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6x6 Wildland Fire Engines

National Association of State Foresters
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REC Project No. 63

6x6 Wildland Fire Engines

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Disclaimer

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Introduction

Since its inception in 1972, REC has provided technical information about converting U.S. Military 6x6's into fire fighting vehicles. The Project 63 report series will replace our past reports about the 2.5-ton and 5-ton 6x6's. Our past 2.5-ton 6x6 information has been completely updated. A more refined tank design and complete details are available now. The previous 2.5-ton report, Project No. 22, is out-of-print and obsolete. Project No. 39, our documentation of the 5-ton 6x6, is still a viable design. We decided, however, to combine our updated 5-ton designs

into this project. We did this for two reasons. Many of the drawings are the same for either 2.5- or 5-ton models. We reduce redundancy. Second, users want information on both to make acquisition decisions. This booklet provides basic data about 6x6's. Details for converting your vehicle are found in the design packets listed on pages 6 and 7. All packets are available on-line or in print. Select the design booklets you need to accomplish your project. We provide additional and updated information about 6x6 conversion on our web site, www.RoscommonEquipmentCenter.com.

The U.S. Military 6x6 Truck Family

A brief history of the military 6x6's produced since WW II may help you identify the unit you need. We will refer to the general series number to describe these trucks. Within each series there are many variants; body styles that the military set up for a specific purpose. As an example, the M35 is a 2.5-ton cargo truck. The M35 series includes the M47 dump truck and the M48 truck tractor, each on the same basic chassis. Appendix A lists some of the common variants of the various 2.5-and 5-ton series.

The shorter wheel base 6x6's have the most application for wildfire conversion. They will be more nimble off-road yet have adequate space to fit the appropriate water load. For this reason, much of the data presented here is specific to the shorter wheelbase variants. The shortest wheelbase 2.5-ton is 154 inches. For the 5-ton, it is 167 inches. Our tank design packet also refers to the short wheelbase trucks. A description of each series is found below.

M135 GMC 2.5-Ton 6x6 Series

These were Korean War vintage (1951-1954) trucks that had a troublesome automatic transmission. No longer readily available, we advise against using these for fire engine use.

M35 (REO) 2.5-Ton 6x6 Series

These were produced from 1955 to 1971. Many have been converted for fire use. Some are still available through FEPP. Found in gasoline

(M35), multifuel (M35A1, M35A2) and diesel engine (M35A2C) models. Retrofit kits are available to add power steering, an item that you should consider. Approximate water payload capacity is 900 gallons. The actual capacity will be dependant on the weight of the tank, accessories, and stored items. Table 1 lists other characteristics of the series.

M35 2.5-Ton 6x6 Extended Service Program (ESP)

From 1994 to 1999, many M35's were remanufactured into the M35A3. They were disassembled and then reassembled using some used and some newer parts. The ESP vehicles have diesel engines, automatic transmission, air assisted steering, improved brake system, 3-point seat belts and other improvements. These are not likely to be available through FEPP for awhile.

M39 5-Ton 6x6 Series

The 5-ton began replacing the 2.5-tons during the 1970's. Greater power, payload, and width than the 2.5-tons are features found in gasoline (M40), diesel (M40A1), and multifuel (M40A2) versions. These can carry about 1500 gallons, depending on the weight of the tank, accessories, and stored items.

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M809 5-Ton 6x6 Series

The M809 series vehicles are similar to the M39 series but with some upgraded components including diesel power. They were produced during the 1970's and 1980's.

M939 5-Ton 6x6 Series

An "improved" version of the M809 that includes automatic transmission, better power steering,

air brakes, tilt hood, hydraulic winch, and engine diagnostic connection. First introduced in 1983, the M939 has 11xR20 tires with rear tandem duals. This is similar to the M39 and M809 vehicles. The M939A1 features 14xR20 super single radial tires. The M939A2 series has the large tires and adds central tire inflation. Table 2 lists other characteristics of each 5-ton series.

Table 1. M35 Series 2.5-Ton Characteristics

	M35	M35A1	M35A2
Height (inches)	99.0	101.5	101.5
Length (inches) ¹	93.0	93.0	93.0
Wheelbase ²	154.0	154.0	154.0
Turning Radius (feet)	36.0	36.0	36.0
Ground Clearance (inches)	12.8	10.9	10.9
Engine Type	Gasoline	Multi-fuel	Multi-fuel
Engine Cylinders	6	6	6
Engine Aspiration	Natural	Turbo	Natural/Turbo
Engine Horsepower	127	130	140/210
Transmission	Manual-4	Manual-5	Manual-5
Maximum Speed (mph)	60	56	56

This data is compiled from military manuals and other sources. Some model variants or model years may have variations.

¹Length of truck tractor variant.

²Some models have a longer wheelbase. This wheelbase accommodates REC's 900 gallon tank design.

Table 2. 5-Ton 6x6 Characteristics for Truck Tractor Variant

Series Name:	M39			M809	M939		
Truck Tractor Variant Name:	M52	M52A1	M52A2	M818	M931	M931A1	M931A2
Height (inches)	103.1	103.1	103.1	112.0	118.5	121.2	121.2
Width (inches)	97.0	97.0	97.0	98.0	97.5	97.4	97.4
Length (inches) ¹	257.5	257.5	257.5	266.0	264.5	264.5	264.5
Wheelbase ²	167.0	167.0	167.0	167.0	167.0	167.0	167.0
Turning Radius (feet)	39.3	39.3	39.3	39.0			
Front Winch Capacity (lbs.)	20,000	20,000	20,000	10,000	17,000	17,000	17,000
Ground Clearance Under Axle (inches)					11.5	13.9	13.9
Ground Clearance Under Chassis (inches)	10.5	10.5	10.5	10.5	10.5	13.1	13.1
Engine Type	Gasoline	Diesel	Multi-fuel	Diesel	Diesel	Diesel	Diesel
Engine Cylinders	6	6	6	6	6	6	6
Engine Aspiration	Natural	Turbo	Turbo	Natural	Natural	Natural	Turbo
Engine Horsepower	224	205	175-180	240	250	250	240
Estimated Fuel Consumption (mpg)	4	5	5		3-4	3-4	5.5-6
Transmission	Manual-5	Manual-5	Manual-5	Manual-5	Auto	Auto	Auto
Maximum Speed (mph)	59	52	52	54	65	65	65

This data is compiled from military manuals and other sources. Some model variants or model years may have variations.

¹Length of truck tractor variant.

²Some models have a longer wheelbase. This wheelbase accommodates REC's 1400 gallon tank design.

Federal Excess Property Program (FEPP)

FEPP is a program in which federal property that is no longer used by a federal agency can be acquired by another federal agency such as the USDA Forest Service. The Forest Service can then loan the property to qualified state or local units for rural fire defense. Congress has



A FEPP obtained 6x6 chassis prior to modification.

authorized the program and the acquisition is assisted by the state forester of the fire department's state. More information is available through the following web sites:

USDA Forest Service FEPP Program, www.fs.fed.us/fire/planning/fepp. This site quickly answers the basic questions about the FEPP Program. Recent FEPP legislation changes are discussed. There is a list of state foresters and state FEPP Program managers with their telephone numbers and addresses. The site is designed to help you get acquainted to the FEPP Program.

The State Foresters Directory is found at <http://205.185.177.133/Sflist.html>. This site has addresses and telephone numbers for each of the state foresters. Email links are often included. Web links to each state forestry page are included. Many of the state foresters web pages have information on the state's FEPP Program.

Comparing a FEPP 6x6 with Commercial Cab and Chassis

Deciding whether to use FEPP or buy a new cab and chassis is usually determined by finances. Others use them because they are excellent off-road. Below is a list of some other things to consider.

Disadvantages

Used vehicle; condition not known until obtained.
Older technology.
Limited operator comfort.
Service and parts options are limited.
24 volt electric; must add 12 volt system for civilian accessories like radios.
Cannot order the truck the way you want it.

Advantages

Acquisition cost is zero compared to approximately \$60,000 for new cab and chassis.
Built rugged, a plus when operating on poor roads or off-road.
Excellent off-road performance.
Power optimized at slower speeds.
Only large 6 wheel drive vehicles with short wheelbase.
Good payload characteristics.

Safe Modification of FEPP

There are many elements that go into the proper design of highway vehicles. Two important considerations are:

- Determining the maximum payload and not exceeding it.

- Installing proper lighting.

Both of these directly affect the safety of the operator and general public.

Gross Vehicle Weight Rating (GVWR): The manufacturer of each truck determines the GVWR for that vehicle. The GVWR is the maximum design load. The manufacturer also lists the Front Axle Weight Rating (FAWR) and Rear Axle Weight Rating (RAWR). These are the maximum design loads on each axle. For 6x6 military vehicles, these ratings are found on a dash plate. None of these ratings should be exceeded. It is prudent to load the truck at 85 to 90 percent of the weight ratings. This reduces operating costs, lengthens truck life, and provides a margin when operators decided they need to take more items.

REC provides an interactive web page¹ that allows you to enter weight and dimensional data to calculate the expected final weight of the vehicle. It is important to understand that it is possible to do this work before you buy or build a tank.

Before you put the vehicle in service, weigh it with the tank full, all the fire tools loaded, and

the occupants seated. If the weight or axle ratings are exceeded you need to make some changes.

Vehicle Lighting: Military 6x6's do not include all the lighting required for highway operation. Vehicles over 80 inches wide need clearance and identification lights. These are the 5 amber lights on the front of the vehicle and 5 red lights on the rear. Stop, tail, and turn lighting and front side and rear side marker lights will be needed as well.

REC provides more information on GVWR and vehicle lighting in its publication, "Guidelines for Designing Wildland Fire Engines." An online version is found at www.RoscommonEquipmentCenter.com.

¹ Currently the calculators are found by going to the "Wildland Engines" section of www.RoscommonEquipmentCenter.com.

Weight Capacity of a U.S. Military Vehicle

For the most part, each model in a military vehicle series is designed for a specific mission. The military has determined what it takes to accomplish that mission and with the vehicle manufacturer, assigns a weight rating to the vehicle that assures it will perform that task. This process is somewhat different than assigning a weight rating to a commercial vehicle. In that case, the manufacturer must sell the vehicle for a variety of potential users. The components are analyzed along with the projected uses to determine the maximum capacity of that truck. The truck user is then obligated to stay within that rating when operating on the highway.

In the military system two military vehicles with essentially the same components but with different missions will likely have different weight ratings. The military rating accounts for the needs of the mission. The tasks performed by a lighter rated truck may not require a large load capacity and only enough capacity to accomplish the mission is assigned to that model. In another case, a higher capacity may be assigned because the mission for that vehicle may not be as severe of duty.

The military often uses "payload" as the defining characteristic for load limit. The payload is the amount of weight that the user can add to the truck as delivered without exceeding its weight limit. For many years the military assigned dual weight ratings, one for on-highway, another for cross-country use. The 5-ton 6x6 had a nominal payload of 5 tons for cross country use, it's highway payload was twice that or 10 tons. In the later 70's, the military dropped the on-highway rating. Since that time a single rating for payload, GVWR and GAWR have been issued to a truck. For the 6x6 series, this change occurred while the M809 5-ton series was still being made. Early M809's will have both highway and cross-country ratings. Later models have only the much lower cross-country rating.

All the M939 series data plates will have only a single load rating equal to 5-ton payload. This is considerably less than the 10-ton highway payload of its predecessors. To add to the confusion, the M939 operator's manual says, ***"The 5-ton load limit rating of M939/A1/A2 series vehicles does not mean these vehicles***

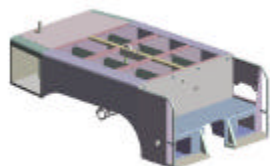
are limited to 5-ton payloads. A vehicle rating only indicates the maximum amount of cargo weight the vehicle axles and frame can withstand when operating under the worst cross-country conditions.” This leaves the post-military user with a dilemma. The GVWR is the accepted definition for the total load capacity of a vehicle. It may have legal stature and this may vary in different states. The military has latitude that the wildland fire organization may not. Our best advice is to operate within the load limits posted on the vehicle’s data plate. Appendix B shows weight information for a variety of 5-ton models.

The REC 1400 gallon water tank was designed prior to the development of the M939. Added to a bare M939 chassis, the tank with water and accessories will push the truck over the weight limits. Sizing the tank smaller for these vehicles is an option. Our on-line truck weight calculators can help you do this.

The last few paragraphs pertained to the 5-ton 6x6 series. Fortunately, the 2.5-ton vehicles were all produced with dual weight ratings. REC’s designs will comfortably fit within maximum load limits of the 2.5-ton.

REC Design Packets for 6x6’s

REC has design packets for both 2.5- and 5-ton 6x6 models. These packets are accessible on the internet or can be obtained from us by local, state, or federal fire agencies, as a printed booklet. A description of each of the packets follows. Current packet availability, updates, and other 6x6 information is available online at RoscommonEquipmentCenter.com.



Packet 63A-2, 900 Gallon Tank Drawings for 2.5-ton 6x6’s, Including Frame Extension. This is the first volume of drawings needed to build REC’s 900 gallon unitized steel water tank for the

2.5-ton. You will also need **Packet 63B, Common 6x6 Tank Parts for 6x6’s, Including Plumbing Examples.** Together, these two packets include all detailed parts, subwelds, subassemblies, completed weldments, and tank assembly drawings. The packet also includes details for extending the truck frame to accommodate the installation and mounting of the tank. This design is for the 154 inch wheelbase models.



Packet 63A-5, 1,400 Gallon Tank Drawings for 5-ton 6x6’s, Including Frame Extension. This is the first volume of drawings needed to build REC’s

1,400 gallon unitized steel water tank for the 5-ton. You will also need **Packet 63B, Common 6x6 Tank Parts for 6x6’s, Including Plumbing Examples.** Together, these two packets include all detailed parts, subwelds, subassemblies, completed weldments, and completed tank drawings. The packet also includes details for extending the truck frame to accommodate the installation and mounting of the tank. This design is for the 167 inch wheelbase models.

Packet 63B, Common 6x6 Tank Parts for 6x6’s, Including Plumbing Examples. This is the second volume of tank part details that are required for either the 900 or 1,400 gallon 6x6 tanks. These parts are the same for either of the tanks and hence if you are interested in both 2-1/2 and 5-ton designs, you need only one copy of this booklet.



Packet 63C, Filler Port and Strainer Drawings for REC Design 6x6 Tanks. This depicts a heavy duty filler port lid designed for either of the REC 6x6 water tanks. It also shows the design for a intake strainer to filter water entering the filler port. If you have another way that you prefer filling a water tank, these parts are optional.



Packet 63D, Pneumatic Controlled Emergency Light Mast. REC designs its water units for off-road and rugged rural use. Rotating emergency beacons are very vulnerable in these situations. REC has designed a telescoping light mast operated pneumatically with

air supplied by the vehicle's brake system. This allows the operator to raise the beacon on the highway so it is a visible warning device for the public. When operating in the woods or on poor rural roads or drives, the operator has the option to lower the light so that it rests on the top of the water tank, hidden by the profile of the cab. This is a relatively inexpensive method of protecting the light and is an optional accessory with the REC system.



Packet 63E, Fabricated Metal Cab Tops for REO Style 6x6's. Most of the 2.5-ton and 5-ton 6x6's available through the military are the so-called REO style. The cab is the same dimensionally and REC has designed a durable metal cab top to fit these cabs. Often the military units come with rag tops and the canvas is not suitable for fire emergency work. This booklet contains complete drawings to fabricate the metal cab.

NOTE: The lower cab of the M939 series is different from the other 5-ton 6x6's. This means that the design of packet 63E will not work as is. The 939 lower cab is similar though, and the 63E concept will work with a few dimensional changes.



Packet 63F-2, Brush Protection Drawings for 2.5-Ton 6x6's. Includes drawings to build heavy duty grill, limb risers, fuel tank guards, and heavy duty bumper. This

concept is designed to protect the vehicle's sheet metal and radiator during off-road use. It reduces the contact of brush on side view mirrors. The bumper design fits both winch or winchless models.



Packet 63F-5, Brush Protection Drawings for 5-Ton 6x6's. Includes drawings to build heavy duty grill, limb risers, fuel tank guards, and heavy duty bumper. This concept is

designed to protect the vehicle's sheet metal and radiator during off-road use. It reduces the contact of brush on side view mirrors. The bumper design fits both winch or winchless models. Not intended for M939 series 6x6's.

Packet 63G, Wiring Diagrams for REC Designed 6x6 Wildfire Engines. Each user will have his own accessories that need electrical power and REC cannot possibly design an electric system that fits all these needs. However, Publication 63G provides some basic information on the most important and required electrical accessories and how they might be tied in to the truck's main electrical source.

Other REC Publications Related to Subject

REC Newsnote #9, Adding a 12 Volt DC Charging Circuit. 1998. Available in pamphlet form or online at www.RoscommonEquipmentCenter.com.

REC Project No. 2, Wiring Conversion on Military Vehicles. Rev. 1981. Available in pamphlet form or online at www.RoscommonEquipmentCenter.com.

REC Newsnote #3, Guidelines for Designing Forest Fire Engines. 1998. Gives additional advise for designing and planning water tank vehicles. Available in pamphlet form or online at www.RoscommonEquipmentCenter.com.

REC Project No. 11, Rustproofing Treatments for Steel Water Tanks. 1983. Available in pamphlet form or online at www.RoscommonEquipmentCenter.com.

Other Sources

NFPA 1906. Standard for Wildland Fire Apparatus. 2001 Edition. NFPA, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

Water Handling Equipment Guide, National Wildfire Coordinating Group, March 1994. Has photographs and lists specifications for wildland fire units across the Nation. Order NFES #1275 from the National Interagency Fire Center, ATTN: Great Basin Cache Supply Office, 3833 South Development Avenue, Boise, Idaho 83705.

Wildland Fire Engine Component Guide, National Wildfire Coordinating Group, March 1994. Lists and discusses common components found on wildland fire vehicles. Has chapters which discuss tanks, pumps, and other components. Order NFES #1871 from the National Interagency Fire Center, ATTN: Supply, 3905 Vista Avenue, Boise, Idaho 83705.

Portrayal Press, Military Booksellers to the World, P.O. Box 1190N, Andover, NJ 07821, telephone (973) 579-5781, www.portrayal.com. Source for military truck manuals in printed form.

M939 Series 5-Ton Truck, CHQ Software. 2001. Order No. CDR-0939 from CHQSoftware.com, C52 Blaine Road, Lone Butte, B.C., V0K 1X0, Canada, Telephone 1-888-300-7718. M939 operator and maintenance manuals on compact disk.

M35 Series 2 1/2-Ton Truck Operator & Technical Manuals, CHQ Software. 2001. Order No. CDR-0037 from CHQSoftware.com, C52 Blaine Road, Lone Butte, B.C., V0K 1X0, Canada, Telephone 1-888-300-7718. M35 operator and maintenance manuals on compact disk.

M39 Series 5-Ton Truck Operator & Technical Manuals, CHQ Software. 2001. Order No. CDR-0039 from CHQSoftware.com, C52 Blaine Road, Lone Butte, B.C., V0K 1X0, Canada, Telephone 1-888-300-7718. M39 and M809 operator and maintenance manuals on compact disk.

Appendix A

6x6 Truck Families and their Variants

5-Ton Models

M39 Series

M51 Truck, Dump
M52 Truck, tractor
M54 Truck, Cargo
M55 Truck, Cargo, Long Wheel Base (LWB)
M61 Truck Chassis
M62 Truck, Wrecker, medium
M63 Truck Chassis
M64 Truck, Cargo Van
M139 Truck Chassis
M246 Truck, Tractor-wrecker
M291 Truck, Van, expandable
M328 Truck, Stake, Bridging
M543 Truck, Wrecker, medium
M748 Truck, Bolster

M809 Series

M813 Truck, Cargo
M814 Truck, Cargo, LWB
M815 Truck, Bolster
M816 Truck, Wrecker, medium
M817 Truck, Dump
M818 Truck, Tractor
M819 Truck Tractor, Wrecker
M820 Truck, Van Expandable
M821 Truck, Bridging

M939 Series

M923 Truck, Cargo dropside w/o winch
M924 Truck, Cargo w/o winch
M925 Truck, Cargo dropside w/winch
M927 Truck, Cargo, LWB w/o winch
M928 Truck, Cargo, LWB w/winch
M929 Truck, Dump w/o winch
M930 Truck, Dump w./winch
M931 Truck, Tractor w/o winch
M932 Truck, Tractor w/winch
M933 Truck, Tractor-wrecker w/winch
M934 Truck, Van, expandable w/o winch
M935 Truck, Van, expandable w/o winch
M936 Truck, Wrecker, medium w/winch

2.5-Ton Models

M35 Series

M35A2C Truck, Cargo, 6x6, 2.5-ton
M46A2C Truck, Cargo, 6x6, 2 1/2 Ton w/drop sides
M34 Truck, Cargo, 6x6, 2 1/2 Ton w/single rear wheels on chassis
M44 Truck Chassis
M47 Truck, Dump Truck Chassis
M57 Truck Chassis
M36A2C Truck, Cargo, long bed
M48 Truck, tractor
M49 Truck, fuel tanker
M50 Truck, water tanker
M59 Truck, Dump
M60 Truck, wrecker, light
M108 Truck, wrecker, light
M109 Truck, shop, van
M132 Truck, medical van
M185 Truck, repair van
M275 Truck, Tractor
M292 Truck, shop, van w/extendible sides
M342 Truck, Dump
M756 Truck, maintenance, pipeline
M763 Truck, maintenance, telephone
M764 Truck, maintenance, earth-boring

Appendix B - Weight Information for Various Series and Types of 5-Ton 6x6's

Model Description	Wheel Base (Inches)	General Series										
		M39				M809				M939		
		Model No.	EVW (lbs.)	Payload (lbs.)		Model No.	EVW (lbs.)	Payload (lbs.) (e)		Model No.	EVW (lbs.)	Payload (lbs.)
On Highway	Cross-Country			On Highway(h)	Cross-Country							
Chassis, Truck	N/A					M812A1	20,810	26,000	16,000			
Dump Truck	167	M51	21,523	20,000	10,000	M817	23,755 (f)	20,000	10,000	M929	25,888	10,000
										M929/A1	25,065	10,000
		M929/A2	23,820	10,000								
		M930	26,624	10,000								
		M930/A1	26,165	10,000								
Tractor Truck	167	M52	18,313 (a)	25,000 (b)	15,000 (c)	M818	20,165 (f)	25,000 (b)	15,000	M931	22,089	15,000 (b)
										M931/A1	21,140	15,000 (b)
		M931/A2	19,895	15,000 (b)								
		M932	22,841	15,000 (b)								
		M932/A1	22,242	15,000 (b)								
Cargo Truck	179	M54	19,231 (a)	20,000	10,000	M813	21,020 (f)	20,000	10,000	M932/A2	20,995	15,000 (b)
		M54A1, M54A2	19,480 (a)	20,000	10,000							
Dropside Cargo Truck	179	M54A1C, M54A1C	19,946 (a)	20,000	10,000	M813A1	21,120 (f)	20,000	10,000	M923	21,600	10,000
										M923/A1	22,175	10,000
										M923/A2	20,930	10,000
										M925	22,360	10,000
										M925/A1	22,275	10,000
Cargo truck	215	M55	23,349 (a)	20,000	10,000	M814	23,540 (f)	20,000	10,000	M925.A2	22,030	10,000
										M927	27,749	10,000
										M927/A1	25,035	10,000
		M927/A2	23,790	10,000								
		M928	27,811	10,000								
		M928/A1	26,135	10,000								
Tractor Wrecker	215	M246	32,830	16,000 (b,d)	12,000 (c,d)	M819	35,065	16,000 (b,g)	12,000 (b,g)	M928/A2	24,890	10,000
		M246A1, M246A2	32,087	16,000 (b,d)	12,000 (c,d)							
Medium Wrecker Truck	179	M62	33,325	(d)	(d)	M816	35,050	12,000 (g)	7,000 (g)	M936	39,334	7,000 (g)
		M543	34,440	(d)	(d)					M936/A1	38,155	7,000 (g)
		M543A1, M543A2	34,690	(d)	(d)					M936/A2	36,910	7,000 (g)
Expansible Van Truck	215	M291A1	26,270	15,000	5,000	M820	28,195 (f)	15,000	5,000	M934	29,946	5,000
		M291A1D	27,136	15,000	5,000	M820A1	27,895 (f)	15,000	5,000	M934/A1	29,280	5,000
						M820A2	30,195 (f)	15,000	5,000	M932/A2	28,035	5,000
Bridge Transporting Truck	215	M328A1	26,586	20,000	10,000	M821	28,880 (f)	20,000	10,000			
Bolster Truck	215	M748A1	20,550 (a)	20,000	10,000	M815	21,040	20,000	10,000			

- a) Add 714 pounds for vehicles equipped with front winch.
- b) On fifth wheel.
- c) 12,000 and 15,000 pound loads on fifth wheel are for limited cross-country operation.
- d) See crane safe load chart.
- e) Subtract 400 pounds for two crew members.
- f) 665 pounds less without front winch.
- g) On crane with boom shipper braced and secured.
- h) These loadings are found in older manuals but not in the newer ones. Units may or may not have these ratings.

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