

ROSCOMMON EQUIPMENT CENTER

**Project Number 63 M939
6x6 Wildland Fire Engines**

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Design Packet 63M939

***Military M939 Series
6x6 Truck Evaluation***

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Introduction

The Federal Excess Personal Property (FEPP) and the more recent Fire Fighter Property (FFP) programs allow wildfire agencies and rural fire departments to supplement their wildland fire engine fleet by providing access to military 6x6 units that are no longer used by the Federal agencies. Because they are excess to the Federal agencies needs, they are usually the older units that have been replaced by more up to date versions. The Department of Defense, the primary initial user of these units, goes through a redesign cycle approximately every 15-20 years. As this cycle works, the units are approximately 20 years old when wildland fire agencies acquire them through one of the excess property programs.

The first 5-ton units available through FEPP in the early 1970s were designated the M39 series. They were produced from the 1950s through the early 1970s. The next version, the M839 series (commonly referred to as the 800 series), was used by the military until the introduction of the M939 series in the mid 1990s.

Currently the M939 series, or 900 series, is becoming more prevalent in the screening process and the 800 series, that agencies have used for many years, is becoming harder to find.

The Roscommon Equipment Center (REC) has assembled this information as a tool for cooperating fire agencies to use when considering using one of the 900 series units.

900 Series Information

Within each series there are a number of models. Each model is designed to perform a specific job within the military and each has its own

specifications and ratings for that specific job. Table 1 lists the models of the 900 series.

Table 1	
Model Number	Vehicle Description
M923	Cargo Truck without Winch (Dropside)
M925	Cargo Truck with Winch (Dropside)
M927	Cargo Truck without Winch XLWB (Extra Long Wheelbase)
M928	Cargo Truck with Winch XLWB
M929	Dump Truck without Winch
M930	Dump Truck with Winch
M931	Tractor Truck without Winch
M932	Tractor Truck with Winch
M934	Expansible Van without Winch
M936	Medium Wrecker with Winch

Another factor within the series is the design variant. Over the design life of the series changes are made. If the changes are significant then a variation or variant number is assigned. Each

model within the 900 series has three variations: the original design, variant A1 and variant A2. The distinctions between the variations are shown in Table 2

Table 2	
Variant	Deviation from the Original 900 Series Design
A1	Super Single Tires replaced Dual Tires on Rear
A2	Super Single Tires replaced Dual Tires on Rear Turbo Charged Engine Central Tire Inflation (CTI)

The differences between the 800 and 900 series are substantial. The 900 series is noticeably taller, six to ten inches, depending on the variant. No dual rear wheels on variant A1 and A2. The engine exhaust and intake are located behind the cab instead of in front. Differences less noticeable at first glance, are the automatic transmission, the full air brakes, tilt forward hood, and a hydraulic driven winch on models equipped with one.

The height of the truck does cause some concerns during off road operation, but mostly in garage head room. The combination of a taller truck and a tilt forward hood requires extensive head room. The tilt forward hood has the advantage of allowing better access to work on the engine compartment but it requires approximately ten feet of over head clearance to open fully.

On the later variations (A1 and A2) 14.00 x 20 tires were used. This allows the use of single rear tires instead of duals for the same payload. This has many advantages in off road operations. Also, while the ground pressure on the rear tires may be the same or slightly increased with the single tires, the front tires have a substantial reduction in ground pressure.

With the exhaust and intake behind the cab they are better protected and the in cab noise levels should be reduced. However, this location does cause a loss of cargo space. Also, when adding

apparatus, design considerations will have to be made to account for not only the physical size of these systems but the air flow requirements and the dispersion of the exhaust heat as well.

The transmission is quite simple to operate. When starting out, the transmission can be placed in the 1-5 range (the highest forward range), it operates the same as an automatic transmission in an automobile would in "Drive," starting out in lower range and shifting automatically as speed increases. It can be set in any range 1-2 through 1-5 and will automatically shift to lower ranges as required. The lowest range is labeled 1 and even with the transfer case in high range it appears to have substantial power.

The improved braking of the 900 Series is noticeable. The switch to a completely air system from the air over hydraulic, used on the earlier series, is an improvement. The system uses "wedge" type brake actuation which allows the components to be mounted in less vulnerable locations for off road operations, but will have increased maintenance considerations over the more common "S cam" type actuation systems.

The winch on the 900 Series is hydraulic driven as opposed to the mechanical drive winch on the 800 Series. With a hydraulic driven winch there is no shear pin to fail, to totally disable the winch. The maximum pull is limited by the hydraulic system pressure. If overloaded the winch simply stalls.

Payload and Weight Distribution

There is one tremendous drawback to the 900 series; limited payload. The M39 and M839 series, for the most part, actually had two payload ratings, one rating for "Cross Country" (CC) operation and one for "On Highway" (OH) operation. While each model within the series had specific weight ratings, the nominal ratings for these series were 5 ton (10,000 lbs.) CC and 10 ton (20,000 lbs.) OH.

The CC rating accounted for the severe duty the military expected during off road operations. It was a reduced rating to help extend the life of the vehicle in severe off road and even battle conditions.

Before the introduction of the 900 series, the military dropped the OH rating and started listing only the CC rating. Table 3 shows the available payload for all 900 series models as published in the military operator's manual for this series.

Table 3		
Model Number	Empty Vehicle Weight (lbs.)	Payload (lbs.)
M923	21,600	10,000
M923A1	22,175	
M923A2	20,930	
M925	22,360	10,000
M925A1	23,275	
M925A2	22,030	
M927	27,749	10,000
M927A1	25,035	
M927A2	23,790	
M928	27,811	10,000
M928A1	26,135	
M928A2	24,890	
M929	25,888	10,000
M929A1	25,065	
M929A2	24,890	
M930	26,624	10,000
M930A1	26,165	
M930A2	24,920	
M931	22,089	15,000
M931A1	21,140	
M931A2	19,895	
M932	22,841	15,000
M932A1	22,242	
M932A2	20,995	
M934	29,949	5,000
M934A1	29,280	
M934A2	28,035	
M936	39,334	7,000
M936A1	38,155	
M936A2	36,910	

As can be seen in Table 3, the models with the most available payload are the 931 and 932 units. In order to help determine what capability a converted 900 series unit might have, REC obtained a M931A2 Truck Tractor. The truck was stripped of all apparatus used for towing to get as

close to a bare chassis as possible. Then it was weighed without personnel in the cab to get a starting point for design considerations. Table 4 lists the weights REC measured and the load ratings from the dash board plate on the unit.

Table 4		
	Gross Rating (lbs.)	As Weighed plus Fuel (lbs.)*
Front Axle	9,830	9,790
Inter Axle	12,635	4,730
Rear Axle	12,635	4,755
Total	35,100	19,275

*The fuel tank was partially full when weighed. REC calculated the effects of a full fuel tank and added it to the figures.

Additionally, by REC calculations, if two 200 lb. persons were in the cab, it would increase the front axle loading to 10,050 lbs. This would exceed the front axle weight rating without further

apparatus. From this it was determined that all weight for any equipment added to these units would need to be added to the rear axle set only.

This information rules out the installation of forward mounted brush protection.

Subtracting the sum of the weighed amounts, 19,275 lbs., from the GVWR of 35,100 lbs., leaves a total available payload of 15,825 lbs. The "Quick and Dirty Calculator" from the REC web site estimates a tank with a capacity of up to 1400 gallons and a basic water handling system, could

be added to this chassis. Due to the age of the chassis and the severity of the expected duty, it may be beneficial to reduce this. REC Newsnote 3 recommends a 10-15 percent reduction.

Extra equipment added such as a larger than normal pump, extra pumps, hand tools, portable water tanks, etc., would also reduce the amount of water the chassis could carry.

Conclusion

While the 900 series 6x6 units now available through FEPP and FFP have many new features that make them more user friendly and comfortable, the lower rated payloads limit their flexibility for conversion into wildland fire suppression units. With the very low or nonexistent front axle payload, wildfire agencies and rural fire departments will need to carefully consider what equipment to add and where it is placed on the unit.

At this point REC does not have plans to develop apparatus designs specifically for the 900 series. While brush armor designed for earlier 6x6s does not appear to be an option, the designs for the tank in Project Packet 63A-5, and the water handling examples in Packet 63B, are adaptable to this unit. However, adjustments to account for lower payload will need to be made.