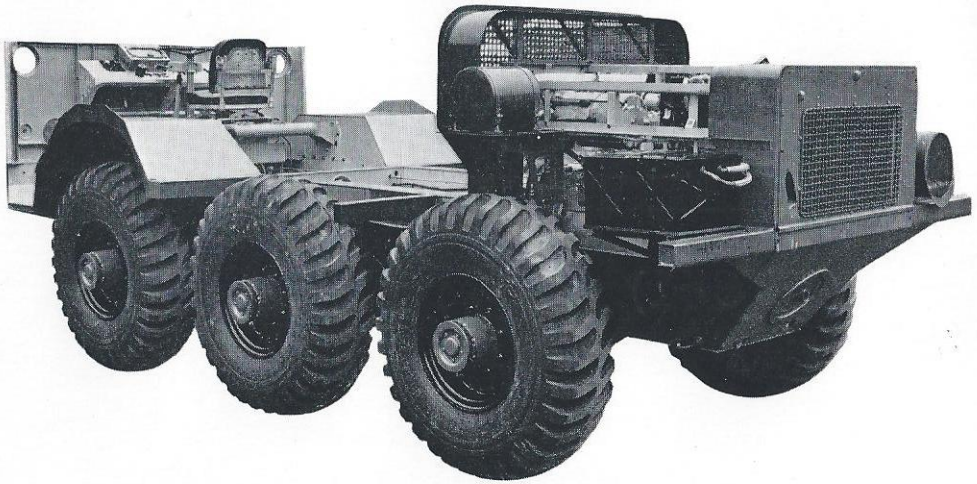
ALVIS LIMITED

HOLYHEAD ROAD, COVENTRY

TELEPHONE COVENTRY 25501

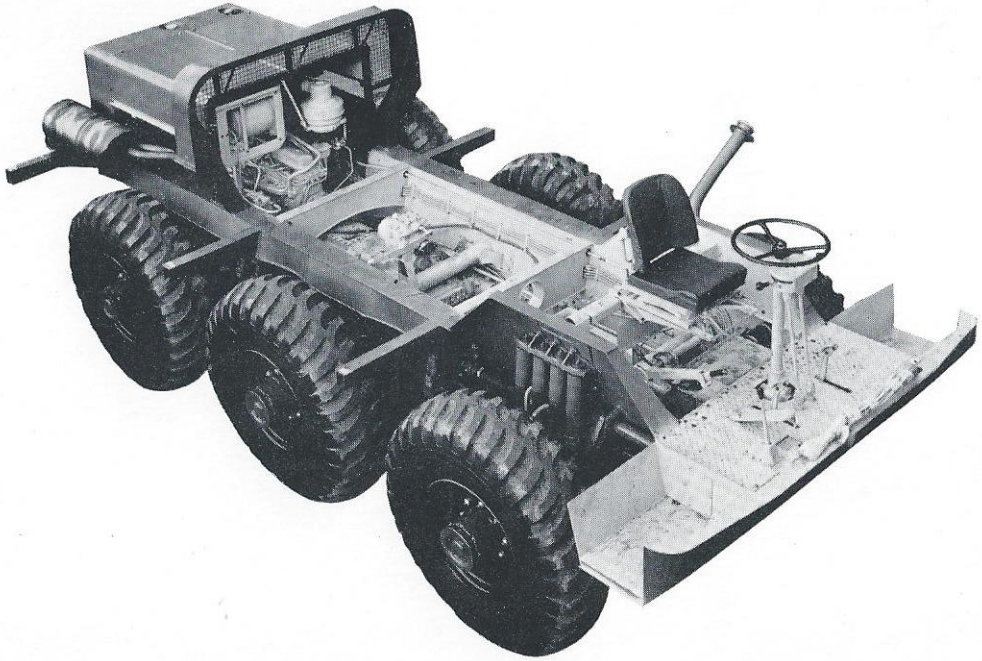
FIRE CRASH TENDER CHASSIS

(FV651)



ABOVE: *rear view, showing engine location*

BELOW: *front view with cab removed, showing general arrangement of chassis*



BACKGROUND

With the introduction of high-speed jet aircraft in military and civilian services, the pattern of aircraft accidents is tending to change due to higher take off and landing speeds. Because of this, the requirements and characteristics of safety equipment are now drastically revised.

One particularly important change is in the performance required of the foam-delivering crash tender, which is no longer of any use if its sphere of activity is confined to metal or concrete roads and runways or even, level and firm ground. Since the majority of both civilian and military airfields are now sited away from built-up areas, the surrounding terrain is rarely either level or firm, and consequently is usually impassable to crash tenders with the old types of long wheel-base commercial vehicle chassis.

What is now required is a high performance, well proven cross-country vehicle, capable of approaching a crashed aircraft directly over any type of terrain. Anticipating this requirement, Alvis Limited designed the Salamander chassis as a private venture, based on their FV.600 series of fighting vehicles. This family of vehicles, designed jointly by the Fighting Vehicles Research and Development Establishment and Alvis, includes the Saladin armoured car, Saracen armoured personnel carrier and other types which are operating with the British and other armed services in all parts of the world, often under extreme conditions of climate and terrain.

Alvis have taken full advantage of the experience gained through the use of these fighting vehicles, to produce a rugged chassis which equals the cross-country performance of a tracked vehicle but without the inherent disadvantages of high running and maintenance costs and, above all, damage to runways and surrounding areas.

The Royal Air Force found that the Salamander would meet their stringent requirements for a new crash tender. They re-

quested full confirmation trials to be carried out by the Fighting Vehicles Research and Development Establishment and on the successful conclusion of these trials, placed initial orders with the company.

The Salamander is now in service with the Royal Air Force, Royal Canadian, South African and Royal Ceylon Air Forces. Repeat orders are now in production and more are being negotiated, together with new inquiries from other Governments. The Salamander is now recognised as *the* modern conception of a foam crash tender chassis, without equal for military or civil use.

CONSTRUCTION

The Salamander chassis is based on the FV.600 series design. This has a 6×6, evenly spaced and independently-sprung, wheel arrangement in which all six wheels are driven, with steering on the front four. The power plant is at the rear. To give lightness of handling during cross-country work, steering and braking are power-assisted.

Standard FV.600 series components are used, except where the special requirements of an air crash tender call for special features.

The chassis has a welded frame in light gauge mild steel and has the same contours as the lower half of the FV.600 series – a pontoon or boat type of construction with the independent suspension and shaft drives coming out at the sides. This gives the frame a flat bottom which has no beam axles underneath to be struck by rocks or any other projections. The actual suspension and drive are protected from contact with obstructions by their shielded positions, going direct to the centre of the wheels. The value of this feature can best be seen when viewing the outline of the vehicle from either the front or rear.

Provision is made for the driver and crew at the front of the vehicle and also for mounting points for the body and fire-fighting equipment.

WEIGHT

Chassis: approximately 6-tons (13,440 lb).

Note: The chassis weight includes fuel, oil and coolant, but excludes the body, fire-fighting equipment and crew.

DIMENSIONS

(*a*)	Overall height (chassis to top of steering wheel)	6ft	(72 in)
(*b*)	Overall height (chassis to top of engine compartment)	6ft 6in	(78 in)
(*c*)	Overall height (to top of cab)	8ft 6in	(102 in)
(*d*)	Overall length	18ft	(216 in)
(*e*)	Overall width	8ft 3 in	(99 in)
(*f*)	Ground clearance (with chassis laden to 12 tons)	1ft 6½in	(18½ in)
(*g*)	Track	6ft 7½in	(79½ in)
(*h*)	Wheelbase	10ft	(120 in)
(*i*)	Approach angle	45 degrees	
(*j*)	Departure angle	50 degrees	

PERFORMANCE

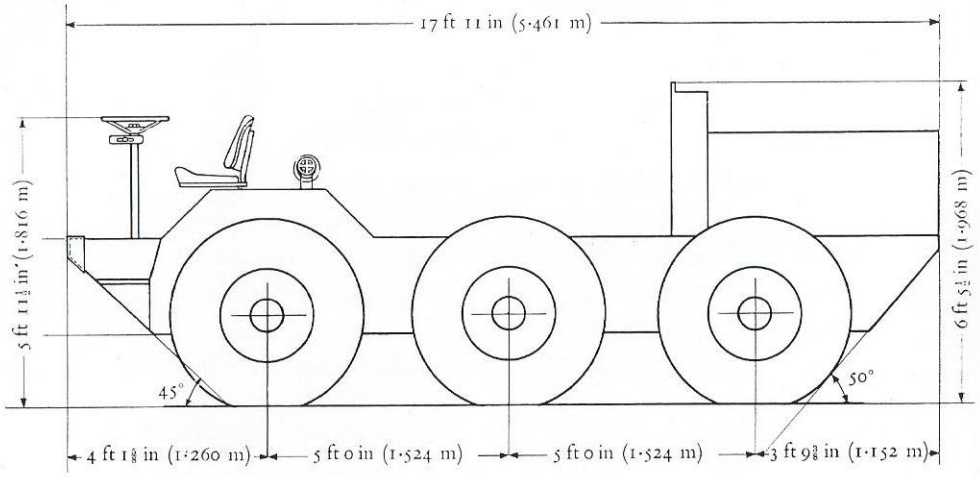
(*a*) Max speed, road, 53·5 mph @ 4000 rpm

(*b*) Acceleration – through gears

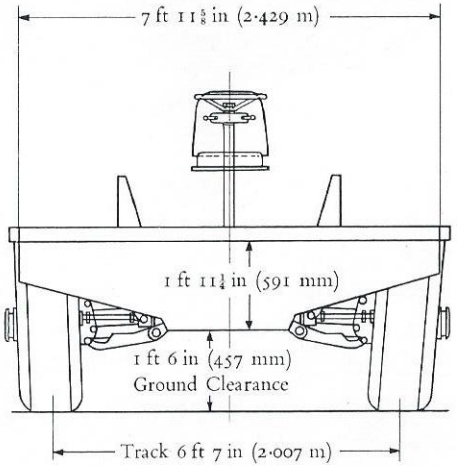
0 to 10	4 secs
0 to 20	8·6 secs
0 to 30	15·6 secs
0 to 40	32·3 secs

(*b*) Acceleration – top gear

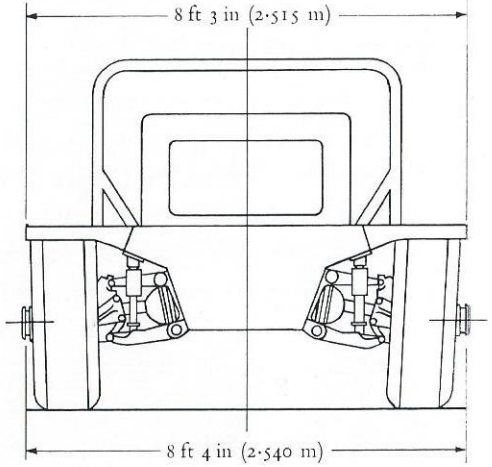
10 to 20	14·3 secs
10 to 30	23·0 secs
10 to 40	43·0 secs
10 to 50	66·0 secs



SIDE VIEW



FRONT



REAR

(*c*)	Standing ¼ mile	32·6 secs
(*d*)	Max speed (¼ mile) 18 secs, with engine governors set at 3750 rpm	50 mph
(*e*)	Retardation	60 per cent
(*f*)	Max gradient surmountable	24 degrees
(*g*)	Vertical obstacle	1ft 6in
(*h*)	Turning circle	45ft ± 5ft
(*i*)	Side overturn angle	37·5 degrees
(*j*)	Trench crossing	5ft
(*k*)	Range of action	120 miles
(*l*)	Fording depth unprepared	2ft 6in

FUEL CAPACITY-CONSUMPTION

(*a*)	Capacity	27 imperial galls
(*b*)	Consumption at average safe speed, roads	4½ to 5 mpg
(*c*)	Consumption at average safe speed, cross country	2½ to 3 mpg
(*d*)	Consumption, engine idling	10·35 pints per hr

MISCELLANEOUS

(*a*)	Gross power/gross weight ratio, BHP/ton	19·6
(*b*)	Net power/gross weight ratio, BHP/ton	17·6
(*c*)	Max tractive effort/top gear, lb/ton, 100 per cent efficiency	152
(*d*)	Max tractive effort/low gear, lb/ton, 100 per cent efficiency	1565

MECHANICAL DETAILS

POWER UNIT

One Rolls-Royce 8 cylinder in-line vertically mounted water-cooled petrol engine, type B.81 No 1 Mk 8A.

Bore	3·75in
Stroke	4·5in

Cubic capacity		397·6 cu in 6500 cc
Compression Ratio		7·27 : 1
Firing Order		1,6,2,5,8,3,7,4
Maximum BHP	Gross	238 @ 4000 rpm
	Net	211
Maximum Torque	Gross	368 lb/ft @ 2500 rpm
	Net	340

The engine is capable of running under all service conditions using 80 octane fuel having a TEL content of 3·6 cc per imperial gallon.

IGNITION

Screened coil and distributor.

LUBRICATION

Dry sump system, full flow filter with removal element. Still type oil cooler for tropical countries only. Normal oil pressure @ 3500 rpm @ 80°C, 35 lb/sq in.

CARBURETTOR AND AIR CLEANERS

One dual Solex downdraught dustproof and non-spillable carburettor with air from oil bath air cleaners.

COOLING SYSTEM

One radiator at the rear of the vehicle with means for draining the complete system from one drain point. Two aerofoil fans in close fitting cowlings are driven by V-belts with centrally mounted jockey pulley to allow adjustment of the belts. A pressure relief valve is set to open at + 10 and — 1 lb/sq in. Cooling system capacity is 7 gallons.

The engine cooling system and transmission units are capable of operating in any ambient temperatures between —26°C (—15°F) and + 50°C (+ 122°F).

HEATING

An immersion heater operated from mains may be fitted in the coolant circulating system.

EXHAUST SYSTEM

One acoustic silencer mounted at the offside rear of the vehicle and provided with adequate means for cooling when the engine is operating with the vehicle stationary.

STARTING

5-inch electric motor and manual starting handle. The opening for the handle in the rear sloping plate to be sealed by waterproof plug when not in use.

FUEL SYSTEM

The fuel tanks are provided with access plates to facilitate internal cleaning and an accessible petrol filter is fitted in the petrol supply line. The tanks are adequately vented with the vents arranged to prevent the discharge of petrol or vapour into the hull.

TRANSMISSION

All six wheels are driven, but a central unit allows differential action between side and side of the vehicle.

The transmission consists of a fluid flywheel, gearbox and transfer box with bevel boxes at each wheel station connected by means of fore and aft shafts at each side of the vehicle. The drive to each wheel is by two constant velocity joints at each end of a short enclosed drive shaft to reduction gears situated in the hub.

GEARBOX

A five-speed epicyclic pre-selective gearbox is used. All five speeds are available for forward or reverse direction. The desired gear can be preselected in advance so that when required it can

be instantaneously engaged by depressing the foot change pedal.

RATIOS

1 : 1	2·64 : 1	10·277 : 1
1·61 : 1	4·73 : 1	

TRANSFER BOX

Comprises a primary helical reduction gear, spiral bevel forward and reverse gears selected by a sliding dog having undercut splines and secondary helical gears with a central differential to a transverse output shaft in line with the central wheel stations, providing in conjunction with the gearbox five speeds forward and reverse.

Ratio 2·43 : 1

BEVEL BOXES

Spiral bevels contained in casings rigidly mounted to the frame each with self-contained lubrication.

Ratio 1 : 1

DRIVE SHAFTS

Four fore and aft drive shafts transmit the drive to the front and rear bevel boxes and are coupled to them by muff-type couplings.

CONSTANT VELOCITY JOINTS

All universal joints are contained in sealed spherical housings, the inner joints being lubricated from the bevel boxes and the outer joints from the hub reduction gear housing.

HUB REDUCTION GEARS

Compound epicyclic reduction gears.

Ratio 4·125 : 1

OVERALL RATIOS

Top	10·05 : 1
4th	16·20 : 1
3rd	26·60 : 1
2nd	47·50 : 1
1st emergency	103·20 : 1

POWER TAKE-OFF

A power take-off is fitted to the transfer box, capable of being engaged when the vehicle is being driven and transmitting approximately 200 HP @ 3750 rpm.

The drive shaft of the power take-off is centrally sited in the frame at a height of 13.1 inches above the centre line of the transmission and suitably flanged to accept Layrub No 2408 coupling or similar suitable unit.

Ratio 1 : 1

The power take-off is capable of engagement with the engine running and the gearbox in engagement. (The engagement lever is positioned in front and on the right-hand side of the driver).

WHEELS

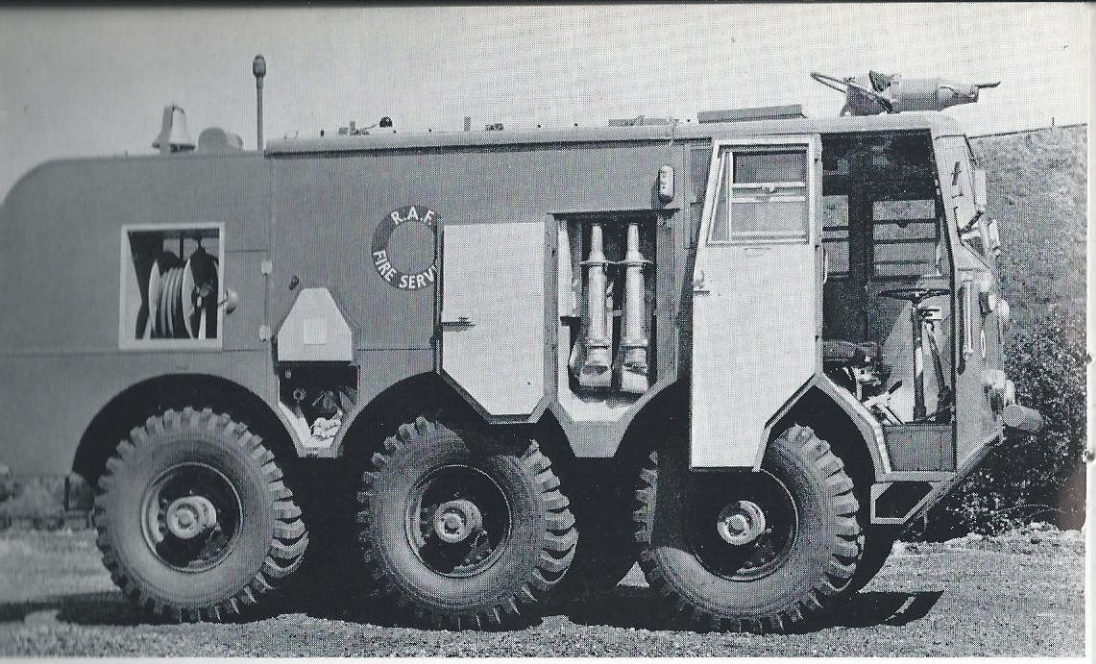
Light alloy 10.0–20-inch divided disc, attached to the wheel hub by means of 8 conical sleeve nuts with left-hand threads on the nearside and right-hand threads on the offside.

TYRES

14.00–20-inch 10 ply Trackgrip pattern, rolling radius 22·4 inches at 18 per cent deflection.

TYRE PRESSURES

(*a*) For continued road use (13½ per cent deflection)	41 lb/sq in
(*b*) For cross country (18 per cent deflection)	28 lb/sq in
(*c*) Normal general use	28 lb/sq in



Salamander with Pyrene equipment

BRAKES

15½-inch diameter × 3-inch wide drum pattern with internal expanding shoes, with mechanical adjustment.

FOOT BRAKE

Power operated from hydraulic supply.

HAND BRAKE

Mechanically operated with flexible cable connections to each wheel by means of a ratchet-type hand brake lever fitted with quick release.

BRAKE HYDRAULIC SYSTEM

A vacuum servo cylinder operated from the engine induction manifold depression further boosts the hydraulic pressure created by the driver's pedal. The brake system is filled with mineral oil, any of the following grades being suitable:

ESSO	WAKEFIELD	SHELL	BP	VACUUM
Necton 37	Castrol Shockol	Tellus 15	Energol Hydraulic 4	Moboil SA Light, or Mobiloil 5W

STEERING

Hydraulically assisted steering is provided and the first four wheels of the vehicle are controlled. The system employed is of the 'free flow' type, or one allowing the castor action of the wheels unrestrained action when running straight, and designed so that in the event of the failure of the hydraulic system the mechanical steering mechanism is able to control the vehicle.

The system comprises an engine-driven hydraulic pump drawing oil from a reservoir and delivering to a control valve actuated

Salamander with Pyrene equipment

by the torque in the steering shaft in conjunction with a double-action hydraulic ram connected to the steering linkage. The system should be filled with mineral oil. The mechanical steering gear employs a recirculating ball drive connected to the front wheels by means of two rigid fore and aft shafts with drop arms and ball-jointed links to the front and centre station wheels. The centre wheels are coupled to the front wheels by a lever system to give half the equivalent movement of the front wheels.

SUSPENSION

Each wheel station has fully independent suspension, comprising wishbone linkage and pre-set torsion bars with adjustable anchorage points. The mounting of the wishbone bearing brackets to the hull is facilitated by the use of an approved metallic cement.

Deflection, static to full bump 5 inches } without bump
static to full rebound 5 inches } stops

SHOCK ABSORBERS

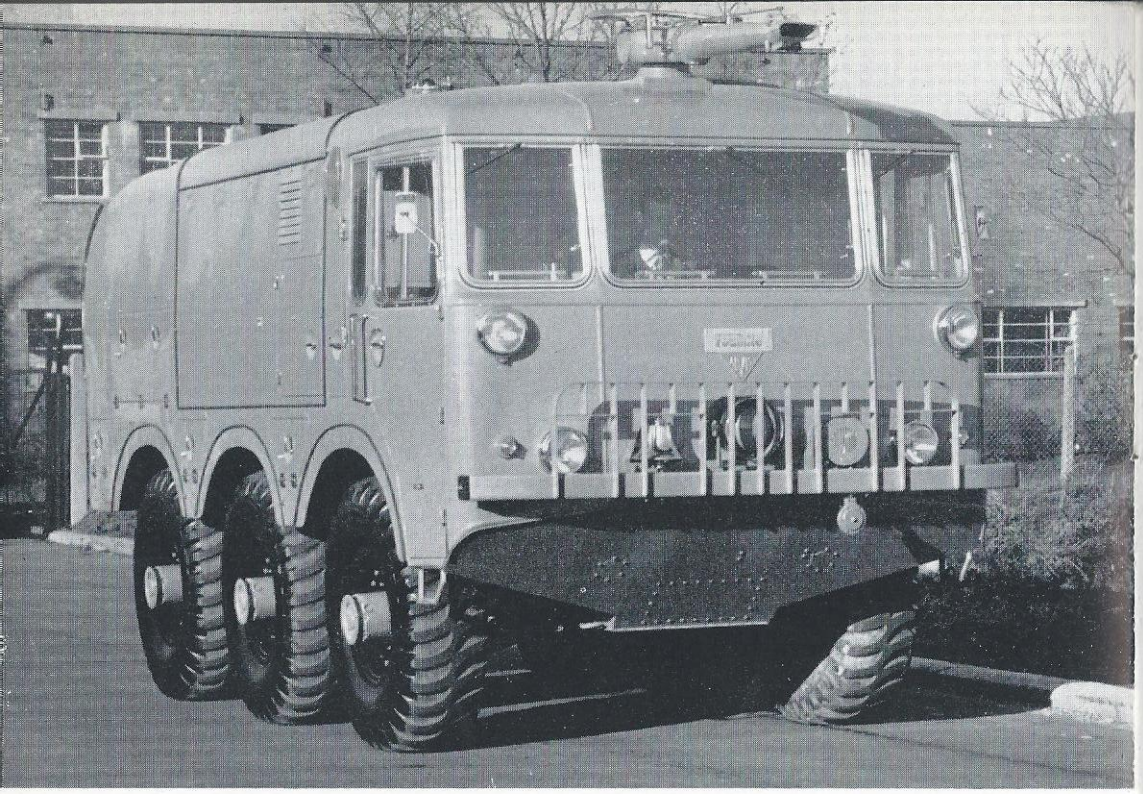
Two double-acting hydraulic telescopic pattern, at each front and rear wheel stations and one at each centre station.

DEFLECTION CONTROL

Rubber buffers mounted in dual telescopic housings at all wheel stations.

FUEL TANKS

Two riveted and soldered 'Terne' sheet metal tanks located under the cab floor. The interior of the tanks has protective treatment against corrosion, and is provided with a filler cap on the nearside of the vehicle. Each tank has removable access plates for cleaning purposes, a fuel contents gauge and drain plug at the lowest point allowing the tank to be drained from outside the chassis. Fuel capacity – total – 27 imperial gallons.



Salamander with Foamite equipment

CONTROLS

(*a*) Steering wheel
(*b*) Gear lever
(*c*) Hand brake
(*d*) Forward and reverse lever
(*e*) Choke control
(*f*) Power take-off control
(*g*) Accelerator pedal
(*h*) Brake pedal
(*i*) Driver's seat adjustment
(*j*) Fuel cock
(*k*) Battery master switch
(*l*) Ignition and light switch unit
(*m*) Gear change pedal

INSTRUMENTS

(*a*) Engine coolant temperature gauge
(*b*) Speedometer reading in 1 mile
(*c*) Ignition warning light
(*d*) Engine oil warning light
(*e*) Fuel gauges
(*f*) Tachometer
(*g*) Hydraulic pressure warning light

ELECTRICAL

The electrical supply is 24-volt (nominal) negative earthed system. An earthing point on the chassis is provided for when mains supply is coupled to the vehicle for heating.

(*a*) 2 batteries, 12 volts, 60 ampere-hr
(*b*) 1 distribution panel (c/w battery-master switch)
(*c*) 1 voltage control unit
(*d*) 1 driver's switchboard
(*e*) 1 starter motor, 5-inch axial type

Salamander with Foamite equipment

(*f*) 1 ignition distribution and contact breaker
(*g*) 1 coil
(*h*) 1 dynamo (single speed)
(*i*) 1 filter unit in engine
(*j*) 1 ignition junction box
(*k*) 1 pair inspection lamp sockets (in distribution panel)

All electrical equipment is screened and suppressed.

LUBRICATION

Facilities are provided for replenishing and draining all component parts containing oil, and accessible level indicators, dipsticks and level plugs are provided.

Individual lubrication nipples are fitted where required, and suitable means taken to retain lubricant and to exclude dirt and water.

FRAME

The specially designed frame has a welded construction in thin mild steel plate. It is provided with longitudinal box section members along the top of each side, is fitted with five cross members to give adequate torsional rigidity, and locally reinforced where point loads are applied.

The frame is provided with mounting points for body and equipment, and is waterproofed to a height of 30 inches from the ground. Suitable drain points are provided and all removable access plates below the fording level are provided with adequate sealing arrangements.

Towing attachments are provided at the front and rear of the vehicle, and the front and rear are fitted with a robust bumper bar extending the full width of the vehicle. The lower front sloping plate is adequately strong to deal with obstacles when travelling across country.