2002 GM/Isuzu Truck

INSTALLATION OF BODY AND SPECIAL EQUIPMENT – Modification of the Frame – (Continued)

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WEIGHT DISTRIBUTION CONCEPTS – Performance Calculations – (Continued)

VEHICLE SPECIFICATIONS INDEX – NPR, NPR HD/W3500, W4500 Gas – (Continued)

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VEHICLE SPECIFICATIONS INDEX – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – (Continued)

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VEHICLE SPECIFICATIONS INDEX – NPR, NPR HD, NQR/W3500, W4500, W5500 Diesel Electrical – (Continued)

INTRODUCTION

This guide has been provided as an aid to final stage manufacturers in determining conformity to the applicable Emission Control and Federal Motor Vehicle Safety Standards. Final stage manufacturers should maintain current knowledge of all Emission Regulations and Federal Motor Vehicle Safety Standards and be aware of their specific responsibility in regards to each standard.

Any manufacturer making material alterations to this incomplete vehicle during the process of manufacturing the complete vehicle should be constantly alert to all effects, direct or indirect, on other components, assemblies or systems caused by such alterations. No alterations should be made to the incomplete vehicle that directly or indirectly results in any either component, assembly or system being in nonconformance with applicable Emission Regulations or Federal Motor Vehicle Safety Standards.

GMICT will honor its warranty commitment (**for the cab-chassis only**), to the ultimate consumer, provided: (1) the final stage manufacturer has not made any alterations or modifications which do not conform to any applicable laws, regulations or standards, or adversely affect the operation of the cab-chassis; and (2) the final stage manufacturer complied with the instructions contained in this guide with respect to the completion of the vehicle. Otherwise, the warranty becomes the responsibility of the final stage manufacturer.

The final stage manufacturer is solely responsible for the final certification of the vehicle and for compliance with Emission Control and Federal Motor Vehicle Safety standards. The information contained in this guide has been provided for the final stage manufacturer's information and guidance.

This guide contains information pertaining to the NPR/W3500 Gas, NPR/W3500 Diesel, NQR/W5500 Diesel, NPR HD, NQR/W4500, W5500 Diesel Crew Cab and FRR/WT5500 Series Chassis Cab.

Following is a list of Federal Motor Vehicle Safety Standards applicable to those vehicles with a GVWR greater than 10,000 lbs. Please refer to the chart on the next page.

FMVSS Chart

FMVSS	Title	NPR, NPR HD/W3500, W4500	NQR/ W5500	FRR/ WT5500
101	Controls and displays	A+	A+	A+
102	Transmission shift lever sequence, starter interlock and transmission braking effect	A+	A+	A+
103	Windshield defrosting and defogging systems	A+	A+	A+
104	Windshield wiping and washing systems	A+	A+	A+
105	Hydraulic brake systems	A+	A+	B
106	Brake hoses	A+	A+	A+
107	Reflecting surfaces	–	–	–
108	Lamps, reflective devices and associated equipment	A+	A+	A+
111	Rear view mirrors	A+	A+	A+
112	Headlamp concealment devices[3]	A	A	A
113	Hood latch systems	A	A	A
115	Vehicle identification number[3]	A	A	A
116	Motor vehicle brake fluids	A+	A+	A+

FMVSS	Title	NPR, NPR HD/W3500, W4500	NQR/ W5500	FRR/ WT5500
118	Power operated window systems[5]	A	A	A
120	Tire selection and rims	A+	A+	A+
121	Air brake systems	B	B	A
124	Accelerator control systems	A+	A+	A+
205	Glazing materials	A+	A+	A+
206	Door locks and door retention components	A+	A+	A+
207	Seating systems	A+	A+	A+
208	Occupant crash protection	A+	A+	A+
209	Seat belt assemblies	A+	A+	A+
210	Seat belt assembly anchorages	A+	A+	A+
211	Wheel nuts, wheel discs, and hub caps[4,3]	A	A	A
213	Child restraint systems	A	A	A
302	Flammability of interior materials	A+	A+	A+

NOTE: This chart is only a guide. For complete information, please refer to “Document for Incomplete Vehicle” provided with each chassis.

Chart Legend

A = Incomplete vehicle; when completed will conform providing no alterations have been made affecting items covered by FMVSS regulations and “Document for Incomplete Vehicle.”
B = Incomplete vehicle; when completed by the final manufacturer will conform providing it is completed in compliance with FMVSS regulations and “Document for Incomplete Vehicle.”
+ = Meets Canadian Motor Vehicle Safety Standards bearing same FMVSS number.
3 = Canadian MVSS only.
4 = Not applicable to truck or bus.
5 = Not applicable to trucks with a GVWR greater than 10,000 lbs.

EPA Requirements

NPR/W3500 Gas, NPR/W3500 Diesel, NQR/W5500 Diesel, NPR HD, NQR/W4500, W5500 Diesel Crew Cab and FRR/WT5500 Series Chassis Cab

To assure that U.S.A. and Canada Emission Requirements are met, this Incomplete Vehicle must be completed in strict accordance with all instructions contained in this document, especially the following instructions which relate to:

A Exhaust emission related components

B Noise emission related components

C Labels

A. EXHAUST EMISSION RELATED COMPONENTS

Compliance of this vehicle with EPA, California and Canada requirements will be maintained providing no alterations are made to the components or systems identified below:

1. DIESEL VEHICLES

Injection Pump
Injector and High Pressure Lines
Turbocharger
Charge Air Cooler and Charge Air Cooler Hoses
Engine Control Module (ECM)
Engine Speed Sensor
Engine Coolant Temperature Sensor
Intake Manifold
Catalytic Converter and Its Location
Variable Swirl System
Exhaust Gas Recirculation System

2. GASOLINE VEHICLES

Vehicle Control Module (VCM)
Fuel Management System
Air Induction System
Ignition System
Catalytic Converter System
Positive Crankcase Ventilation System
Exhaust Gas Recirculation System
Evaporative Emission Control System
Miscellaneous Items Used in Above Systems

ADDITIONAL CANADA MOTOR VEHICLE SAFETY STANDARD
CMVSS NO. 1101–EMISSION DEVICE
CMVSS NO. 1102–CRANKCASE EMISSION (GASOLINE ENGINE ONLY)
CMVSS NO. 1103–EXHAUST EMISSIONS
CMVSS NO. 1104–OPACITY (DIESEL ENGINE ONLY)
CMVSS NO. 1105–EVAPORATIVE EMISSION (GASOLINE ENGINE ONLY)

(EPA Requirements – continued on next page)

(EPA Requirements – continued from previous page)

B. NOISE EMISSION RELATED COMPONENTS

Compliance of this vehicle with EPA and Canada requirements will be maintained providing no alterations are made to the components or systems.

CMVSS NO. 1106–NOISE

This incomplete vehicle, when completed, will conform to the above statements except CMVSS-1106 providing no alterations are made which effect the function, physical or mechanical properties, environment, locations or vital spatial clearances of the components identified below:

* Engine assembly
  Exhaust emission control system
  P.C.V. system (if equipped)
* Intake system
* Exhaust system
  Fuel system (if equipped)
* Transmission assembly
* Axle
* Tires
* Fan and drive
  Diesel fuel injection controls (if equipped)
  Turbocharger and associated controls (if equipped)
* Catalytic converter and its location
  Variable swirl system (if equipped)

Conformity with CMVSS 1106 is not determined solely by the design of the incomplete vehicle. When completed, it should conform to CMVSS 1106 providing no alterations are made to the noise attenuation components identified thus * in the above list.

C. LABELS

The emission control related information labels which are permanently affixed are required by government regulation and must not be obstructed from view or defaced so as to impair its visibility or legibility.

PART 3: RADIO NOISE

CANADIAN RADIO INTERFERENCE REGULATIONS

A. The following statement is applicable to NPR/W Series Chassis-Cab (Gasoline Engine Only).

This incomplete vehicle, when completed, will conform to the above regulations providing no alterations or substitutions are made which affect any parts or components identified below:

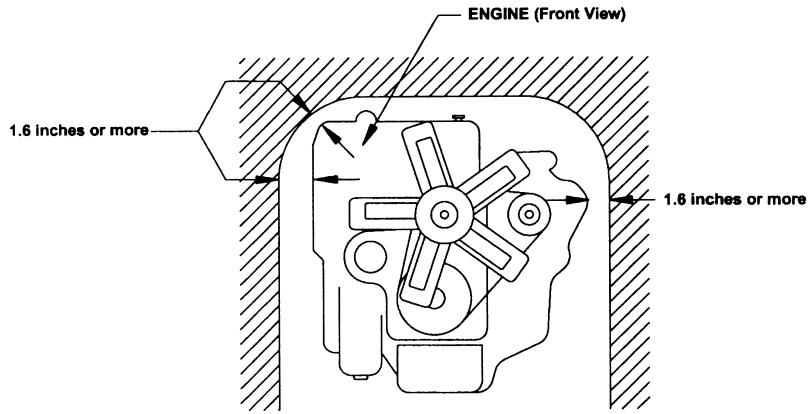
A. Distributor
B. Ignition Wires
C. Spark plug wires

INSTALLATION OF BODY AND SPECIAL EQUIPMENT

Clearances

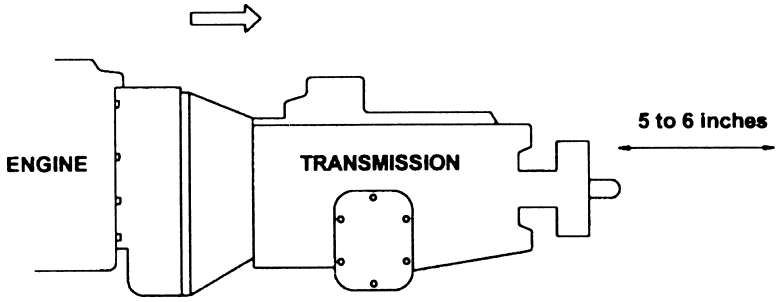
Engine

At least 1.6 inches of clearance should be maintained around the engine. No obstacles should be added in front of the radiator or intercooler.



Transmission

The transmission is removed from the rear. Enough clearance must be provided to allow rearward movement of the transmission assembly. Clearance should be sufficient to allow 5 to 6 inches of unrestricted movement of the transmission assembly. In addition, provide at least 2 inches of clearance around the control lever on the side of the transmission to allow free movement without any binding.



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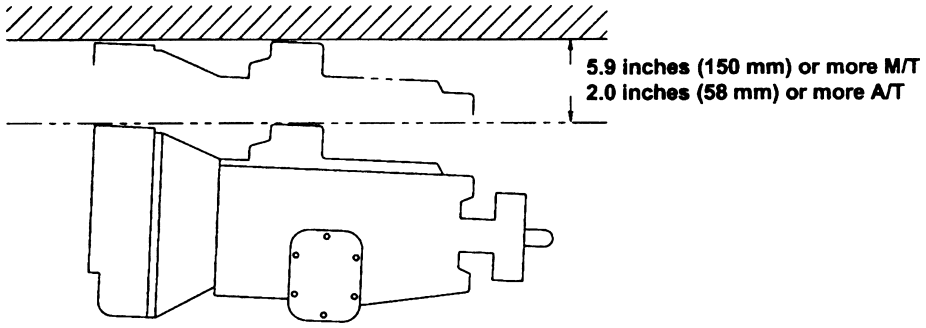
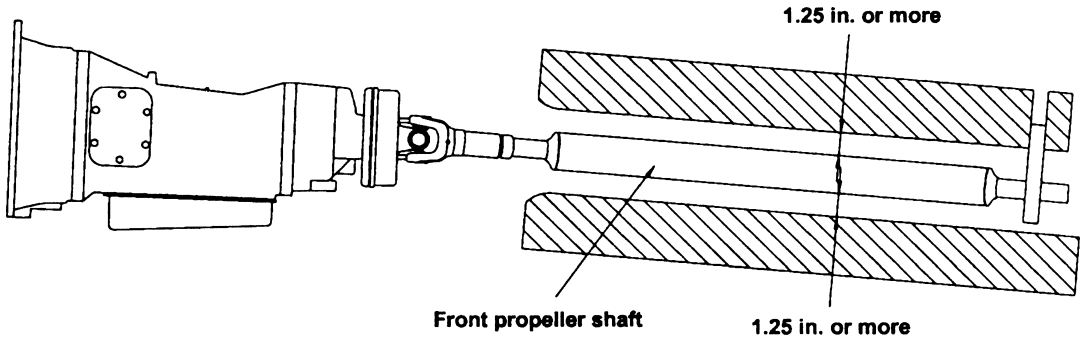
At least 6 inches of clearance should be maintained above the transmission to allow easy removal of the upper cover for manual transmissions. At least 2 inches of clearance should be maintained above the automatic transmission to allow for transmission removal.



Transmission

Front and Center Propeller Shafts

At least 1.25 inches of clearance should be maintained around front and center propeller shafts.



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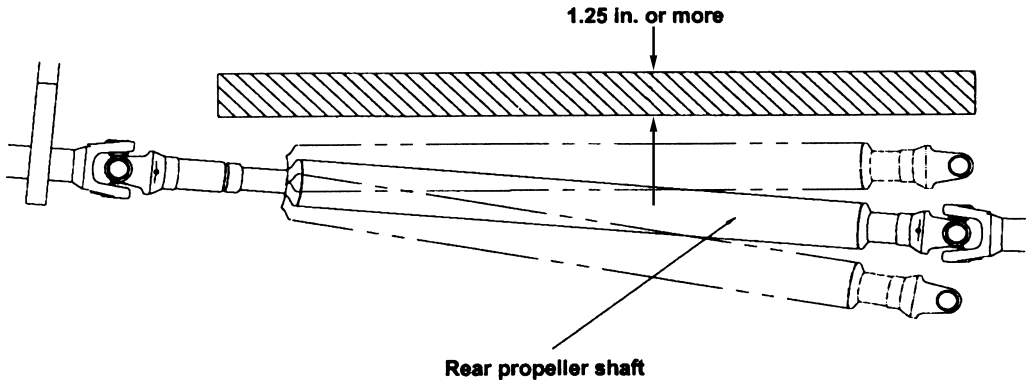
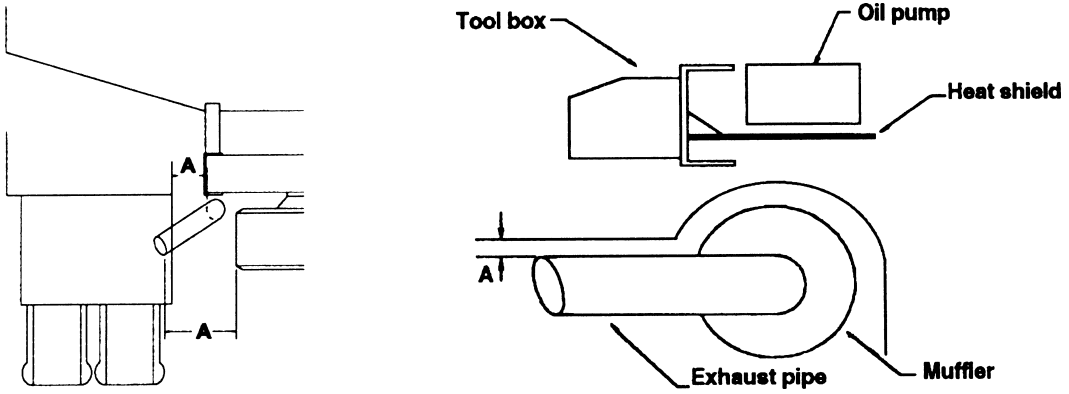
Rear Propeller Shaft

With the rear springs at maximum deflection, at least 1.25 inches of clearance should be provided over the rear propeller shaft.



Exhaust System

If flammable materials such as wood are used in the body, provide at least 3.9 inches of clearance between the body and any parts of the exhaust pipe (A), muffler and catalytic converter. If it is impossible to maintain this minimum clearance, use a heat shield. Also use a heat shield if an oil pump or line is located above the exhaust pipe, muffler or catalytic converter.



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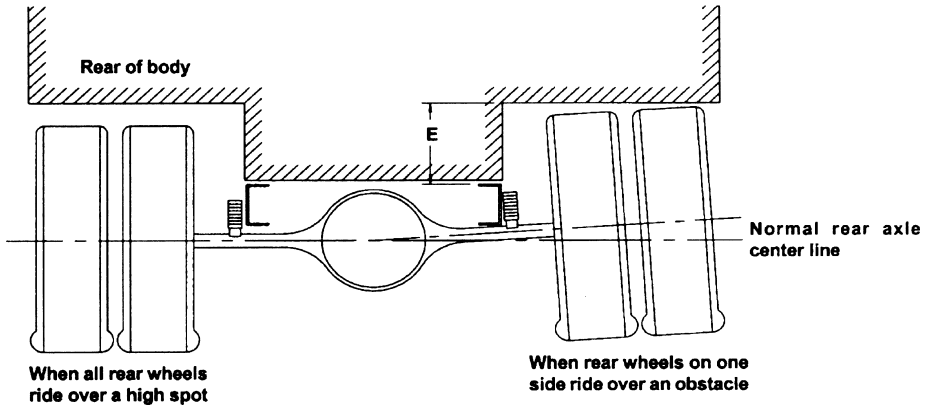
Rear Wheel and Axle

The design and installation of the body should allow sufficient clearance for full vertical movement of the rear wheels and axle when the vehicle travels over rough or unlevel surfaces.



Note: For recommended clearance, please refer to … ???

Other Clearances

The transmission control cable may be broken if it is bent by or interferes with the body and its fixtures. To prevent this, 1 inch of minimum clearance should be provided. When cable is detached from body mounting, be sure not to bend the cable.

Accessibility to the grease nipple on the rear spring bracket/shackle should be provided so that serviceability with a grease gun is not hampered.

Parts	Minimum Clearance	Location
Brake Hose	6.7 in. 1.6 in.	Axle Side Frame Side
Parking Brake Cable	1.2 in.	—
Fuel Hose	1.6 in.	—
Shock Absorber	2.4 in. 1.2 in.	Axle Side Frame Side

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Body Installation

Chassis

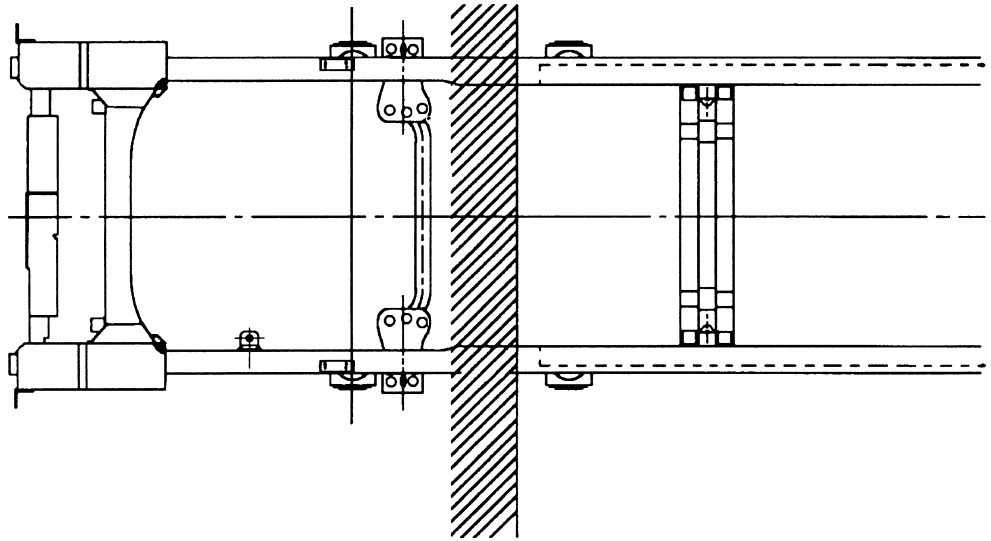
To maintain the performance of the truck chassis, either a side member or subframe should always be used for body mounting. Body mounting with low rigidity will often adversely affect riding comfort.

Special Equipment on the Chassis

When installing special equipment on the chassis, extra consideration must be given to the weight and construction of the equipment to assure proper distribution of the load. Localization of the load should be prevented. All special equipment should be properly secured into position. We recommend the use of subframe members when installing special equipment.

Subframe Design and Mounting

The subframe assembly should be mounted as close to the cab as possible. It should be contoured to match the shape and dimensions of the chassis frame as closely as possible.



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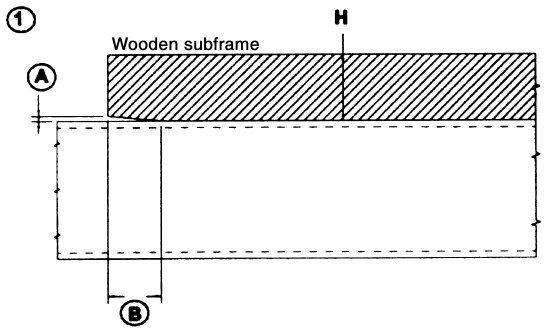
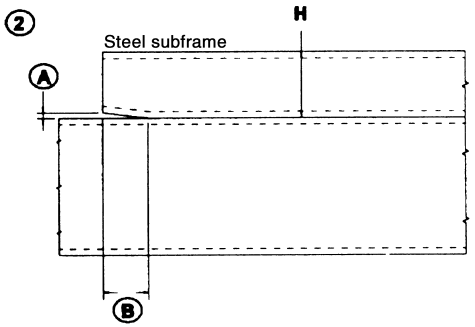
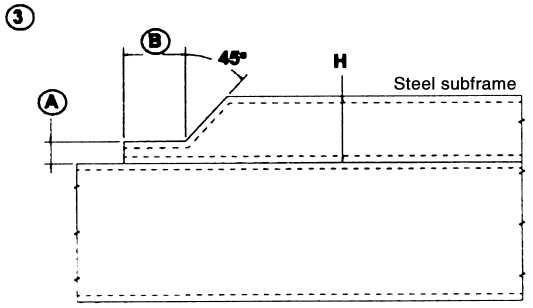
Subframe Contour

Contouring of the front end of the subframe members as shown in the three illustrations below will prevent stresses from being concentrated on certain areas of the chassis frame.







Drawing	A	B
①	0.2 in.	$\frac{H}{2}$ ~ H
②	0.2 in.	H or more
③	$\frac{H}{3}$	H or more

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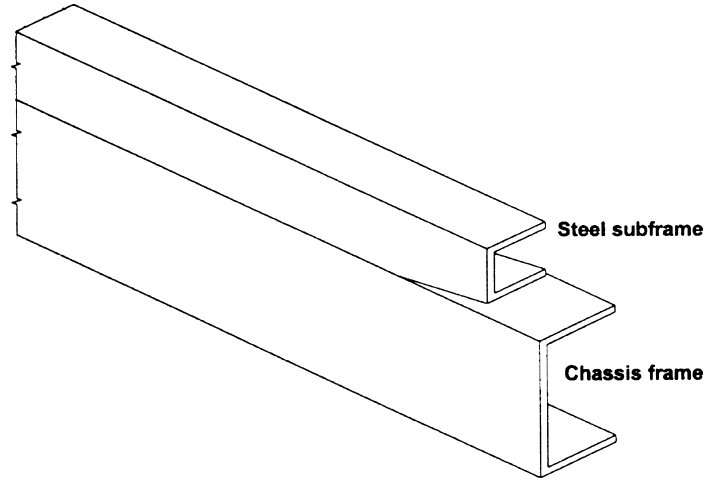
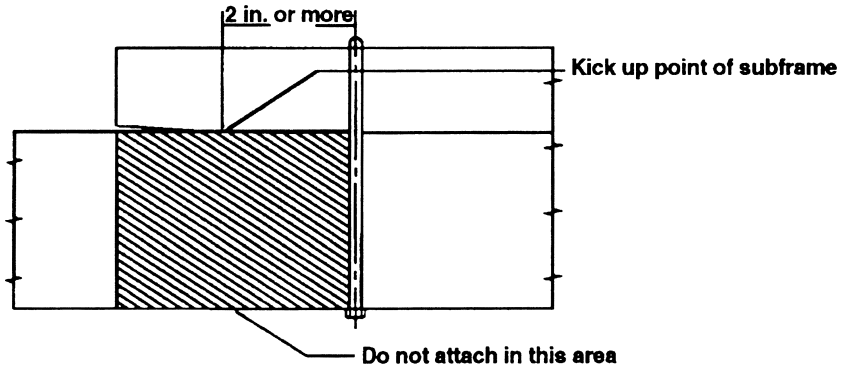
When using a steel subframe, do not close the end of the subframe.



Prohibited Attachment Areas

Do not attach the subframe with a bolt on bracket to the chassis frame at the points indicated by shading in the following illustrations.

1. At the front end of the subframe. The attaching bolt or bracket must be at least 2 inches behind the kick up point of the subframe.



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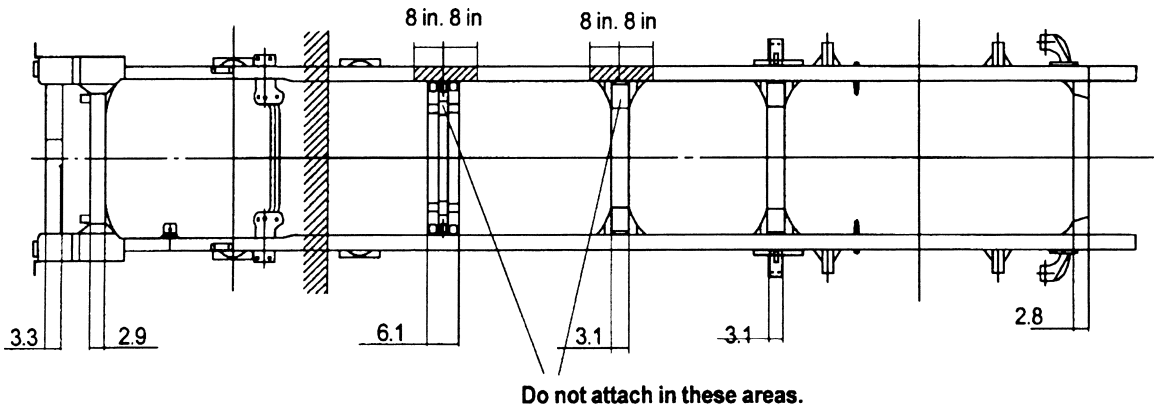
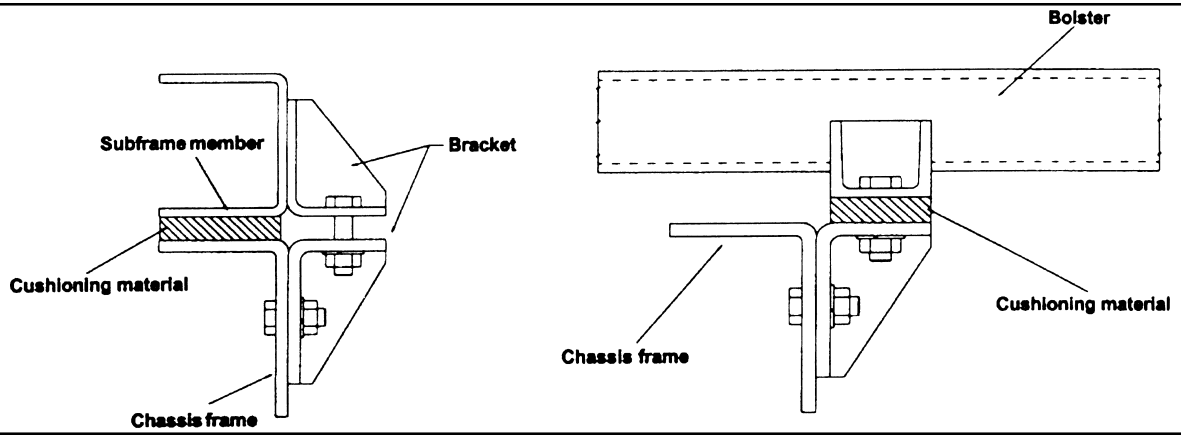
2. Within 8 inches of bends in the chassis frame or the attachment points of any crossmembers.



Subframe Mounting

Bracket Installation



Mounting brackets should be clamped to the chassis frame using bolts. For proper positions in which to install the bolts, refer to the preceding section and the section “Modifications to the Chassis Frame.”

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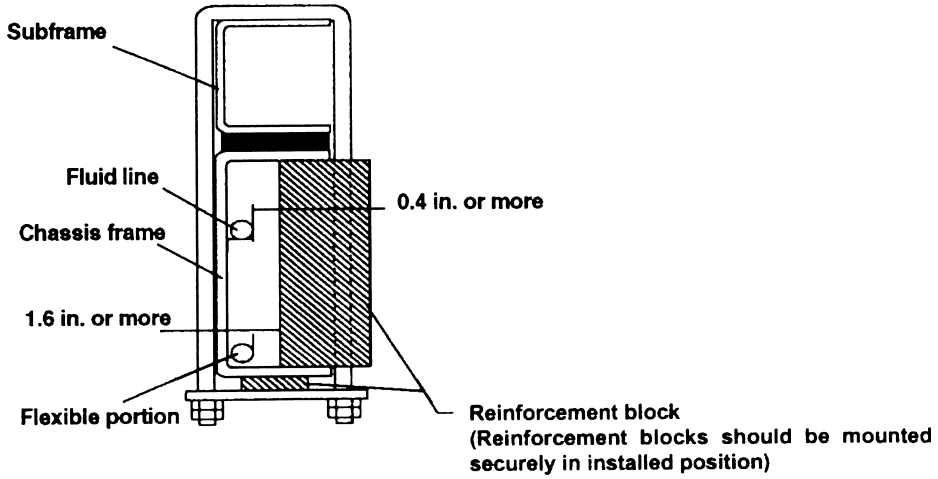
U-bolt Installation

When U-bolts are used to retain the subframe, reinforcement blocks must be installed in the frame members. This will prevent distortion of the frame flange as they are tightened. The drawing indicates the correct placement of reinforcement blocks. If you use wood blocks, be sure that there is sufficient clearance between them and any parts of the exhaust system.

If any fluid lines or electric cables are located near the reinforcement blocks, you must provide at least 0.4 inches of clearance between rigid or stationary portions, and at least 1.6 inches between moveable or flexible portions of the lines.



For the installation positions of the U-bolts, refer to “Prohibited Attachment Areas.”

Crew Cab Body/Frame Requirement

The Crew Cab NPR HD/W4500 and NQR/W5500 will be available in two wheelbases, 150 and 176 inches. Effective CA will be 84.7 and 110.7 inches. On this model chassis, General Motors Isuzu Commercial Trucks will require that the body installed on the chassis have an understructure manufactured with any of the following structural steel “C” channels:

4” x 1-5/8”, 7.25 lbs./ft. = ok
5” x 1-3/4”, 6.7 or 9.0 lbs./ft. = ok
6” x 2”, 8.2, 10.5 or 13.0 lbs./ft. = ok

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Modification of the Frame

Modifications of the chassis frame should be held to an absolute minimum. Modification work should be performed according to the instructions in the following paragraphs.

When modification is complete, chassis frame members should be carefully inspected to eliminate the possibility of any safety-related defects.

NOTE: PLEASE REFER TO NOTES ON CHASSIS FRAME MODIFICATION WITH ANTILOCK BRAKES.

Working on Chassis frame

The chassis frame is designed and built with consideration for proper load distribution. Sufficient physical strength is provided when the load is evenly distributed. Installation of special equipment on the chassis frame can cause variations in load distribution. If even distribution of load is not kept in mind when the equipment is installed, localization of stresses on specific areas of the frame could cause cracking of the chassis frame members or other problems, even if the total weight of the equipment is within the design limit.

The chassis frame is designed as an integral unit. Therefore, we do not recommend cutting the chassis frame under any circumstances.

Drilling and Welding

IMPORTANT NOTE: For vehicles equipped with electronic or hydra-matic transmissions, electric arc welding must be done with the negative battery cable disconnected.

1. Do not drill or weld in the shaded portions of the chassis frame members. Do not weld within 0.8 inches from the edges of any existing holes.
2. Hold the length of any welding beads within 1.2-2.0 inches. Allow at least 1.6 inches between adjacent welding beads.
3. All holes must be drilled. Do not use a torch to make any holes.
4. All riveting must be done with cold rivets. Do not use hot rivets.
5. The flange of the chassis frame must not be cut under any circumstances.
6. The subframe must be attached to the chassis frame with bolts. Do not weld.

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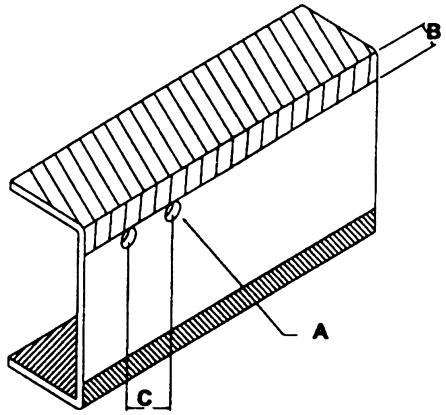

Dimensions: **A - not more than 0.51 in. in diameter**
B - must be more than 0.8 in.
C - must be more than 1.0 in.

Reinforcement of Chassis Frame

Reinforcements must be installed to prevent the considerable variation in the section modulus. They must be welded so as to avoid localized stresses.

The frame of the NPR, NPR HD/W3500, W4500 and NQR/W5500 is made of SAPH440 mild steel. The frame of the FRR/WT5500 is made of HT540A.

The drawing on the following page illustrates correct and incorrect methods of frame reinforcement.

Welding

1. Keep reinforcement plates and chassis frame free from moisture and water.
2. Avoid cooling with water after welding.
3. Use a suitable means to protect pipes, wires, rubber parts, leaf springs, etc. against heat and effect of sputtering.
4. Remove fuel tank assembly when welding portions near the fuel tank.
5. Remove coat of paint completely when welding painted areas.

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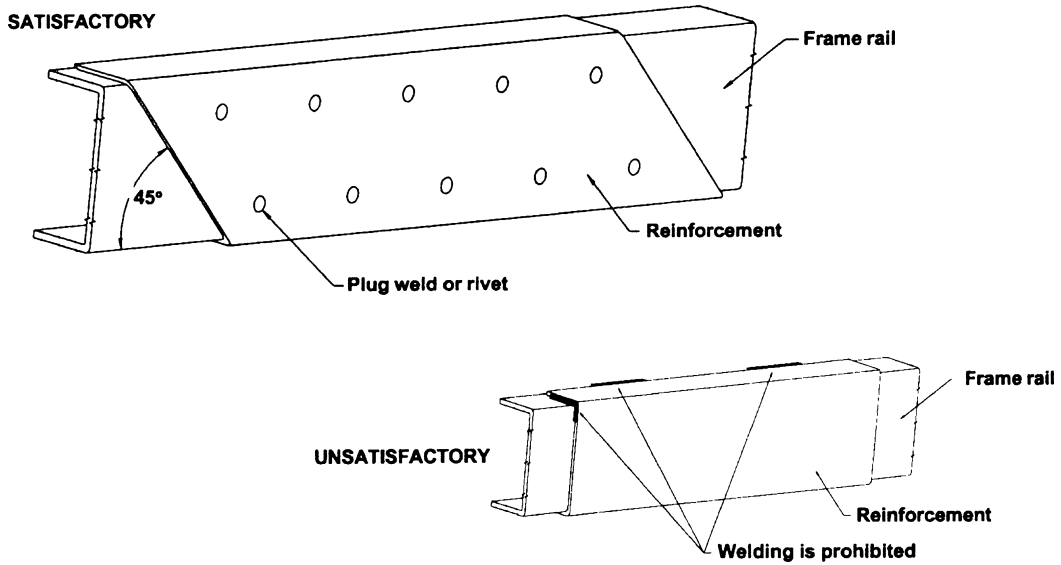

Fluid Lines

Do not disturb the layout of any brake lines or fuel lines unless absolutely necessary. When modification is needed, follow the instructions below carefully to ensure safety. Brake fluid lines must not be cut and spliced under any circumstances. We do not recommend the cutting or splicing of any fuel lines, but if it is absolutely necessary, be sure that the correct fitting and tools are used to form the joint, and then pressure test the joint. Steel lines are metric sizes.

Preparation of Additional Lines

1. Where possible, use only genuine GM/Isuzu lines as supplied by authorized GM/Isuzu dealers.
2. Use the correct metric flaring and bending tools to form the lines.
3. Avoid repeated bending. Do not use heat for flaring and bending the lines. Before and after forming the new lines, examine them carefully for scratches, distortion, dents and the presence of any foreign matter.

(Installation of Body and Special Equipment Section – continued on next page)

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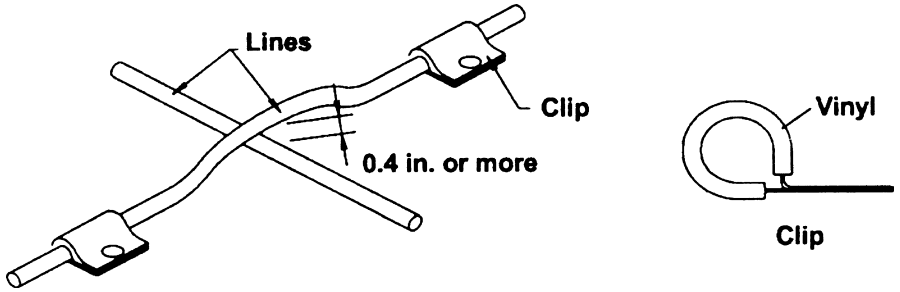
Installation of Additional Lines

Install new lines away from adjacent parts and away from any sources of heat.

1. A minimum clearance of 0.4 inches must be maintained between lines. Where necessary, clip the lines into position in order to maintain this minimum clearance.
2. Minimize any crossing between lines. If a crossing is unavoidable, use the following procedure:
   a. At least 0.4 inches of clearance should be maintained between lines at the crossing point.
   b. If the 0.4 inches of clearance cannot be maintained, or if the lines are subject to vibration, clip them securely.
3. Plan the bends and clipping points of the lines to minimize vibration and the resulting fatigue.
4. Use rust-proofed clips and apply vinyl coating to the portions of the lines to be clipped.
5. Install new lines in positions where they are protected against water, dirt, grit, sand, rocks and other foreign matter that can come from above or below, or can be flung up by the wheels.



Electrical Wiring and Harnessing

To increase the reliability of the wiring, all frame harnesses are covered with corrugated vinyl tubing. The following instructions apply to extending or modifying these harnesses. See the Electrical Section for information on commonly used circuits in the NPR, NPR HD, NQR, FRR/W3500, W4500, W5500, WT5500.

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Wiring

1. Most wiring connections on GM/Isuzu vehicles are made with terminals. We recommend the use of terminals when splicing cables and wires.
2. When splicing, use new wire of the same gauge, and do not make splices inside the corrugated tubing.
3. When making connections to the end of the harness, make sure the connections are electrically perfect. Use insulating tape as needed to prevent the entry of water, which results in short circuits and/or corrosion.
4. When making new circuits, or modifying circuits already installed, make the cables only just taut enough to remove any slack. Use clips or grommets where required to protect cables from heat or sharp edges. When cables must run near the exhaust system, see the instructions in the "Exhaust System" section.
5. Always use rustproof clips, and apply vinyl coating to that portion of the clips in direct contact with the harnesses. No scotch clips or connectors.
6. To minimize the vibration of the harness, clipping points should be set up according to the table.

Harness Diameter	Clip Distance
less than 0.2 in.	less than 11.8 in.
0.2 in. ~ 0.4 in.	approx. 15.7 in.
0.4 in. ~ 0.8 in.	approx. 19.7 in.

7. When changing the length of the battery cable, do not cut or splice the existing cable. Make up a new cable of the correct length and wire gauge for the load and distance, without splices.
8. When using connectors, use a socket (female) connector on the electrical source side and a plug (male) connector on the electrical load side to lower the possibility of a short circuit when disconnected.
9. When connecting cables to moving or vibrating parts such as the engine or transmission, be sure to maintain sufficient slack in the wiring to absorb the vibration. Follow the example of existing cables connected by GM/Isuzu. Keep flexible cables clear of other parts.
10. Do not use vinyl tape in the engine compartment. The heat will tend to make it peel off. Use plated steel clips coated with rubber or vinyl.

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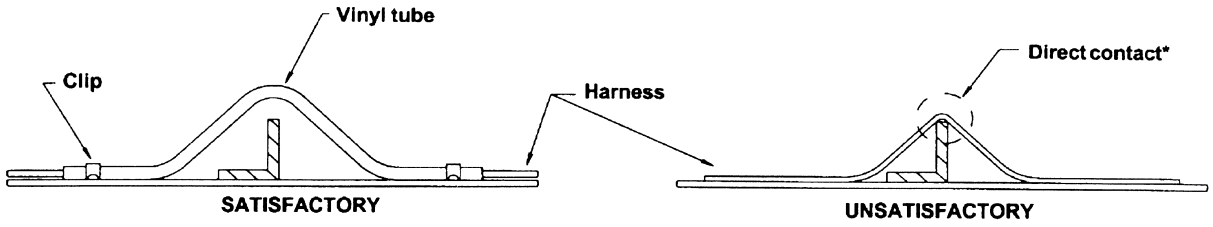
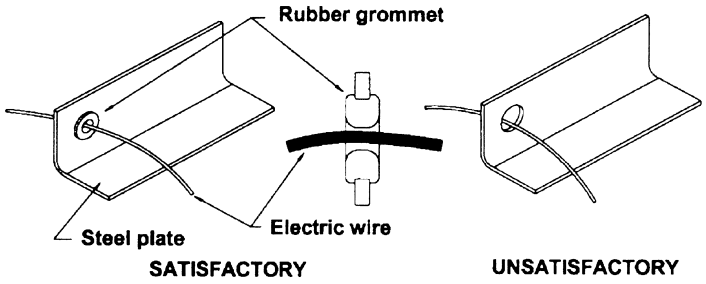
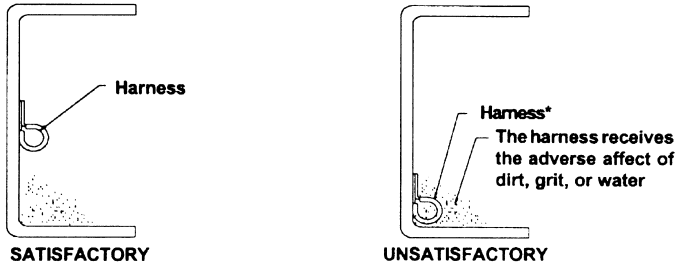


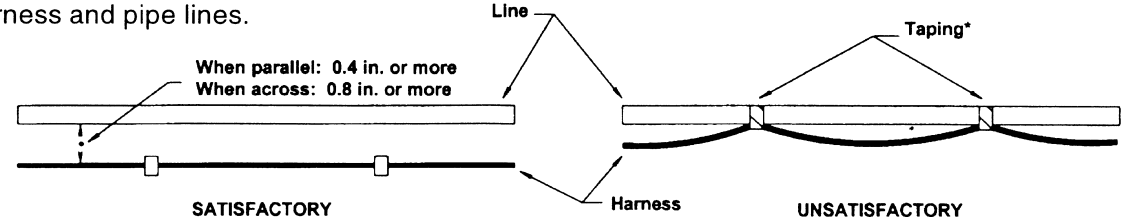


* Cables should not be in contact with sharp edges or pierced holes.



* Harnesses should not be installed on inside lower face of the chassis frame.

* Harnesses should not be taped to fuel lines or other lines. A sufficient clearance should be maintained between harness and pipe lines.



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Wire Color Code

The electrical circuits of the N/W and FRR/WT Series Chassis Cab are connected with low-voltage stranded wire for automotive applications. The color coding standards are as follows for the N/W and FRR/WT Series Chassis Cab:

(1)	Black	B	Starter circuits and grounds	(5)	Yellow	Y	Instrument circuit
(2)	White	W	Generator (alternator) circuit	(6)	Brown	Br	Accessory circuit
(3)	Red	R	Lighting circuit	(7)	Light Green	Lg	Other circuit
(4)	Green	G	Signal circuit	(8)	Blue	L	Windshield wiper motor circuit

Maximum Allowable Current

Harness Design Diameter (mm)	AWG Equivalent	No. of Wires/Wire Diameter (mm)	Cross Sectional Area (mm^2)	Maximum Allowable Current (Amps)
100	00	217/0.80	109.1	363
85	0	169/0.80	84.96	305
60	1	127/0.80	63.84	248
50	1	108/0.80	54.29	223
40	1	85/0.80	42.73	191
30	2	70/0.80	35.19	171
20	4	41/0.80	20.61	123
15	6	84/0.45	13.36	93
8	8	50/0.45	7.952	68
5	8	65/0.32	5.228	51
3	12	41/0.32	3.297	39
2	14	26/0.32	2.091	29
1.25	16	16/0.32	1.287	21
0.85	18	11/0.32	0.8846	17
0.5	20	7/0.32	0.5629	13

Reference: The values given in the “maximum allowable current” column are based on the ambient temperature condition of 104ºF with temperature increase of 104ºF.

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Electrical System Modifications

Modifications/add-on wiring must be carefully reviewed to ensure compatibility with the base vehicle wiring by reviewing system schematics, wire routing paths, harness connections, etc. Due to the wide range of modifications that may be required for vocational needs, it is not feasible for the O.E.M. to take into account all potential revisions. For this reason, any person modifying existing vehicle wiring must assume responsibility that the revisions have not degraded the electrical system performance. Any add-on wiring needs to be properly fused and routed to prevent cut, pinch, and chafe problems, as well as avoid exposure to excessive heat. Care must be exercised that existing vehicle interfaces do not have their current load capabilities exceeded, and that the respective control devices are not overloaded. Added wire size should be at least as large as the wire to which it is attaching in order for fuse protection to be maintained

A Packard electric wiring repair kit is available through Kent-Moore (P/N J38125-B) (Phone # 1-800-345-2233). This kit contains instructions, tools and components for making repairs to wiring harness components. This kit would also greatly assist in accomplishing necessary add-on wiring such as body marker lamps, so that system reliability/durability is maintained.

Electrical wiring components can be obtained through your authorized GM/Isuzu dealers. Packard Electric components are also available through Pioneer Standard Company (1-800-PACKARD). Pioneer may also be able to assist in making necessary wiring additions by providing custom wiring stubs or jumpers to your specifications.

Exhaust System

Modification of the exhaust system should be avoided. If modifications are absolutely necessary, the following points should be maintained.

1. Maintain the clearance specified in the “Exhaust System” table between all parts of the exhaust system and any fuel lines, brake lines, brake hoses, electrical cables, etc. The exhaust outlet should not point toward any of these parts.

	Clearance
Brake Lines	2.4 in. or more. (If the combined section of a group of parallel brake lines is more than 7.8 in., a clearance of 7 in. or more should be provided.)
Flexible Brake Hoses	3.9 in. or more. (The temperature of flexible brake hoses should not exceed 158°F. If the highest temperature is not measurable, a clearance of more than 15.7 in. should be maintained between the hoses and the exhaust system.)
Wiring Harnesses and Cables	3.9 in. or more.
Steel Fuel Lines	3.1 in. or more.
Rubber or Vinyl Fuel Hoses	5.9 in. or more.

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2. If a tool box is installed, it should preferably be made from steel. If a wooden tool box is installed, at least 7.8 inches of clearance should be maintained between the tool box and any parts of the exhaust system.
3. If the exhaust system is modified, it is the responsibility of those making the modification to ensure that the noise level meets appropriate standards.

Fuel System

Relocation of the fuel tank, or installation of additional fuel tanks, is not recommended. If modifications to the fuel system are unavoidable, follow these recommendations:

1. Maintain adequate clearance between the fuel tank and any other device or structure.
2. Do not connect any additional fuel hose.

Rear Lighting

Brackets installed are temporary. Please do not use these brackets for body installation.

Serviceability

No matter what other modifications or changes are made, access to components requiring daily preventive maintenance or other routine service must not be obstructed. This includes:

1. Inspection, filling and draining of engine oil and cooling water.
2. Inspection, filling and draining of transmission fluid.
3. Adjustment, removal and installation of the fan belts.
4. Inspection, filling and removal of the battery and battery cover.
5. Inspection and filling of brake fluid.
6. Inspection and bleeding of the brake system and servo unit.
7. Maintenance of clearance for tightening of check bolt on brake safety cylinder.
8. Operation of the spare tire carrier, including mounting and dismounting of the spare tire.
9. Adjustment, removal and installation of distributor and/or cover.

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Wheelbase Alteration

With certain applications, it may become necessary to alter the wheelbase of the chassis. The next two sections provide the suggested guidelines for accomplishing either shortening or lengthening of the wheelbase.

Shortening/Lengthening the Wheelbase Without Altering the Frame

Since the frame is an integral part of the chassis, it is recommended that the frame not be cut if it is possible to avoid it. When shortening/lengthening the wheelbase on some models, it is possible to do so without cutting the frame. This is possible on models which have a straight frame rail. If the chassis does not have a straight frame rail, it may still be necessary to cut the frame. For instructions on shortening/lengthening these chassis, refer to the "Altering the Wheelbase by Altering the Frame" section of this book. Otherwise, the wheelbase may be shortened/lengthened by removing the rear suspension, drilling new suspension mounting holes at the appropriate spot in the frame, and sliding the rear suspension, suspension liner, and suspension crossmembers forward or aft. The suspension and suspension crossmembers' rivet holes left in the frame rail flange must be filled with GRADE 8 bolts and hardened steel washers at both the bolt head and nut, HUC bolts or GRADE 8 flanged bolts and hardened steel washers at the nut. When shortening/lengthening the wheelbase in this manner, the following guidelines must be adhered to:

1. All frame drilling must comply with the DRILLING AND WELDING section of this book.
2. All rivet holes left in the frame rail flange from the suspension and suspension crossmembers must be either filled with GRADE 8 bolts and hardened steel washers at both the bolt head and nut, HUC bolts or GRADE 8 flanged bolts and hardened steel washers at the nut.
3. The components required to be slid forward or aft are the suspension and suspension hangers, suspension crossmembers and suspension frame liner.

Altering the Wheelbase by Altering the Frame

Even on a straight frame rail, it may be desirable to cut the frame and lengthen or shorten the wheelbase rather than simply sliding the rear suspension back or forward. The following section offers some guidelines and suggestions for cutting and lengthening or shortening the frame.

Glossary of Terms – Chassis Wheelbase Alteration

CA – Length from back-of-cab to rear axle centerline in inches.

AL – Added length (in case of a lengthened wheelbase). Difference between WB (new) and WB (old).

SL – Shortened length (in case of shortened wheelbase). Difference between WB (old) and WB (new).

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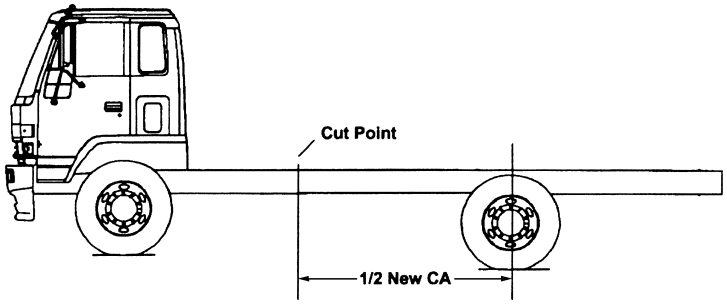
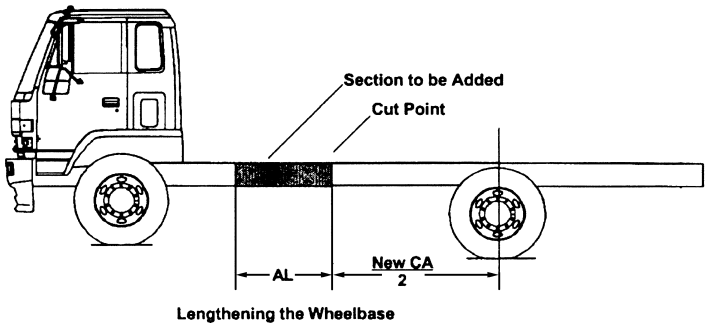
1. Determine the added length (AL) or shortened length (SL) required to lengthen or shorten chassis. (For added wheelbase: New CA = CA + AL; For shortened wheelbase: New CA = CA – SL.)

2. Obtain the material to be used as the insert for the lengthened wheelbase in the correct length (AL). The insert must have the same cross sectional dimensions and yield strength as the original frame rail.

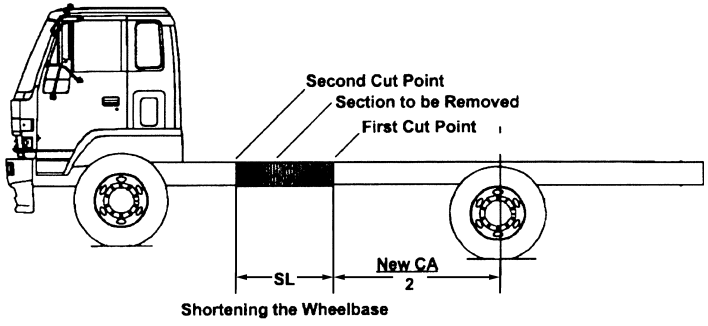
3. Divide the new CA by two (2). Measure (new CA)/2 from the center of the rear axle forward and mark this point on the chassis frame.



4. Cut the chassis frame at this point. If the wheelbase is to be lengthened, addition of the previously obtained insert (of length AL determined in step 1) will be made at this time. If the wheelbase is to be shortened, measure the distance (SL) forward of this cut and remove a length (SL) section from the chassis frame (see figure below). Insure that an adequate area on the frame remains for the required addition of the necessary reinforcements. These are the only suggested places for cutting the frame and reinforcements but may be changed upon the advice of GMICT Application Engineering.



Lengthening the Wheelbase



Shortening the Wheelbase

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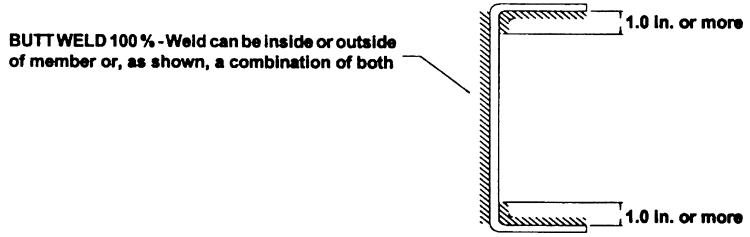
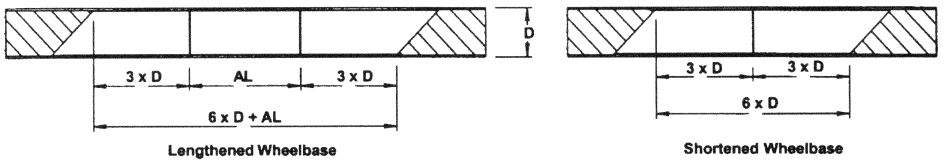
5. When welding the insert (length AL for wheelbase lengthening) to the original frame rail, a continuous butt weld must be used at the splices. When shortening the wheelbase, weld the ends of the chassis frame together with a continuous butt weld over the junction of the frame ends. Weld both the inside and outside of the frame rails using welding techniques prescribed by established welding standards (ref. SAE J1147) and in accordance with this guide. An example of this weld is shown below.



6. Determine the appropriate additional internal reinforcements which are required using this equation:

   Reinforcement Length = AL + 6 x (original frame rail web depth).

   The figure below shows how this reinforcement is to be placed over the extended or shortened section of the frame rail.



D = Original frame rail web depth

The suggested cross section of this reinforcement is a snug fit inner channel. If the new wheelbase exceeds the upper limit of the optional wheelbases of this model, i.e.; a “long bridge”, it may be necessary to use an “inverted L” reinforcement in addition to the snug fit channel reinforcement (see figures on next page). GMICT Application Engineering should be consulted for approval of such cases. It should be noted that these methods of reinforcements, and any other methods which may be used, require a 45° angled cut at both ends to avoid stress concentrations in the frame (note the figures under item 7).

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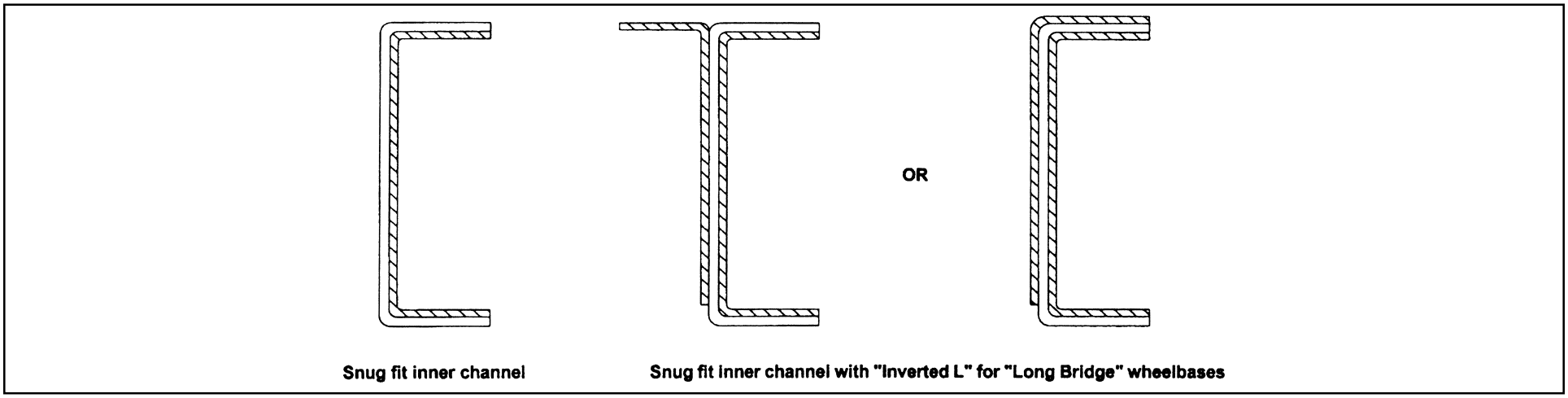

7. The reinforcements must be fastened securely to only the web of the original chassis frame rail. The reinforcement must be held rigidly in place using either HUC bolts, GRADE 8 bolts and hardened steel washers at both the bolt head and nut, or GRADE 8 flanged bolts and hardened steel washers at the nut. Below are some suggested bolt patterns. It should be noted that these bolt patterns must not align the bolts vertically, i.e.: the bolt pattern must be staggered.

8. Lengthening the frame will also require extending the brake lines, basic chassis electrical harness, excluding ABS wiring harness. It is recommended that the original brake lines be removed and replaced with brake lines of the same diameter as the original lines and of the appropriate length. The electrical harness must be extended in accordance with the ELECTRICAL WIRING AND HARNESSING section of this book.

9. The propeller shafts' overall length will also need to be lengthened or shortened. If the extension is within the limits of the optional wheelbases of the respective model, the exact propeller shaft lengths and angles are given on or about Page 12 of the respective sections of this book. If the modified wheelbase exceeds the optional wheelbases of the respective model, the following guidelines must be adhered to:

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a. Propeller Shaft Length

The maximum propeller shaft lengths (pin to pin) for the respective models are shown in the table below.

	NPR/W3500, W4500 Diesel	NPR/W3500, W4500 Gas	NQR/W5500	FRR/WT5500
Propeller Shaft Diameter (in.)	3.25	3.0	3.0	4.0
Maximum Propeller Shaft Length (in.)	50.8	50.8	50.8	62.0

b. Propeller Shaft Angles

The maximum propeller shaft angles, with respect to the previous shaft, are shown in the table below.

	NPR/W3500, W4500 Diesel	NPR/W3500, W4500 Gas	NQR/W5500	FRR/WT5500
Maximum Propeller Shaft Angle	5.7°	5.1°	5.7°	5.5°

c. The propeller shaft angles must be designed such that the angles will cancel to avoid propeller shaft whip.

d. The propeller shaft yokes must be assembled such that the propeller shaft yokes are “in phase.” “In phase” means that the yokes at either end of a given propeller shaft assembly are in the same plane.

10. Extending the frame will also require relocation and/or addition of crossmembers. If the extension is within the limits of the optional wheelbases of the respective model, the exact crossmember locations and dimensions are given in the respective model sections of this book. If the modified wheelbase exceeds the optional wheelbases of the respective model, the following guidelines must be adhered to:

a. The crossmember location will largely be determined by the propeller shaft lengths and where the center carrier bearing locations are for the propeller shaft assembly.

b. A crossmember must be located at the front and rear spring hangers of the rear suspension (refer to the appropriate section of this book to see where these suspension crossmembers are to be located).

c. The crossmember must be constructed such that it supports both the upper and lower flange on each frame rail (see drawing on next page). A crossmember such as the one on the next page may be constructed, or GM/Isuzu crossmembers may be obtained from your GMICT parts dealer.

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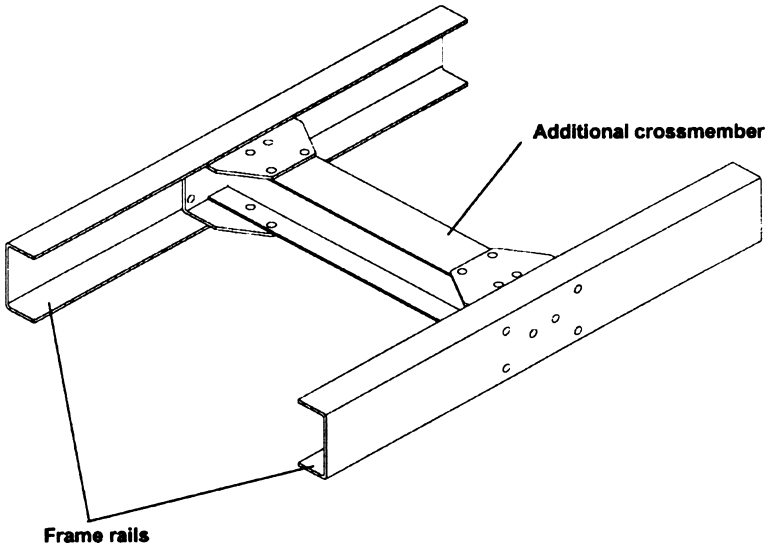

d. The maximum distance between crossmembers for the respective models is given in the table below.

	NPR/W3500, W4500 Diesel	NPR/W3500, W4500 Gas	NQR/W5500	FRR/WT5500
Maximum Distance Between Crossmembers (in.)	35.7	35.7	35.7	49.8

e. The drilling for any additional holes in the frame rails must comply with the DRILLING AND WELDING section of this book.

11. All other aspects of lengthening or shortening the wheelbase must comply with the applicable section of this Body Builder's Guide. For special applications and longer than recommended body lengths, GMICT Application Engineering must be consulted for approval. In the West Coast, call 1-562-229-5314 and, in the East Coast, call 1-770-475-9195, extension 353.

12. Please contact applications engineering for guidelines on N/W SERIES CHASSIS frame modifications when the vehicle is equipped with an antilock brake system.

FRR/WT Series Chassis

Please contact applications engineering for guidelines on FRR/WT SERIES CHASSIS frame modifications when the vehicle is equipped with an Antilock Brake System.

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(Installation of Body and Special Equipment Section – continued from previous page)

13. The Crew Cab NPR HD/W4500 and NQR/W5500 will be available in two wheelbases, 150 and 176 inches. Effective CA will be 84.7 and 110.7 inches. On this model chassis, General Motors Isuzu Commercial Trucks will require that the body installed on the chassis have an understructure manufactured with any of the following structural steel "C" channels:

    4" x 1-5/8", 7.25 lbs./ft. = ok

    5" x 1-3/4", 6.7 or 9.0 lbs./ft. = ok

    6" x 2", 8.2, 10.5 or 13.0 lbs./ft. = ok

Hydraulic Brake System

Before Work Begins

As with any electrical work on the chassis, the battery should be disconnected before electrical work is started.

ABS Program

The antilock brake system (ABS) computer will hold its codes when disconnected and reprogramming as a result of battery disconnection will not be necessary. If the wheelbase is changed, the trim level of the ABS system must be readjusted per the instructions in the service manual. An authorized GM/Isuzu dealer should do this reprogramming using appropriate tools.

For your reference, and to help you determine if the system needs to be reprogrammed, the following provisions apply to all ABS systems with hydraulic brakes. The ABS module has four (4) programs: A, B, C and D. These programs are tied to the wheelbase and axle combination of the chassis. (The axle and wheelbase codes can be found on the passenger's visor.)

A is for the FL1 axle and covers wheelbase from 140 (FQT), 158 (EG5), and 170 (EH8) inches.

B is for the FL2 axle and covers wheelbase from 140 (FQT), 158 (EG5), 170 (EH8), 188 (EK8), and 200 (EM2) inches.

C is for the FL1 axle and covers wheelbase from 188 (EK8), 200 (EM2), 218 (FPL), 233 (EQ8), and 248 (ES5) inches.

D is for the FL2 axle and covers wheelbase from 218 (FPL), 233 (EQ8), and 248 (ES5) inches.

Moving between program/wheelbase groups A, B, C or D **will** require that the system be reprogrammed. Moving wheelbase within a program group **will not** require reprogramming.

(Installation of Body and Special Equipment Section – continued on next page)

(Installation of Body and Special Equipment Section – continued from previous page)

ABS Computer Location

a. The ABS computer is located under the cab on the front crossmember and is an integral part of the brake fluid modulation system. These components cannot be relocated.

ABS Electrical Harness

a. The harness cannot be cut and spliced.

b. The only approved way to make the harness longer is to purchase the appropriate wheelbase harness from the GM/Isuzu parts department.

c. Extra wire resulting from a frame shortening can be coiled and secured to the frame.

Hydraulic Brake Lines

a. Hydraulic brake lines should be shortened or lengthened using appropriate fitting and steel lines.

BODY APPLICATION SUMMARY CHART

2002 Model Year Body Application Summary Chart

Model/GVWR	WB	BOC	10 ft.	12 ft.	14 ft.	16 ft.	18 ft.	20 ft.	22 ft.	24 ft.
NPR/W3500 Gas 12,000 lbs.	109 132.5 150 176	9.25 9.25 9.25 9.25	X	X	X	X	X	X[1]		
NPR HD/W4500 Gas 14,050 lbs.	109 132.5 150 176	9.25 9.25 9.25 9.25	X	X	X	X	X	X[1]		
NPR/W3500 Diesel 12,000 lbs.	109 132.5 150 176	9.25 9.25 9.25 9.25		X	X	X	X	X[1]		
NPR HD/W4500 Diesel 14,500 lbs.	109 132.5 150 176	9.25 9.25 9.25 9.25		X	X	X	X	X[1]		
NPR HD/W4500 Crew Cab Diesel 14,500 lbs.	150 176	4.2 4.2		X[4]		X[5]				
NQR/W5500 Diesel 17,950 lbs.	109 132.5 150 176	9.25 9.25 9.25 9.25		X	X	X	X	X	X[2]	

(2002 Model Year Body Application Summary Chart continued on next page)

1 = NPR, NPR HD/W3500, W4500 and Diesel 20-foot body requires GMICT Application Engineering Department approval.
2 = NQR/W5500 22-foot body requires GMICT Application Engineering Department approval.
3 = BOC 10.0 inches for MT.
4 = 16' Dovetail landscape (12' deck plus 4' dovetail).
5 = 18' Dovetail landscape (14' deck plus 4' dovetail).

IMPORTANT: Body selection recommendations are based on water-level weight distribution and no accessories, liftgate or refrigeration units. This table is intended for reference and does not preclude the necessity for an accurate weight distribution calculation.

(Body Application Summary Chart Section – continued on next page)

(Body Application Summary Chart Section – continued from previous page)

2002 Model Year Body Application Summary Chart (Chart continued from previous page)

Model/GVWR	WB	BOC	10 ft.	12 ft.	14 ft.	16 ft.	18 ft.	20 ft.	22 ft.	24 ft.
NQR/W5500 Crew Cab Diesel 17,950 lbs.	150 176	4.2 4.2		X[4]		 X[5]				
		MT/AT								
FRR/WT5500 Diesel 18,000/19,500 lbs.	148 167 179 191 218	7.5/10 7.5/10 7.5/10 7.5/10 10.0/10			X[3]	X	X	X	X	X

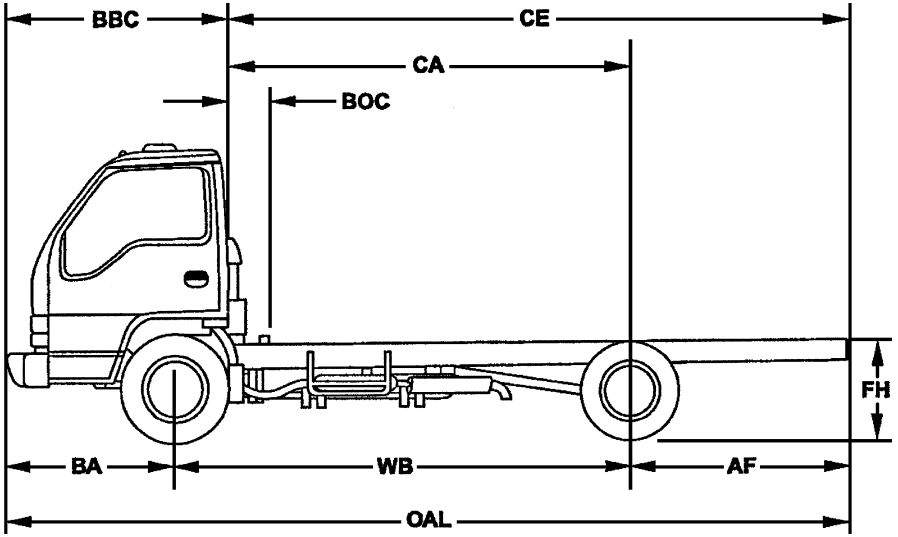
1 = NPR, NPR HD/W3500, W4500 and Diesel 20-foot body requires GMICT Application Engineering Department approval.
2 = NQR/W5500 22-foot body requires GMICT Application Engineering Department approval.
3 = BOC 10.0 inches for MT.
4 = 16' Dovetail landscape (12' deck plus 4' dovetail).
5 = 18' Dovetail landscape (14' deck plus 4' dovetail).

IMPORTANT: Body selection recommendations are based on water-level weight distribution and no accessories, liftgate or refrigeration units. This table is intended for reference and does not preclude the necessity for an accurate weight distribution calculation.

(Body Application Summary Chart Section – continued on next page)

(Body Application Summary Chart Section – continued from previous page)

NPR, NPR HD/W3500, W4500 Gas



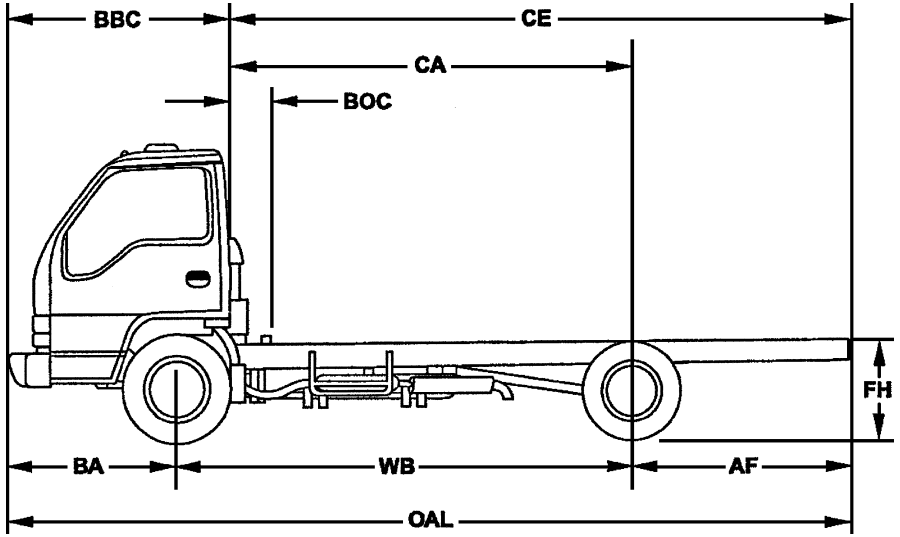
2002 Model Year – Body & Payload Weight Distribution (% Front/% Rear) – Automatic Transmission

Model	GVWR	WB	CA	CE	OAL	BOC	10 ft.	12 ft.	14 ft.	16 ft.	18 ft.	20 ft.
NPR/W3500 Gas	12,000	109	88.4	131.5	199.5	9.25	18/82	7/93				
NPR HD/W4500 Gas	14,050	109	88.4	131.5	199.5	9.25	18/82	7/93				
NPR/W3500 Gas	12,000	132.5	111.9	155	223	9.25			14/86			
NPR HD/W4500 Gas	14,050	132.5	111.9	155	223	9.25			14/86			
NPR/W3500 Gas	12,000	150	129.4	172.5	240.5	9.25				16/84	8/92	
NPR HD/W4500 Gas	14,050	150	129.4	172.5	240.5	9.25				16/84	8/92	
NPR/W3500 Gas	12,000	176	155.4	198.5	266.3	9.25						15/85*
NPR HD/W4500 Gas	14,050	176	155.4	198.5	266.3	9.25						15/85*

(Body Application Summary Chart Section – continued on next page)

(Body Application Summary Chart – continued from previous page)

NPR, NPR HD/W3500, W4500 Diesel



2002 Model Year – Body & Payload Weight Distribution (% Front/% Rear) – Manual/Automatic Transmission

Model	GVWR	WB	CA	CE	OAL	BOC	10 ft.	12 ft.	14 ft.	16 ft.	18 ft.	20 ft.
NPR/W3500 Diesel	12,000	109	88.4	131.5	199.5	9.25		7/93				
NPR HD/W4500 Diesel	14,050	109	88.4	131.5	199.5	9.25		7/93				
NPR/W3500 Diesel	12,000	132.5	111.9	155	223	9.25			14/86			
NPR HD/W4500 Diesel	14,050	132.5	111.9	155	223	9.25			14/86			
NPR/W3500 Diesel	12,000	150	129.4	172.5	240.5	9.25				16/84	8/92	
NPR HD/W4500 Diesel	14,050	150	129.4	172.5	240.5	9.25				16/84	8/92	
NPR/W3500 Diesel	12,000	176	155.4	198.5	266.3	9.25						15/85*
NPR HD/W4500 Diesel	14,050	176	155.4	198.5	266.3	9.25						15/85*

(Body Application Summary Chart Section – continued on next page)

(Body Application Summary Chart Section – continued from previous page)

NQR/W5500 Diesel

2002 Model Year – Body & Payload Weight Distribution (% Front/% Rear) – Manual/Automatic Transmission

Model	GVWR	WB	CA	CE	OAL	BOC	10 ft.	12 ft.	14 ft.	16 ft.	18 ft.	20 ft.	22 ft.
NQR/W5500 Diesel	17,950	109	88.4	131.5	199.5	9.25		7/93					
NQR/W5500 Diesel	17,950	132.5	111.9	155	223	9.25			14/86				
NQR/W5500 Diesel	17,950	150	129.4	172.5	240.5	9.25				16/84	8/92		
NQR/W5500 Diesel	17,950	176	155.4	198.5	266.3	9.25						15/85	8/92**

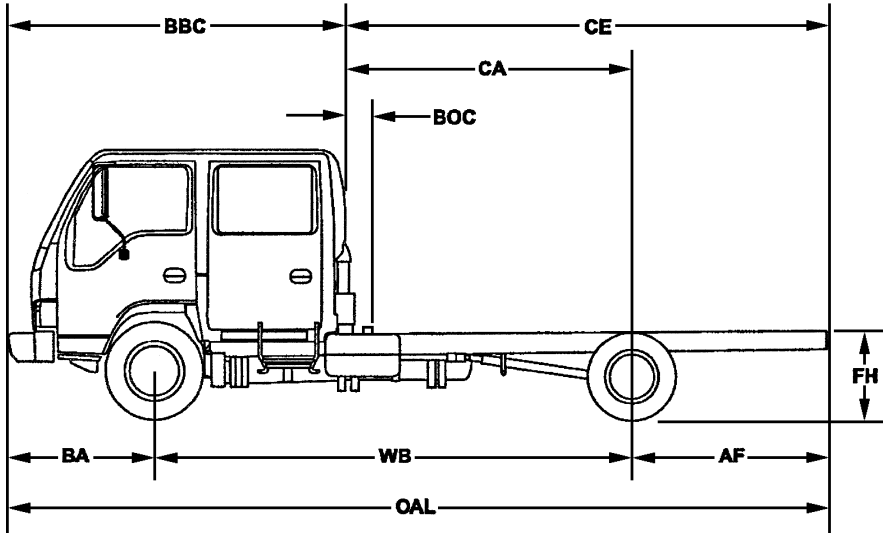
* NPR, NPR HD/W3500, W4500 Gas and Diesel 20-foot body requires GMICT Application Engineering Department approval.
** NQR/W5500 22-foot body requires GMICT Application Engineering Department approval.

IMPORTANT: Weight distribution percentages listed do not include added accessories, liftgate or refrigeration units. Percentages based on water-level distribution of body and payload weight which is determined by subtracting chassis wet weight (including 200 lb. driver) from GVWR. These tables are intended for reference and do not preclude the necessity for an accurate weight distribution calculation.

(Body Application Summary Chart Section – continued on next page)

(Body Application Summary Chart – continued from previous page)

NPR HD, NQR/W4500, W5500 Crew Cab Diesel



2002 Model Year – Diesel Crew Cab Body & Payload Weight Distribution (% Front/% Rear)

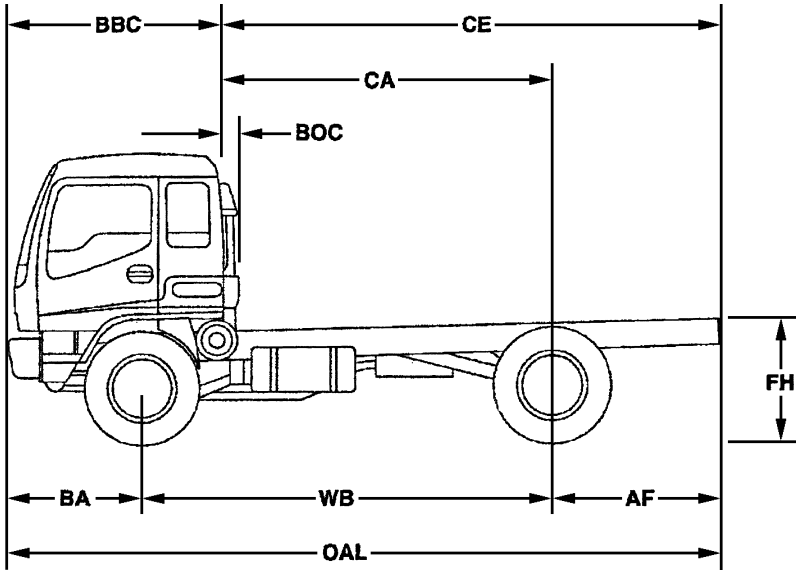
Model	GVWR	WB	CA	CE	OAL	BOC	10 ft.	12 ft.	14 ft.	16 ft.
NPR HD/W4500 Crew Cab Diesel	14,500	150	88.9	132	240.5	4.2		8/92		
NPR HD/W4500 Crew Cab Diesel	14,500	176	114.9	158	266.5	4.2			15/85	
NQR/W5500 Crew Cab Diesel	17,850	150	88.9	132	240.5	4.2	16/84	8/92		
NQR/W5500 Crew Cab Diesel	17,850	176	114.9	158	266.5	4.2			15/85	8/92

IMPORTANT: Weight distribution percentages listed do not include added accessories, liftgate or refrigeration units. Percentages based on water-level distribution of body and payload weight which is determined by subtracting chassis wet weight (including 200 lb. driver and a crew of 6 @ 200 lbs. each) from GVWR. These tables are intended for reference and do not preclude the necessity for an accurate weight distribution calculation.

(Body Application Summary Chart Section – continued on next page)

(Body Application Summary Chart Section – continued from previous page)

FRR/WT5500



2002 Model Year – Body & Payload Weight Distribution (% Front/% Rear)

Model	GVWR	WB	CA	CE	OAL	BOC	14 ft.	16 ft.	18 ft.	20 ft.	22 ft.	24 ft.
Manual Transmission												
FRR/WT5500	18,000/19,500	148	117.1	180.6	259.3	7.5	16/84*	10/90				
FRR/WT5500	18,000/19,500	167	136.2	206.5	285.2	7.5			12/88			
FRR/WT5500	18,000/19,500	179	148.0	226.2	304.9	7.5				11/89		
FRR/WT5500	18,000/19,500	191	159.8	243.9	322.2	7.5					11/89	
FRR/WT5500	18,000/19,500	218	187.4	283.3	362.0	10.0						15/85

* BOC 10.0 inches.

(2002 Model Year Body & Payload Weight Distribution Chart continued on next page)

(Body Application Summary Chart Section – continued on next page)

(Body Application Summary Chart Section – continued from previous page)

2002 Model Year – Body & Payload Weight Distribution (% Front/% Rear) *(Chart continued from previous page)*

Model	GVWR	WB	CA	CE	OAL	BOC	14 ft.	16 ft.	18 ft.	20 ft.	22 ft.	24 ft.
Automatic Transmission												
FRR/WT5500	18,000/19,500	148	117.1	180.6	259.3	10	15/85	7/93				
FRR/WT5500	18,000/19,500	167	136.2	206.5	285.2	10			10/90			
FRR/WT5500	18,000/19,500	179	148.0	226.2	304.9	10			9/91			
FRR/WT5500	18,000/19,500	191	159.8	243.9	322.2	10				9/91		
FRR/WT5500	18,000/19,500	218	187.4	283.3	362.0	10					15/85	

IMPORTANT: Weight distribution percentages listed do not include added accessories, liftgate or refrigeration units. Percentages based on water-level distribution of body and payload weight which is determined by subtracting chassis wet weight (including 200 lb. driver) from GVWR. These tables are intended for reference and do not preclude the necessity for an accurate weight distribution calculation.

MECHANICAL AND CAB SPECIFICATIONS

Engine Horsepower and Torque Chart

The following table presents Net versus Gross Horsepower and Torque ratings for 1999 thru 2002 Isuzu/W-Series Truck Product Engines:

Engine Model	Application	Net Hp[1] hp/rpm	Net Torque[1] lbs.-ft./rpm	Gross Hp[1] hp/rpm	Gross Torque[1] lbs.-ft./rpm
GMPT 5.7L-V8	NPR/W3500, NPR HD/W4500 Gas	N/A	N/A	250/4400	330/2800
Isuzu 4HE1-TC Manual Transmission	NPR/W3500, NPR HD/W4500 Diesel	137/2800	268/1300	142/2800	275/1300
Isuzu 4HE1-TC Automatic Transmission	NPR/W3500, NPR HD/W4500, NQR/W5500 Diesel	169/2700	339/2000	175/2700	347/2000
Isuzu 4HE1-TC Manual Transmission	NQR/W5500 Diesel	169/2700	339/2000	175/2700	347/2000
Isuzu 6HK1-TC Manual Transmission	FRR/WT5500 Diesel	193/2400	426/1500	200/2400	441/1500
Isuzu 6HK1-TC Automatic Transmission	FRR/WT5500 Diesel	193/2400	426/1500	200/2400	441/1500

NOTE: [1] Horsepower and Torque Ratings measured under SAE J1349 standards.

GVW/GCW Ratings

The following table presents GVW ratings and corresponding GCW ratings for each model truck:

Truck Model	Transmission	GVWR (lbs.)	GCWR (lbs.)[1]	Truck Model	Transmission	GVWR (lbs.)	GCWR (lbs.)[1]
NPR/W3500 Gas	Automatic	12,000	15,000	NPR HD/W4500 Diesel	Manual	14,500	20,500
NPR HD/W4500 Gas	Automatic	14,050	17,050	NQR/W5500 Diesel	Automatic	17,950	19,500[2]
NPR/W3500 Diesel	Automatic	12,000	18,000	NQR/W5500 Diesel	Manual	17,950	22,500
NPR/W3500 Diesel	Manual	12,000	18,000	FRR/WT5500 Diesel	Automatic	18,000/19,500	22,050
NPR HD/W4500 Diesel	Automatic	14,500	19,500	FRR/WT5500 Diesel	Manual	18,000/19,500	30,000

[1] The NPR, NPR HD, NQR/W3500, W4500, W5500 are not approved for Hot Shot applications.
[2] GCWR 20,950 with addition of optional Isuzu Transmission Oil Cooler.

(Mechanical and Cab Specifications Section – continued on next page)

(Mechanical and Cab Specifications Section – continued from previous page)

Rear Frame Height Chart

The following table provides the rear frame height for each model/GVWR with standard tires:

Model	GVWR (lbs.)	Standard Tire	Frame HT (in.) FH Std. Tires
NPR/W3500 Gas	11,050	215/85R-16E	32
NPR HD/W4500 Gas	14,050	225/70R-19.5F	32.75
NPR/W3500 Diesel	12,000	215/85R-16E	32
NPR HD/W4500 Diesel	14,050	215/85R-16E	32
NQR/W5500 Diesel	17,950	225/70R-19.5F	32.8
FRR/WT5500 Diesel	18,000/19,500	225/70R-19.5F	32.25[1]

[1] 191-inch and 218-inch WB have frame height of 35.2 inches.

Clutch Engagement Torque

The following table provides the engagement torque of the engines currently is use in GM/Isuzu medium duty trucks:

Engine	Torque (lbs.-ft.)	at (RPM)
Isuzu 4HE1-TC (142 HP)	260	1,000
Isuzu 4HE1-TC (175 HP)	265	1,000
Isuzu 6HK1-TC (200 HP)	331	1,000
Isuzu 6HK1-TC (230 HP)	368	1,000

(Mechanical and Cab Specifications Section – continued on next page)

(Mechanical and Cab Specifications Section – continued from previous page)

Paint Code Chart

GM/ISUZU OPTION CODE	GM/ISUZU PAINT COLOR NAME	GM/ISUZU PAINT CODE
1985 KS22		
N/A	Calm White	0133-P1
1986-95 NPR/W3500, W4500 Diesel		
844	Glacier White	0172-P1
1993-94 NPR/W3500, W4500 EFI		
844	Glacier White	0172-P1
1995.5-01 NPR, NQR/W3500, W4500, W5500 DIESEL		
729	Arc White	W301-P801-0
730	Adriatic Blue Solid (1999 Model Only)	B302-P801-0
845	Polar Silver (NPR only)	N507-P901-0
989	Sunbelt Green	G021-P801-0
1995.5-01 NPR/W3500, W4500 GAS		
729	Arc White	W301-P801-0
N/A	Accuride White (Wheels Only)	301-W-30102
845	Polar Silver	N507-P901-0
989	Sunbelt Green	G021-P801-0
1989-94 NQR/W5500		
844	Glacier White	0172-P1

(Mechanical and Cab Specifications Section – continued on next page)

(Mechanical and Cab Specifications Section – continued from previous page)

CV Chart 2

GM/ISUZU PAINT CODE	GM/ISUZU OPTION CODE	GM/ISUZU COLOR NAME	AKZO NOBEL CODE	BASF R-M CODE	BASF GLASS CODE
301-W-30102	N/A	Accuride White	FLNA40154	RM23519	IS-25319
B302-P801-0	730	Adriatic Blue (Solid)	FLNA50274	730	730
W301-P801-0	729	Arc White	FLNA40156	RM25318	IS-25318
WE8774	N/A	*Bright Red	FLNA30252	27427	IS-27427
0133-P1	N/A	Calm White	FLNA40252	HS14391	IS-820
WE5398	N/A	*Dark Green Gray	FLNA90856	27425	IS-27425
U715-P801-0	809	Doeskin Tan	FLNA80050	27406	IS-U715
0172-P1	844	Glacier White	FLNA40155	RM15602	IS-844
WE9907	N/A	*Medium Adriatic Blue	FLNA90857	27426	IS-27426
B721-P801-0	801	Medium Blue	FLNA50172	27403	IS-B721
N507-P901-0	845	Polar Silver	FLNA91205	23664	845
R725-P801-0	810	Red Orange	FLNA20079	27407	IS-R725
WE9885	N/A	*Rose Black	FLNA90858	27428	IS-27428
G021-P801-0	989	Sunbelt Green	FLNA60290	605301	989
U716-P801-0	815	Tangier Orange	FLNA20080	27409	IS-U716
Y719-P801-0	812	Wheatland Yellow	FLNA10182	27408	IS-Y719
G705-P801-0	807	Woodland Green	FLNA60181	27404	IS-G705

(Mechanical and Cab Specifications Section – continued on next page)

(Mechanical and Cab Specifications Section – continued from previous page)

CV Chart 2 (Continued)

DUPONT CODE	ICI AUTO COLOR	PPG CODE	SHERWIN WILLIAMS/ MARTIN SENOUR	SPIES HECKER CODE	STANDOX
F2499	8AR8	91513	51548	15593	301-W-30102
W9775	2NV9B	19320	57541	50287	730
W9774	2NV8	91512	51400	10280	729
C8508	TC78B	75057	34983	34169	N/A
G8477	KK27	91522	34657	16222	0133-P1
B9329	2NP9B	36575	47155	65071	N/A
B8462	KPL5B	28613	56203	21882	809
H8620	ND92	90330	35478	10281	844
B9321	2NY4B	190401	46829	56120	N/A
B8041	KPL2B	190217	56143	55933	801
F2193	EPW3B	36658	56991	73192	845
B8250	KPL4B	61784	56202	21881	810
B9218	1AB2B	95057	45738	74223	N/A
M6682	WMK4	401420	61559	67847989	989
B9043	KPL6B	61785	56204	21883	815
B9042	KPL7B	83931	56144	21884	812
B8046	KPL3B	48339	56201	64962	807

NOTES: 1. STANDOX uses paint code found in vehicle for paint identification.
2. GM-Based colors. No GM/Isuzu Option Code.

(Mechanical and Cab Specifications Section – continued on next page)

N/W Series Towing Procedure

NOTE: When towing, disconnect the propeller shaft at the rear axle to ensure the automatic transmission is not damaged.

Proper equipment must be used to prevent damage to vehicles during any towing. State and local laws which apply to vehicles in tow must be followed. Vehicles should not be towed at speeds in excess of 55 mph (90 km/h). Connect to the main structural parts of the vehicle. DO NOT attach to bumpers, tow hooks or brackets. Use only equipment designed for this purpose. Follow the instructions of the wrecker manufacturer. A safety chain system must be used. The procedures below must be followed when towing to prevent possible damage.

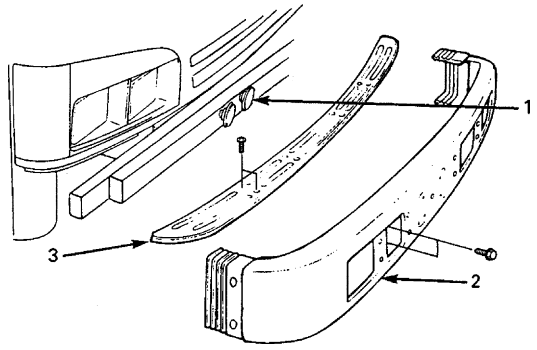
Front End Towing (Front Wheels Off the Ground)

To prepare a disabled vehicle for front end towing with front wheels raised off the ground, the following steps are necessary:

- Block the rear wheels of the disabled vehicle.
- Disconnect the propeller shafts at the rear axle. Secure the propeller shafts to the frame or crossmember.
- If there is damage or suspected damage to the rear axle, remove the axle shafts.
- Cover the hub openings to prevent the loss of lubricant or entry of dirt or foreign objects.
- Place 4" x 4" wood beam against the towing guide behind the bumper. (If no 4" x 4" is available, then remove the bumper.) Ensure the towing chains do not contact the horns or the bumper.

Legend:

1. Horns
2. Bumper (removed for towing)
3. Filler



(Mechanical and Cab Specifications Section – continued on next page)

(Mechanical and Cab Specifications Section – continued from previous page)

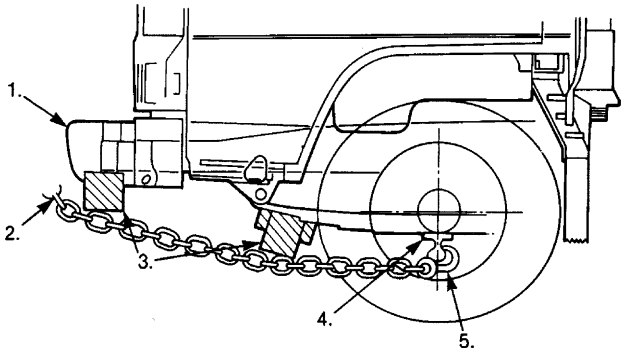
After Towing
After towing the vehicle, block the rear wheels and install axle shafts or propeller shaft. Apply the parking brake before disconnecting from the towing vehicle.

Front End Towing (All Wheels On the Ground)

Your vehicle may be towed on all wheels provided the steering is operable. Remember that power steering and brakes will not have power assist. There must be a tow bar installed between the towing vehicle and the disabled vehicle.

Legend:

1. Bumper
2. Towing Chain
3. Towing Guide
4. Front Axle
5. Tow Hook



To prepare a disabled vehicle for front end towing with all wheels on the ground, the following steps are necessary:

- Block the wheels of the disabled vehicle.
- Disconnect the propeller shafts at the rear axle. Secure the propeller shafts to the frame or crossmember.
- Provide wood blocking to prevent towing chains and bar from contacting the bumper.
- If there is damage or suspected damage to the rear axle, remove the axle shafts.
- Cover the hub openings to prevent the loss of lubricant or entry of dirt or foreign objects.

After Towing
After towing the vehicle, block the rear wheels and install axle shafts or propeller shaft. Apply the parking brake before disconnecting from the towing vehicle. Check and fill rear axle with oil if required.

(Mechanical and Cab Specifications Section – continued on next page)

(Mechanical and Cab Specifications Section – continued from previous page)

Rear End Towing (Rear Wheels Off the Ground)

When towing a vehicle with rear wheels raised, secure the steering wheel to maintain straight-ahead position. Make certain that the front axle is not loaded above the front axle Gross Axle Weight Rating (GAWR) as indicated on the vehicle's VIN and Weight Rating plate.

Special Towing Instructions:

1. All state and local laws regarding such items as warning signals, night illumination, speed, etc., must be followed.
2. Safety chains must be used.
3. No vehicle should ever be towed over 55 mph (90 km/h).
4. Loose or protruding parts of damaged vehicles should be secured prior to moving.
5. A safety chain system completely independent of the primary lifting and towing attachment must be used.
6. Operators should refrain from going under a vehicle which is being lifted by the towing equipment unless the vehicle is adequately supported by safety stands.
7. No towing operation which for any reason jeopardizes the safety of the wrecker operator or any bystanders or other motorists should be attempted.

(Mechanical and Cab Specifications Section – continued on next page)

(Mechanical and Cab Specifications Section – continued from previous page)

FRR/WT5500 Series Towing Procedure

Your vehicle should be towed by an authorized dealership or professional towing service to prevent damage. Proper equipment must be used and state (Provincial in Canada) and local laws, which apply to vehicles in tow, must be followed. Vehicles should not be towed in excess of 55 mph (90 km/h).

Connect to the main structural parts of the vehicle. Do not attach to bumpers, tow hooks or brackets. Use only equipment designed for this purpose. Follow the instructions of the wrecker manufacturer.

A safety chain system must be used.

Front End Towing (Front Wheels Off the Ground)

Before Towing
Block the rear wheels of the disabled vehicle. Release the parking brake as described under “Air-Operated Parking Brake” in this section. Drain rear axle oil and remove the axle shafts. Cover the hub openings to prevent the loss of lubricant or entry of dirt or foreign objects.

After Towing
After towing the vehicle, block the rear wheels, remove the covers from the hub openings and install the axle shafts. Apply the parking brake before disconnecting from the towing vehicle. Check and fill rear axle with oil if required.

Front End Towing (All Wheels On the Ground)

Your vehicle may be towed on all wheels provided the steering is operable. Remember that power steering will not have power assist. If air pressure is exhausted, the vehicle will not have brakes. There must be a tow bar installed between the towing and the disabled vehicle.

Before Towing
Block the wheels of the disabled vehicle. Disconnect the propshaft at the rear axle. Secure the propshaft to the frame or crossmember. If there is damage or suspected damage to the rear axle, drain oil and remove the axle shafts. Cover the hub openings to prevent the loss of lubricant or entry of dirt or foreign objects.

After Towing
After towing the vehicle, block the rear wheels and install axle and propeller shafts. Check for proper phasing of universal joints. Apply the parking brake before disconnecting from the towing vehicle. Check and fill rear axle with oil if required.

(Mechanical and Cab Specifications Section – continued on next page)

(Mechanical and Cab Specifications Section – continued from previous page)

Rear End Towing (Rear Wheels Off the Ground)

Before Towing
Secure the steering wheel to maintain straight-ahead position. Make certain that the front axle is not loaded above the front axle Gross Axle Weight Rating (GAWR) as indicated on the vehicle's VIN and Weight Rating plate.

After Towing
Block the rear wheels and release the steering. Apply the parking brake before disconnecting from the towing vehicle. Check and fill the rear axle with oil as required.

Special Towing Instructions:

1. Call your local authorized dealership or professional towing service.
2. All state and local laws regarding such items as warning signals, night illumination, speed, etc. must be followed.
3. Safety chains must be used.
4. No vehicle should ever be towed over 55 mph (90 km/h).
5. Loose or protruding parts of damaged vehicles should be secured before moving.
6. A safety chain system completely independent of the primary lifting and towing attachment must be used.
7. Operators should refrain from going under a vehicle, which is being lifted by the towing equipment unless the vehicle is adequately supported by safety stands.
8. No towing operation, which for any reason jeopardizes the safety of the wrecker operator or any bystanders or other motorists, should be attempted.

WEIGHT DISTRIBUTION CONCEPTS

Weight Restrictions

The Gross Vehicle Weight Rating (GVWR) and the Gross Axle Weight Rating (GAWR) of each Incomplete Vehicle are specified on the cover of its Incomplete Vehicle Document in conformance to the requirements of Part 568.4 of the Federal Motor Vehicle Safety Regulations. The final stage manufacturer is responsible under Part 567.5 to place the GVWR and the GAWR of each axle on the Final Vehicle Certification Label. The regulation states that the appropriate rating "shall not be less than the sum of the unloaded vehicle weight, rated cargo load, and 150 pounds times the vehicle's designated seating capacity."

Unloaded vehicle weight means the weight of a vehicle with maximum capacity of all fluids necessary for operation of the vehicle, but without cargo or occupants.

During completion of this vehicle, GVWR and GAWR may be affected in various ways, including but not limited to the following:

1. The installation of a body or equipment that exceeds the rated capacities of this Incomplete Vehicle.
2. The addition of designated seating positions which exceeds the rated capacities of this Incomplete Vehicle.
3. Alterations or substitution of any components such as axles, springs, tires, wheels, frame, steering and brake systems that may affect the rated capacities of this Incomplete Vehicle.

Use the following chart to assure compliance with the regulations. Chassis curb weight and GVW rating is located on Page 2 in each vehicle section. Always verify the results by weighing the completed vehicle on a certified scale.

Curb Weight of Chassis (lbs.)		_____ (From required vehicle section)
PLUS weight of added body components, accessories or other permanently attached components.	+	_____ (Body, liftgate, reefer, etc.)
PLUS total weight of passengers, air conditioning and all load or cargo.	+	_____ (Driver, passengers, accessories and load)
EQUALS Gross Vehicle Weight (lbs.) (GVW) of completed vehicle.	=	_____ (Should equal GVWR from required vehicle section)

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Gross Axle Weight Rating

The Gross Vehicle Weight is further restricted by the Gross Axle Weight Rating (GAWR). The maximum GAWR for both front and rear axles is listed in each Vehicle Section. Weight distribution calculations must be performed to ensure GAWR is not exceeded. Always verify the results by weighing the completed vehicle on a certified scale.

NOTE: Although the Front Gross Axle Weight Rating (FGAWR) plus the Rear Gross Axle Weight Rating (RGAWR) may exceed the Gross Vehicle Weight Rating (GVWR), the total GVW may not exceed the respective maximum GVWR.

The variation in the GAWRs allow the second stage manufacturer some flexibility in the design of the weight distribution of the attached unit.

Weighing the Vehicle

Front and rear GAWRs and total GVWR should be verified by weighing a completed loaded vehicle. Weigh the front and rear of the vehicle separately and combine the weights for the total GVWR. All three weights must be less than the respective maximum shown in the vehicle sections.

Tire Inflation

Tire inflation must be compatible with GAWR and GVWR as specified on the cover of the Incomplete Vehicle Document for each vehicle.

Center of Gravity

The design of the truck body should be such that the center of gravity of the added load does not exceed the guidelines as listed in each Vehicle Section. If the body is mounted in such a way that the center of gravity height exceeds the maximum height of the center of gravity designated for each model, the directional stability at braking and roll stability at cornering will be adversely affected. A vertical and/or horizontal center of gravity calculation must be performed if a question in stability arises to ensure the designed maximum height of the center of gravity is not violated.

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Weight Distribution

A truck as a commercial vehicle has but one purpose. That purpose is to haul some commodity from one place to another. A short distance or a long distance, the weight to be hauled, more than any other factor, determines the size of the truck. A small weight requires only a small truck; a large weight requires a large truck. A simple principle, but it can easily be misapplied. In any case, selecting the right size truck for the load to be hauled will ensure that the job will be done and that it will be able to be done with some degree of reliability and within the legal limitations of total gross weight and axle gross weights.

Not only must a truck be selected that will handle the total load, but the weight must also be properly distributed between the axles. This is of extreme importance from both a functional and economic aspect. If a truck consistently hauls less than its capacity, the owner is not realizing full return on his investment and his operating costs will be higher than they should be. If the truck is improperly loaded or overloaded, profits will be reduced due to increased maintenance costs and potential fines resulting from overloading beyond legal limitations. Careful consideration must be given to distribution of the load weight in order to determine how much of the total, including chassis, cab, body and payload, will be carried on the front axle and how much will be carried on the rear axle, on the trailer axles and the total. Moving a load a few inches forward or backward on the chassis can mean the difference between acceptable weight distribution for the truck or an application that will not do the job satisfactorily.

Every truck has a specific capacity and should be loaded so that the load distribution is kept within Gross Axle Weight Ratings (GAWR) and the truck's Gross Vehicle Weight Rating (GVWR) or Gross Combination Weight Rating (GCWR) for a tractor/trailer and the weight laws and regulations under which the truck will operate. Improper weight distribution will cause problems in many areas:

1. Excessive front end wear and failure
    a. Tie-rod and kingpin wear
    b. Front axle failure
    c. Overloading of front suspension
    d. Wheel bearing failure
2. Rapid tire wear
    a. When the weight on a tire exceeds its rating capacity, accelerated wear will result and could result in tire failure.

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

3. Rough, erratic ride

    a. If the center of the payload is directly over or slightly behind the rear axle, the lack of sufficient weight on the front axle will create a bobbing effect, very rough ride, and erratic steering. This condition will be magnified when the truck is going uphill.

4. Hard steering

    a. When loads beyond the capacity of the front axle are imposed upon it, the steering mechanism is also overloaded and hard steering will result.

    b. Excessive overloading could result in steering component damage or failure.

5. Unsafe operating and conditions

    a. Poor traction on the steering axle effects the safety of the driver and equipment, particularly on wet, icy and slippery surfaces. Experience indicates that approximately 30% of the total weight at the ground on a truck or tractor should be on the front axle with a low cab forward vehicle.

    b. When a truck is overloaded, a dangerous situation may exist because minimum speeds cannot always be maintained, directional control may not be precise and insufficient braking capacity can cause longer than normal braking distances.

6. High maintenance costs

    a. Improper weight distribution and overloading cause excessive wear and premature failure of parts. Additional stresses imposed on the frame by the misapplication of wheelbases may be instrumental in causing the frame to crack or break.

7. Noncompliance with weight laws and regulations

    a. When there is the possibility that axle loads will exceed existing weight laws and regulations, careful weight distribution is necessary to provide a correct balance between front and rear axle loads and total load within legal limitations.

In this way, maximum payloads may be carried without exceeding legal limits. If the body is too long for a wheelbase, the center of the body and payload is placed directly over the rear axle. This places all the payload on the rear axles, resulting in overloading the rear tires, rear axle springs and wheel bearings and potentially exceeding the rear axle legal weight limit. The front axle is then carrying no part of the payload and is easily lifted off the ground when going over rough terrain, creating a very rough ride and temporary loss of steering control. If the body is too short for the wheelbase used, frame stress may be increased and may result in excessive loads on the front axle. Excessive front axle loads increase wear on the kingpins and bushings, wheel bearings and steering gear. Excessive front axle loads also overstress the front axle, springs, tires and wheels. All of these contribute directly to higher maintenance costs and hard steering, both of which are undesirable.

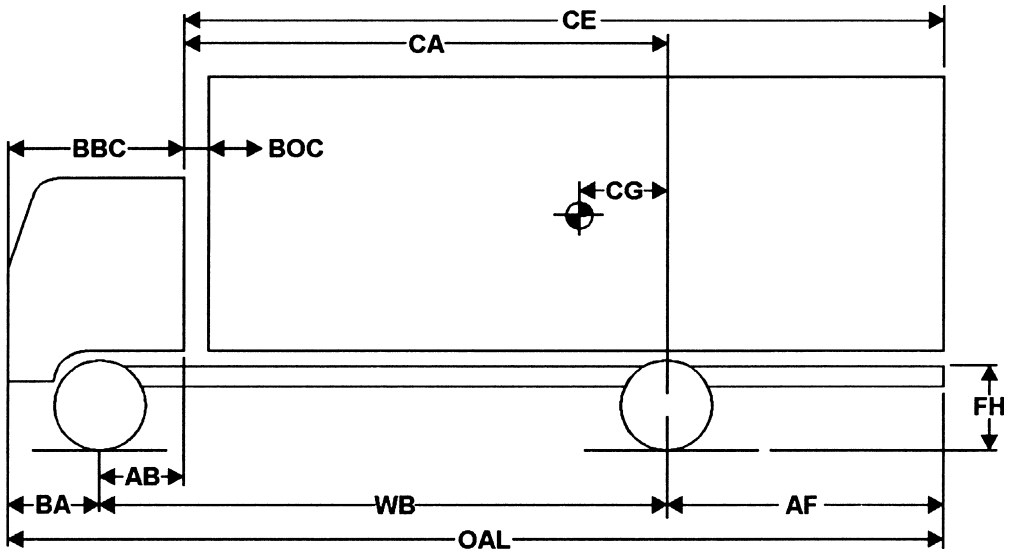
(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Weight distribution analysis involves the application of basic mathematical principles to determine the proper positioning of the payload and body weight in relation to the wheelbase of the truck chassis.

It is much less expensive to work all of this out on paper, make mistakes on paper and correct them there than to set up the truck incorrectly and either have it fail to do the job or, much worse, fail completely.

It is important to become familiar with the dimensions of the truck, as these will be needed to perform the necessary calculations.



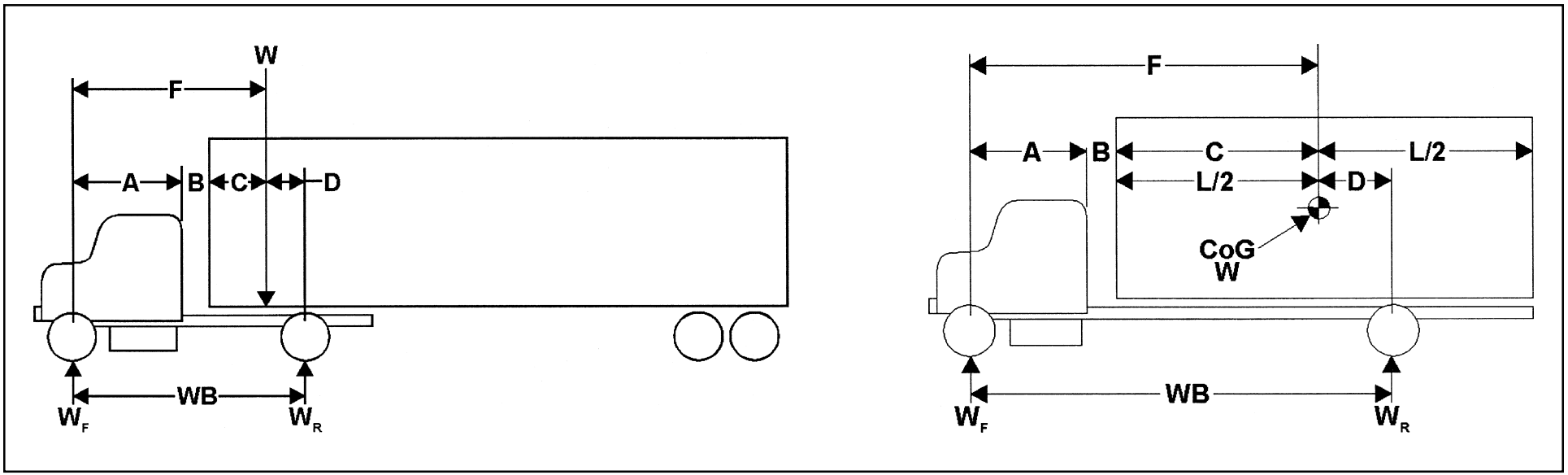
Glossary of Dimensions

BBC – Bumper to back of cab
BA – Bumper to axle
CA – Cab to axle
AB – Axle to back of cab
BOC – Back of cab clearance
CE – Cab to end of frame
CG – Center of gravity of body and payload from axle
WB – Wheelbase
OAL – Overall length
AF – Axle to end of frame
FH – Frame height

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Weight Distribution Formulas



A – Front axle to back of cab

B – Distance between cab and body or trailer

C – Front of body to C.G. or front of trailer to kingpin

D – Distance C.G. of body or fifth wheel is ahead of rear axle

F – (A + B + C) or distance C.G. of weight of fifth wheel is behind front axle

WB – Wheelbase

W – Weight of body plus payload, or kingpin load

W_f – Portion of W transferred to front axle

W_r – Portion of W transferred to rear axle

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Basic Formulas

(a) $W \times D = W_f \times WB$ **or** **(b)** $W \times F = W_r \times WB$

(c) $WB = (A + B + C + D) = (F + D)$

(d) $W = W_f \times W_r$

1. $W_f = \frac{W \times D}{WB}$

2. $D = \frac{W_f \times WB}{W}$

3. $WB = \frac{W \times D}{W_f}$

4. $W = \frac{W_f \times WB}{D}$

5. $W_r = \frac{W \times F}{WB}$

6. $F = \frac{W_r \times WB}{W}$

7. $WB = \frac{W \times F}{W_r}$

8. $W = \frac{W_r \times WB}{F}$

Weight Distribution Formulas in Words

To find:

1. Weight transferred to front axle = (Total weight) x (Distance C.G. is ahead of the rear axle) / (Wheelbase)

2. Distance C.G. must be placed ahead of rear axle = (Weight transferred to the front axle) x (Wheelbase) / (Total weight)

3. Wheelbase = (Total weight) x (Distance C.G. is ahead of the rear axle) / (Weight to be transferred to the front axle)

4. Total Weight = (Weight to be transferred to the front axle) x (Wheelbase) / (Distance C.G. is ahead of the rear axle)

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

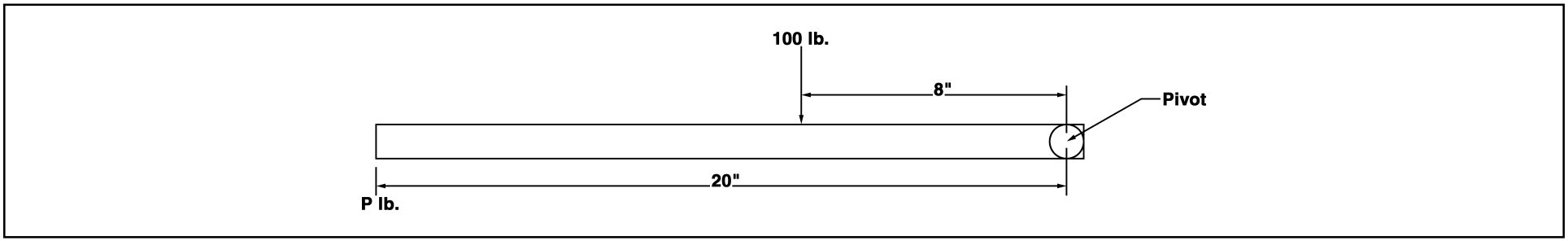
5. Weight transferred to the rear axle = $\frac{\text{(Total weight) x (Distance C.G. is behind the front axle)}}{\text{(Wheelbase)}}$

6. Distance C.G. must be placed behind the front axle = $\frac{\text{(Weight transferred to the rear axle) x (Wheelbase)}}{\text{(Total weight)}}$

7. Wheelbase = $\frac{\text{(Total weight) x (Distance C.G. is behind the front axle)}}{\text{(Weight to be transferred to the rear axle)}}$

8. Total weight = $\frac{\text{(Weight to be transferred to the rear axle) x (Wheelbase)}}{\text{(Distance C.G. is behind the front axle)}}$

9. Remember = Total weight must always equal weight transferred to the rear axle plus the weight transferred to the front axle



To find the value of “P”, the leverages must be equal for balance.

Example: 100 lbs. x 8 in. = “P” x 20 in.

or “P” = $\frac{\text{100 lbs. x 8 in.}}{\text{20 in.}}$

Therefore: “P” = 40 lbs.

This same approach is used to determine axle loadings on a tractor or truck chassis. Assuming the rear axle serves as a pivot point, the front axle load can be determined by applying the lever principle.

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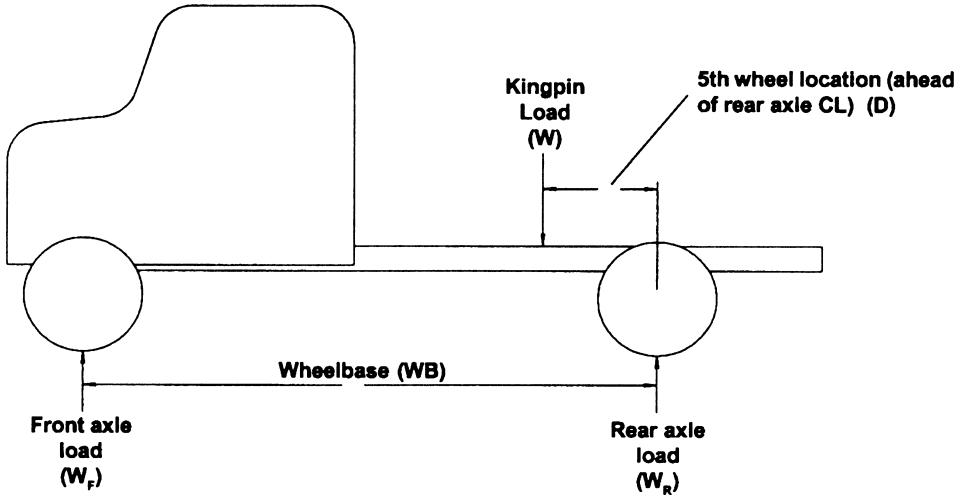


Front Axle Load: = $\frac{\text{Kingpin Load x 5th Wheel Location}}{\text{Wheelbase}}$

Rear Axle Load: = Kingpin Load – Front Axle Load

Example: (4) A tractor has a wheelbase of 150 inches. If the kingpin load is 20,000 lbs. and the fifth wheel location is 15 inches, find the total weight on the front and rear axles. The tare weight of the tractor is 7,000 lbs. on the front axle and 4,400 lbs. on the rear axle.

$$\text{Front Axle Load} = \frac{20{,}000 \times 15}{150\ \text{WB}} = 2{,}000 \text{ lbs.}$$

$$\text{Rear Axle Load} = 20{,}000 - 2{,}000 \text{ lbs.} = 18{,}000 \text{ lbs.}$$

Therefore:
Total Front Axle Weight = 2,000 + 9,000 lbs.
Total Rear Axle Weight = 4,400 + 18,000 lbs.
= 22,400 lbs.

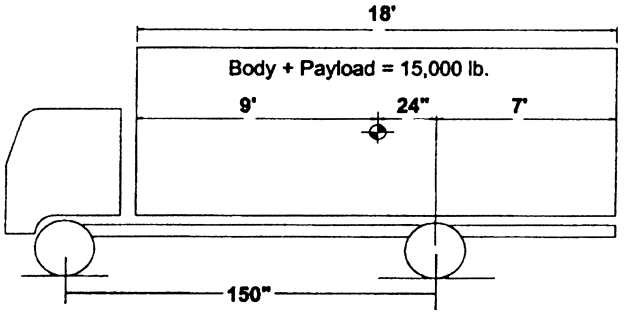
(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

In calculating the weight distribution for a truck, the same lever principle is applied; however, there is one change in the initial consideration of the method of loading the truck body. Instead of the trailer kingpin location ahead of the rear axle centerline, we must determine the position of the center of gravity of the payload and body weight in relation to the rear axle centerline.

For our calculations, we assume that the payload is distributed in the truck body so that the load is supported evenly over the truck body floor (water-level distribution). The weight of the body itself is also considered to be evenly distributed along the truck frame. In this manner, we can add the payload and body weights together and calculate the distribution on the vehicle chassis as an evenly distributed load on the truck frame rails.

So that we can make the necessary calculation in a simple manner, the total body and payload weight is considered to act at the center of gravity which will be at the center of the body length.



Example:

$$\text{Front Axle Load} = \frac{(\text{Body Weight} + \text{Payload}) \times \text{C of G location}}{\text{Wheelbase}}$$

$$\text{Rear Axle Load} = (\text{Body Weight} + \text{Payload}) - \text{Front Axle Load}$$

$$\text{Therefore, Front Axle Load} = \frac{15{,}000 \times 24}{150} = 2{,}400 \text{ lbs.}$$

Rear Axle Load = 15,000 – 2,400 = 12,600 lbs.

(Weight Distribution Concepts Section – continued on next page)

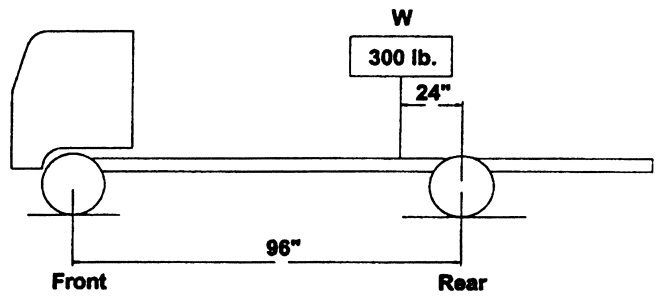
(Weight Distribution Concepts Section – continued from previous page)

If the truck tare weight without the body is 5,000 lbs. on the front axle and 2,400 lbs. on the rear axle, then
Total Front Axle Weight = 5,000 + 2,400 = 7,400 lbs. and
Total Rear Axle Weight = 2,400 + 12,600 = 15,000 lbs.

This same lever principle is applied in all calculations of weight distribution, whether we are dealing with concentrated loads as with a kingpin load acting on a fifth wheel or if it be with an evenly distributed load as with a truck body. The same approach is made in calculating an evenly distributed load on a trailer.

In the case of a tractor/trailer or a tractor with a set of double or triple trailers, each unit is handled as a separated unit and then combined to determine the total.

This simple example illustrates how the principles are applied. Using the formulas, find the weight distributed to each axle.



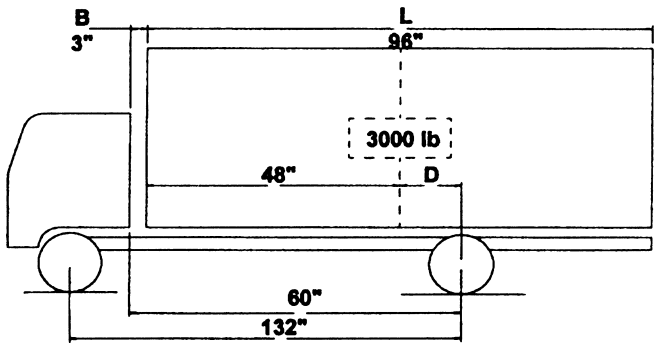
	Front Weight		**Rear Weight**
A.	$W_f = \frac{W \times D}{WB}$	A.	Total Weight –
B.	$\frac{300 \times 24}{96}$	B.	300 – 75
C.	= 75 lbs.	C.	= 225 lbs.

The body manufacturer can provide the body length and weight, or actual measurements of the body may be taken with a tape. Generally, (D) is unknown. This you must find logically, or with a tape measure.

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Find (D) and then solve for W_f and W_r.



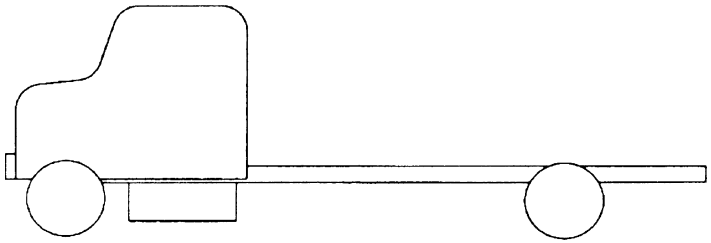
D = 60–3–48 = 9 in.

W_f = 205

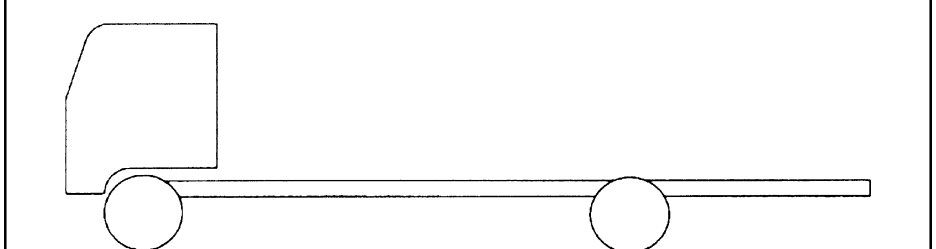
W_r = 2,795

Recommended Weight Distribution % of Gross Vehicle Weight by Axle

Conventional (2 Axle)



COE (2 Axle)



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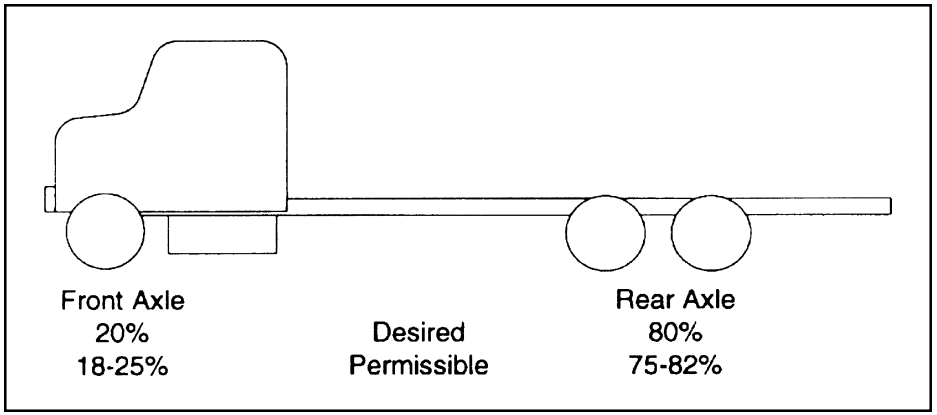
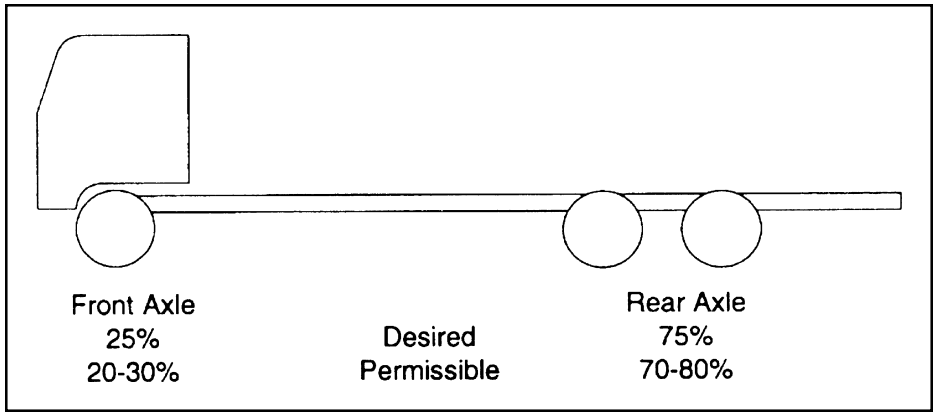
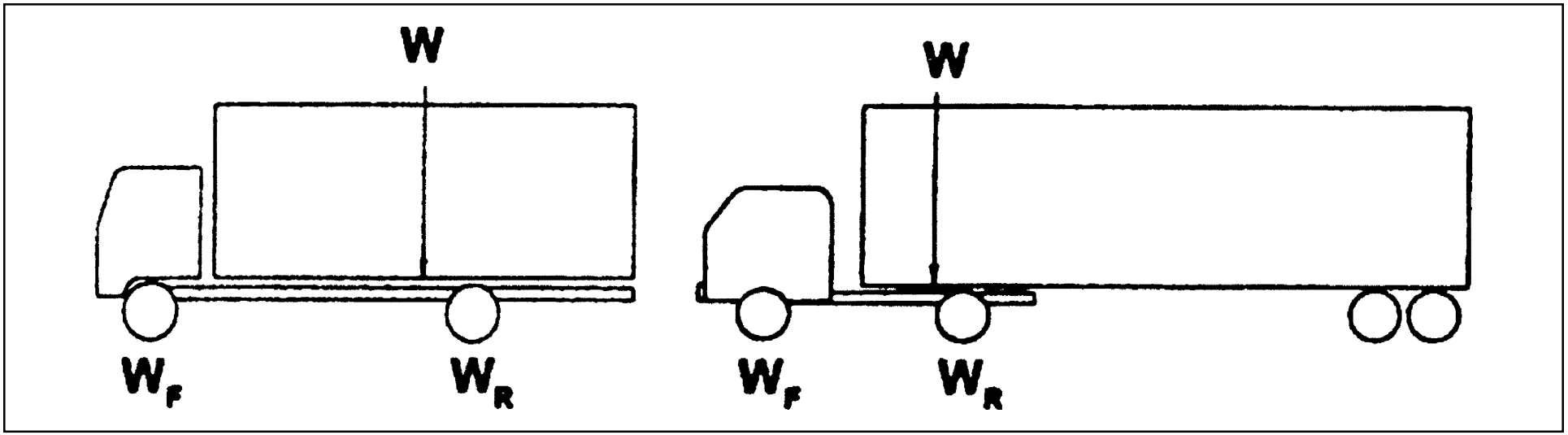
Conventional (3 Axle)



COE (3 Axle)



Calculating tractor/trailer weight distribution can be thought of in the same terms as calculating full trucks.



The weight at the center of the body and the load when applied is the same as the single point load of the kingpin on the fifth wheel.

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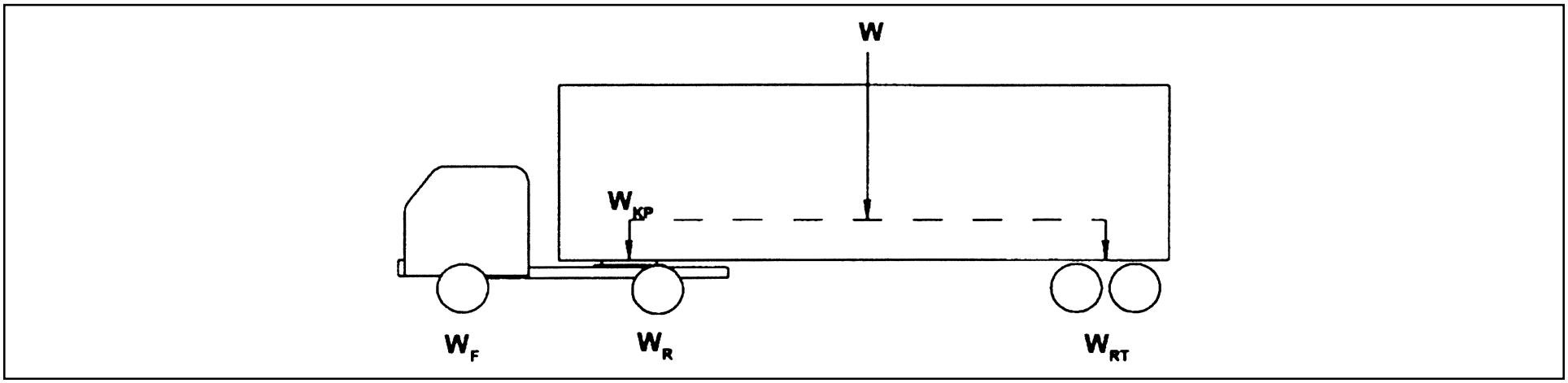
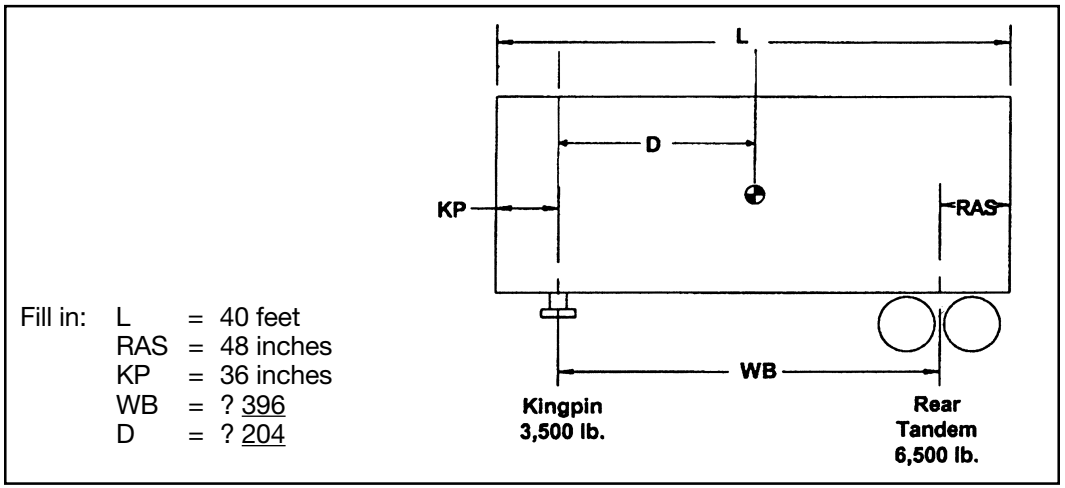
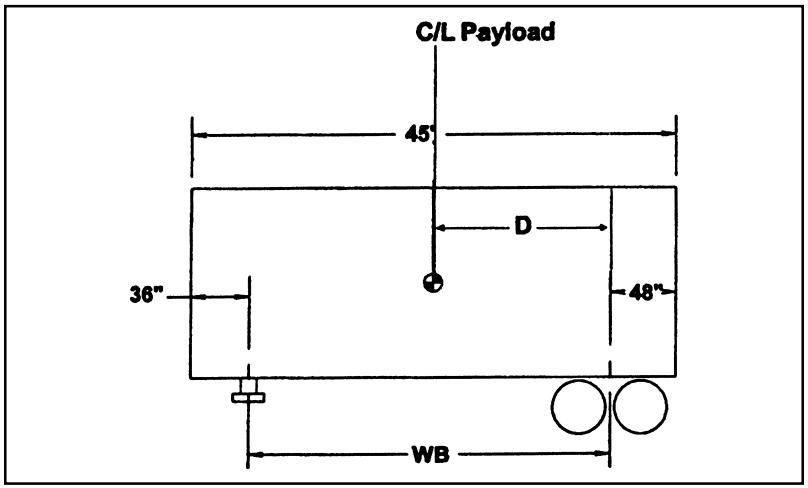
Trailer Weight





Fill in:
- L = 40 feet
- RAS = 48 inches
- KP = 36 inches
- WB = ? 396
- D = ? 204



In the following example, a 50,000-pound payload at water-level loading. Calculate the payload (PL) weight transfer to kingpin and the rear axle.

NOTE: Apply the same principles used with truck chassis.

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Payload at Kingpin

$$PL_{kp} = \frac{W \times D}{WB}$$

Calculate the "D" dimension.

OAL/2 – AF = D
45 feet/2 – 48 inches = 222 inches

$$PL_{kp} = \frac{50{,}000 \text{ lbs.} \times 222 \text{ in.}}{456 \text{ in.}} = 24{,}342 \text{ lbs.}$$

PL_{kp} = 24,342 lbs.

Payload at Rear Tandem

$PL_{rt} = W - PL_{kp}$

PL_{rt} = 50,000 lbs. – 24,342 lbs. = 25,658 lbs.

PL_{rt} = 25,658 lbs.

Once the weight on the kingpin is determined, it can then be treated on the tractor the same as a weight on a straight truck.

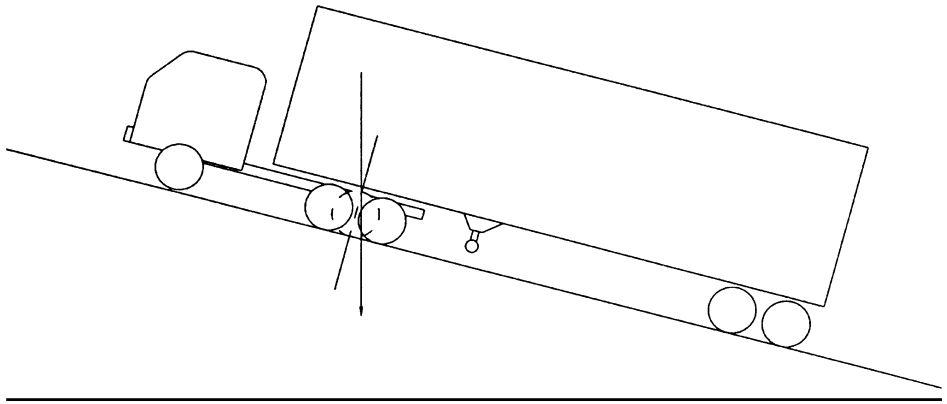
Due to the variations in hauling and wheelbase requirements from one truck application to another, there is no one specific fifth wheel setting that will apply in all cases.

A "rule of thumb" which has proven satisfactory in many cases sets the fifth wheel one inch ahead of the rear axle for every 10 inches of wheelbase. In the case of tandem axles, the wheelbase is measured from the center line of the front axle to the midpoint between the tandem rear axles. The location of the fifth wheel fixes the load distribution between the front and rear axles. Too far forward and the front axle is overloaded. If too far back, the front axle may be too lightly loaded and cause an unsafe steering and braking control situation at the front axle.

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

A tractor on a hill with the fifth wheel set at the axle center line or too close to it will result in an unsafe handling situation by transferring too much weight to the rear axle and actually unloading the front axle.



Performance Calculations

The following calculations have been included to help you determine the performance characteristics required by their customers and to select the appropriate model vehicle:

1. Speed Formula

This formula can be used to determine:

1. Top speed of the vehicle.
2. Speed in a given gear.
3. Final ratio required for a given speed.

$$\textbf{MPH @ Governed Speed} = \frac{\textbf{(60) x (RPM)}}{\textbf{(Rev/Mile) x (Gear Ratio)}}$$

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Definitions in formulas:

RPM	=	Revolutions per minute of the engine
Rev/Mile	=	Tire revolutions per mile
Gear Ratio	=	The product of the axle ratio times the transmission ratio
60	=	Time Constant

Example: NPR/W3500 12,000 GVWR automatic transmission.

RPM	=	3,000
Rev/Mile	=	674
Gear Ratio	=	.703 x 5.375

$$\textbf{MPH @ Governed Speed} = \frac{\textbf{(60) x (3,000)}}{\textbf{(674) x (.703 x 5.375)}}$$

MPH @ Governed Speed = 70 MPH

2. Grade Horsepower Formula

This formula can be used to determine horsepower required for a given grade and speed.

$$\textbf{Horsepower Req'd. for a given grade} = \frac{\textbf{GVWR x Grade x Speed}}{\textbf{37,500 x Efficiency Factor}} + \textbf{AHP}$$

Definitions in formulas:

GVWR	=	Gross Vehicle Weight Rating
Grade	=	Grade anticipated in percent
Speed	=	Speed in miles per hour
37,500	=	Constant
Efficiency Factor	=	Factor for losses in drivetrain due to friction (use 0.9 for a 90% efficient driveline)
AHP Resistance	=	Horsepower required to overcome wind force

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Example: NPR/W3500 11,050 GVWR automatic transmission with a van body.

GVWR	=	12,000 lbs.
Grade	=	1 percent
Speed	=	55 MPH
37,500	=	Constant
Efficiency Factor	=	0.9
AHP Resistance	=	53.6 HP (see the following formula for calculation)

$$\textbf{HP Required for Grade} = \frac{\textbf{12,000 x 1 x 55}}{\textbf{37,500 x 0.9}} + \textbf{53.67}$$

HP Required for Grade = 73.22

3. Air Resistance Horsepower Formula

This formula is used to determine the horsepower required to overcome air resistance at a given speed.

$$\textbf{Air Resistance Horsepower} = \frac{\textbf{FA x Cd x (MPH)}^3}{\textbf{156,000}}$$

Definitions in formulas:

FA	=	Frontal area of vehicle in square feet
Cd	=	Aerodynamic Drag Coefficient
MPH	=	Speed of vehicle in miles per hour
156,000	=	Constant

Frontal area is calculated by multiplying the height of the vehicle by the width of the vehicle and subtracting the open area under the vehicle from the total.

Aerodynamic Drag Coefficients *(Source Material: Motor Truck Engineering Handbook):*

0.70	for most trucks, semitrailer combinations with tanks or van bodies
0.77	for double and triple trailers and flatbeds with loads
1.00	car and boat haulers

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Example: NPR/W3500 12,000 GVWR van body with 96" wide, 115" high (84" body height + 31" frame height).

$$\mathbf{FA} = \frac{\mathbf{(96) \times (115)}}{\mathbf{(12) \times (12)}} - \mathbf{3.2}$$

FA = 73.47 ft.^{2}
Cd = 0.70
Speed = 55 mph

$$\text{Air Resistance HP} = \frac{73.47 \times 0.70 \times (55)^3}{156{,}000}$$

$$\text{Air Resistance HP} = 54.85$$

4. Engine Horsepower Formula

This formula can be used to derive the output at a given RPM and torque.

$$\mathbf{Horsepower} = \frac{\mathbf{Torque \times RPM}}{\mathbf{5{,}252}}$$

Definitions in Formulas:

Torque = Twisting output of engine given in lbs.-ft.
RPM = Revolutions per minute of engine
5,252 = Constant

Example: NPR/W3500 12,000 GVWR automatic transmission.

Torque = 347 lbs.-ft.
RPM = 2,000

$$132\ HP = \frac{(347) \times (2{,}000)}{5{,}252}$$

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

5. Gradeability Formula

This formula can be used to determine how large of a grade a vehicle can climb.

$$\textbf{Percent Grade} = \frac{\textbf{1,200 x (T) x (E) x (C) x (R)}}{\textbf{GVWR x r}} \textbf{ – RR}$$

Definitions in formulas:

1,200	=	Constant
T	=	Maximum Torque of Engine
E	=	Engine Efficiency (0.9)
C	=	Driveline Efficiency (0.9)
R	=	Transmission Ration x Axle Ratio
RR	=	Rolling Resistance (see following chart)
GVWR	=	Gross Vehicle Weight Rating
r	=	Loaded radius of tire

Example: NPR/W3500 12,000 GVWR automatic transmission on concrete highway.

T	=	347 lbs.-ft.
E	=	0.9
C	=	0.9
R	=	.703 x 5.375 (in overdrive)
RR	=	1.0
GVWR	=	12,000
r	=	14.1 in.

$$\textbf{Percent Grade} = \frac{\textbf{1,200 x (347) x (0.9) x (0.9) x (.703) x (5.375) – 1.0}}{\textbf{12,000 x 14.1}}$$

Percent Grade = 6.53 – 1

Gradeability = 5.53%

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Road Rolling Resistance			
Road Rolling Resistance – Expressed in Percent Grade			
Road Surface	**Grade**	**Road Surface**	**Grade**
Concrete, excellent	1.0	Cobbles, ordinary	5.5
Concrete, good	1.5	Cobbles, poor	8.5
Concrete, poor	2.0	Snow, 2 inches	2.5
Asphalt, good	1.25	Snow, 4 inches	3.75
Asphalt, fair	1.75	Dirt, smooth	2.5
Asphalt, poor	2.25	Dirt, sandy	3.75
Macadam, good	1.5	Mud	3.75 to 15.0
Macadam, fair	2.25	Sand, level soft	6.0 to 15.0
Macadam, poor	3.75	Sand, dune	16.0 to 30.0

6. Startability Formula

This formula is used to determine what type of a grade a vehicle can be started on.

$$\textbf{Startability} = \frac{\textbf{(1,200) x (CET) x (E) x (C) x (R)}}{\textbf{(GVWR x r)}} - \textbf{10\%}$$

Definitions in formulas:

1200	=	Constant
CET	=	Clutch Engagement Torque
E	=	0.9
C	=	0.9
R	=	Transmission x Axle Ratio
10%	=	Average break away resistance and static inertia constant
GVWR	=	Gross Vehicle Weight Rating
r	=	Loaded radius of tire

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Example: NPR/W3500 12,000 GVWR manual transmission.

CET = 260 lbs.-ft.
R = 6.02 x 4.10
GVWR = 12,000 lbs.
r = 14.1 in.

$$\text{Startability} = \frac{(1{,}200) \times (260) \times (0.9) \times (0.9) \times (6.02 \times 4.10)}{(12{,}000 \times 14.1)} - 10\%$$

Startability = 26.86%

7. Vertical Center of Gravity Formula

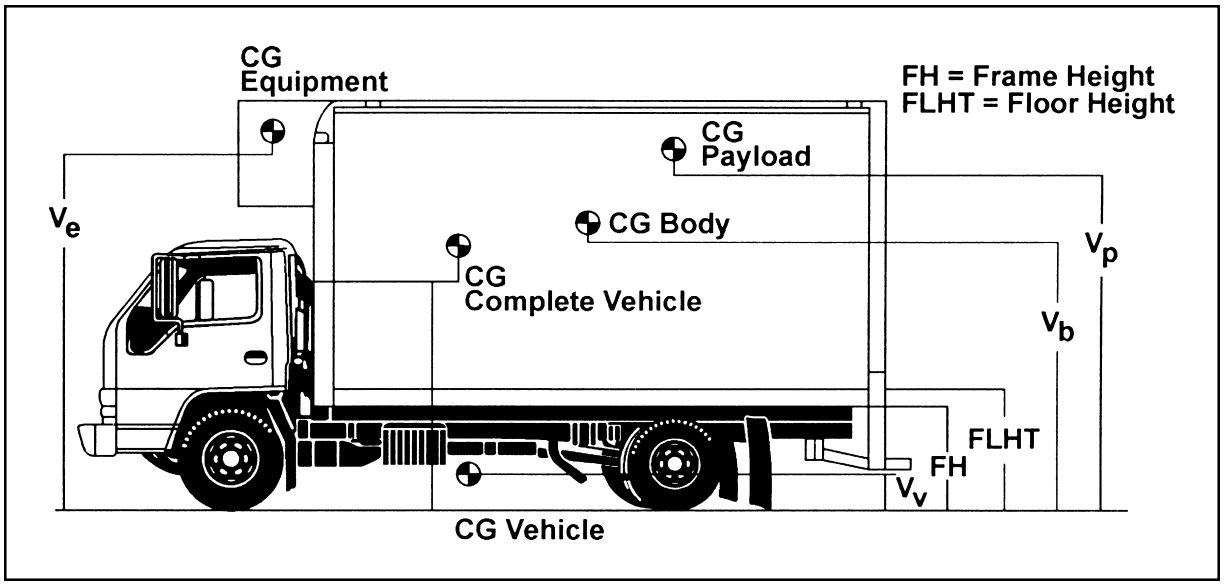
These formulas are used to estimate the vertical center of gravity of a completed vehicle in order to determine whether maximum allowable limits have been exceeded. This formula should be used when encountering high center of gravity loads.

7.1 Wv x (Vv) = Mv
7.2 Wb x (Vb) = Mb
7.3 Wp x (Vp) = Mp
7.4 We x (Ve) = Me

$$\text{7.5 } \mathbf{VCg} = \frac{\mathbf{(Mv + Mb + Mp + Me)}}{\mathbf{(Wv + Wb + Wp + We)}}$$

Definitions in formula:

VCg = The total average vertical center of gravity of the completed vehicle (vehicle, body, payload and equipment)
Wv = Weight of vehicle
Wb = Weight of body
Wp = Weight of payload
We = Weight of equipment



(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Definitions in formula *(continued)*:

Vv = Distance from ground to center of gravity of the vehicle
Vb = Distance from ground to center of gravity of the body
Vp = Distance from ground to center of gravity of the payload
Ve = Distance from ground to center of gravity of the equipment
Mv = Moment of vehicle
Mb = Moment of body
Mp = Moment of payload
Me = Moment of equipment

Example: NPR/W3500 12,000 GVWR automatic transmission, 132" WB, 14' body length, 84" high body, full payload of boxes stacked to a maximum height of 48" above the flooring.

Wv = 5,291 lbs. *(from vehicle specifications)*
Wb = 2,100 lbs. *(from body manufacturer)*
Wp = 4,609 lbs. *(GVWR – (Wv + Wb + We))*
Vv = 24.9 in. *(from Body Builder's Guide, NPR Section)*
Vb = 80 in. *(from body manufacturer)*
Vp = 62 in. *(1/2 of payload height + frame height + height from frame to flooring)*
Mv = 5,291 x 24.9 = 131,746 lbs.-in. *(from 7.1)*
Mb = 2,100 x 80 = 168,000 lbs.-in. *(from 7.2)*
Mp = 4,609 x 62 = 285,758 lbs.-in. *(from 7.3)*

We, Ve, Me = None in this example

$$VCg = \frac{(131{,}746 + 168{,}000 + 285{,}758)}{(5{,}291 + 2{,}100 + 4{,}609)}$$

$$VCg = \frac{(528{,}504)}{(12{,}000)} = 48.8 \text{ inches}$$

48.8 < 54.0 inches (54 inches is maximum allowable VCg per mfg. specifications from Body Builder's Guide, NPR/W3500 section)

Since maximum VCg for this truck is not exceeded, 48" stack height above flooring is acceptable.

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

8. Horizontal Center of Gravity Formula

These formulas are used to estimate the horizontal center of gravity of a completed vehicle in order to determine whether it exists between the centerlines of the front and rear axles. This formula should be used when a load and/or permanent equipment (liftgate, reefer unit, snowplow, etc.) is installed on either extreme along the completed vehicle's overall length.

8.1 Wv x (Hv) = Mv

8.2 Wb x (Hb) = Mb

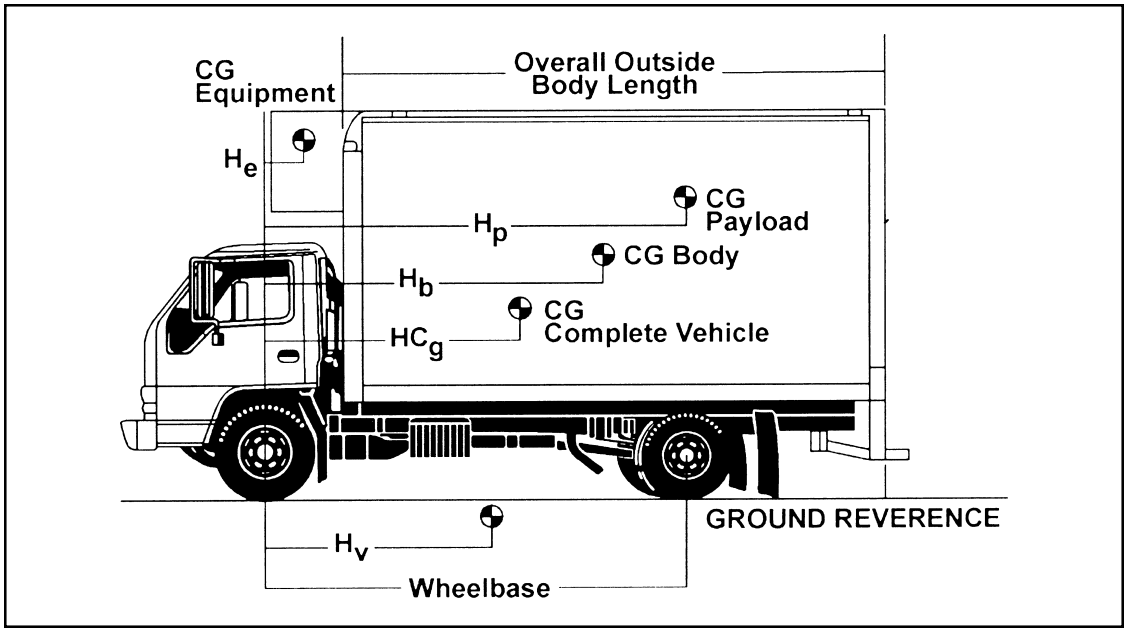
8.3 Wp x (Hp) = Mp

8.4 We x (He) = Me

8.5 **HCg** $= \dfrac{\textbf{(Mv + Mb + Mp + Me)}}{\textbf{(Wv + Wb + Wp + We)}}$

Definitions in formula:

HCg = The total average horizontal center of gravity of the completed vehicle (vehicle, body, payload and equipment)
Wv = Weight of vehicle
Wb = Weight of body
Wp = Weight of payload
We = Weight of equipment
Hv = Distance from front axle to center of gravity of the vehicle
Hb = Distance from front axle to center of gravity of the body
Hp = Distance from front axle to center of gravity of the payload
He = Distance from front axle to center of gravity of the equipment
Mv = Moment of vehicle
Mb = Moment of body
Mp = Moment of payload
Me = Moment of equipment



(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Example: NPR/W3500 Diesel 12,000 GVWR automatic transmission, 132" WB, 14' body length, full payload of boxes stacked and distributed evenly throughout the flooring, 1,000 lb. reefer unit attached in front of body.

Wv = 5,291 lbs. *(from vehicle specifications)*

Wb = 2,100 lbs. *(from body manufacturer)*

Wp = 3,609 lbs. *(GVWR – (Wv + Wb + We))*

We = 1,000 lbs. *(from equipment manufacturer)*

Hv = 42.4 in. *(from Body Builder's Guide, NPR Section)*

Hb = 107.5 in. *(from body manufacturer)*

Hp* = 107.5 in. *(1/2 of payload height + distance from front axle to front of body)*

He = 17.5 in. *(from equipment manufacturer)*

Mv = 5,291 x 42.4 = 224,338 lbs.-in. *(from 8.1)*

Mb = 2,100 x 107.5 = 225,750 lbs.-in. *(from 8.2)*

Mp = 3,609 x 107.5 = 387,967 lbs.-in. *(from 8.3)*

Me = 1,000 x 17.5 = 17,500 lbs.-in. *(from 8.4)*

$$HCg = \frac{(224{,}338 + 225{,}750 + 387{,}967 + 17{,}500)}{(5{,}291 + 2{,}100 + 3{,}609 + 1{,}000)}$$

$$HCg = \frac{(855{,}555)}{(12{,}000)} = 71.3 \text{ inches}$$

71.3 < 132 inches (132 inches is the wheelbase dimension)

Since HCg for this truck is not greater than the WB or negative (–), (denotes HCg forward of front axle centerline), it exists between the centerlines of the front and rear axles.

NOTE: Hp and Hb dimensions are the same in this example because CG of body and payload happen to be at the same point.

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Highway System Limits

The Federal Government established the Federal Bridge Gross Weight Formula to provide a standard to control the spacing of truck axles on trucks that use highway bridges. This is intended to space loads out over a distance to avoid too high a concentration in one area that could cause damage. The truck's gross weights, axle weight and axle spacing are set in order to keep axle loads and gross weight loads within the limits set by the Federal Government. The Bridge Formula Table is used to check trucks to make sure that Federal weight limit requirements are met and that the allowable gross and axle weights are in the correct relationship with the spacing of axles to prevent high load concentrations on highway bridges.

The Federal Government has established the following formula to be used to determine the allowable weight limits and axle spacings for trucks.

$$W = 500\left(\frac{LN}{N-1} + 12N = 36\right)$$

Where:

W = The total gross weight that may be carried on any group of two or more consecutive axles to the nearest 500 lbs.

L = The distance (spacing) in feet between the outer axles of any group of two or more consecutive axles.

N = The number of axles in the group under consideration; except that two consecutive sets of tandem axles may carry a gross load of 34,000 lbs. each provided the overall distance between the first and last axles of such consecutive sets of axles is 36 feet or more.

Bridge Formula Definitions

The following definitions are used for bridge formula calculations.

Gross Weight

The total weight of a truck (and/or trailer) combined with the weight of the load being hauled. The Federal gross weight limits on interstate highways and federal-aid highways and reasonable access is 80,000 lbs.

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Single Axle Weight

The total weight at the ground by all wheels of an axle whose centers may be included between parallel transverse planes 40 inches apart, extending across the width of the truck. The Federal single axle weight limit on the Interstate system and reasonable access is 20,000 lbs.

Tandem Axle Weight

The total weight at the ground of two or more consecutive axles whose centers may be included between parallel vertical planes spaced more than 40 inches but not more than 96 inches apart, extending across the full width of the truck. The Federal tandem axle weight limit on the Interstate system and reasonable access is 34,000 lbs.

Consecutive Axle Weight

The Federal law states that any two or more consecutive axles may not exceed the weight as computed by the formula even though the single axles, tandem axles, and gross weights are within the legal requirements.

Exception to the Bridge Formula

There is one exception to the use of the Federal Bridge Formula: two consecutive sets of tandem axles may carry a gross load of 34,000 lbs. each, providing the overall distance between the first and last axles of such consecutive sets of tandem axles is 36 feet or more.

Other Federal Provisions

Maximum Width: 102 inches overall

Length: States cannot set overall length limits on tractor, semitrailer, tractor/semitrailer, or tractor/semitrailer trailer combinations. States must allow tractors with double trailers. States must allow semitrailers of up to 48 feet in length for doubles combinations. There is also not a limitation on overall length for semitrailer or doubles combinations.

These width and length dimensions apply to trucks operating on interstate highways and federal-aid highways designed by the Federal Highway Administration. This also provides for reasonable access to the interstate highways.

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Federal Bridge Formula Table

Distance in feet between the extremes of any group of 2 or more consecutive axles	Maximum Load in Pounds on Any Group of 2 or More Consecutive Axles							
	2 Axles	3 Axles	4 Axles	5 Axles	6 Axles	7 Axles	8 Axles	9 Axles
4	34,000*							
5	34,000*							
6	34,000*							
7	34,000*							
8 and less	34,000*	34,000						
8 and more	38,000	42,000						
9	39,000	42,500						
10	40,000	43,500						
11		44,000						
12		45,000	50,000					
13		45,500	50,500					
14		46,500	51,500					
15		47,000	52,000					
16		48,000	52,500	58,000				
17		48,500	53,500	58,500				
18		49,500	54,000	59,000				
19		50,000	54,500	60,000				
20		51,000	55,500	60,500	66,000			
21		51,500	56,000	61,000	66,500			
22		52,500	56,500	61,500	67,000			

* Tandem Axle by Definition.

\+ Exception to Federal Bridge Formula Table and Law. See Text for Explanation.

NOTE: All permissible load calculations are to the nearest 500 lbs. Maximum load on any single axle, 20,000 lbs. Weights over 80,000 lbs. are in excess of the Federal GVW on the National Highway Network.

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Federal Bridge Formula Table (Continued)

Distance in feet between the extremes of any group of 2 or more consecutive axles	Maximum Load in Pounds on Any Group of 2 or More Consecutive Axles							
	2 Axles	3 Axles	4 Axles	5 Axles	6 Axles	7 Axles	8 Axles	9 Axles
23		53,000	57,500	62,500	68,000			
24		54,000	58,000	63,000	68,500	74,000		
25		54,500	58,500	63,500	69,000	74,500		
26		55,500	59,500	64,000	69,500	75,000		
27		56,000	60,000	65,000	70,000	75,500		
28		57,000	60,500	65,500	71,000	76,500	82,000	
29		57,500	61,500	66,000	71,500	77,000	82,500	
30		58,500	62,000	66,500	72,000	77,500	83,000	
31		59,000	62,500	67,500	72,500	78,000	83,500	90,000
32		60,000	63,500	68,000	73,000	78,500	84,500	90,500
33			64,000	68,500	74,000	79,000	85,000	91,000
34			64,500	69,000	74,500	80,000	85,500	91,500
35			65,500	70,000	75,000	80,500	86,000	92,000
36			66,000+	70,500	75,500	81,000	86,500	93,000
37			66,500+	71,000	76,000	81,500	87,000	93,500
38			67,500+	72,000	77,000	82,000	87,500	94,000
39			68,000	72,500	77,500	82,500	88,500	94,500
40			68,500	73,000	78,000	83,500	89,000	94,500
41			69,500	73,500	78,500	84,000	89,500	95,000
42			70,000	74,000	79,000	84,500	90,000	95,500

* Tandem Axle by Definition.

\+ Exception to Federal Bridge Formula Table and Law. See Text for Explanation.

NOTE: All permissible load calculations are to the nearest 500 lbs. Maximum load on any single axle, 20,000 lbs. Weights over 80,000 lbs. are in excess of the Federal GVW on the National Highway Network.

(Weight Distribution Concepts Section – continued on next page)

(Weight Distribution Concepts Section – continued from previous page)

Federal Bridge Formula Table (Continued)

Distance in feet between the extremes of any group of 2 or more consecutive axles	Maximum Load in Pounds on Any Group of 2 or More Consecutive Axles							
	2 Axles	3 Axles	4 Axles	5 Axles	6 Axles	7 Axles	8 Axles	9 Axles
43			70,500	75,000	80,000	85,000	90,500	96,000
44			71,500	75,500	80,500	85,500	91,000	96,500
45			72,000	76,000	81,000	86,000	91,500	97,500
46			72,500	76,500	81,500	87,000	92,500	98,000
47			73,500	77,500	82,000	87,500	93,000	98,500
48			74,000	78,000	83,000	88,000	93,500	99,000
49			74,500	78,500	83,500	88,500	94,000	99,500
50			75,500	79,000	84,000	89,000	94,500	100,000
51			76,000	80,000	84,500	89,500	95,000	100,500
52			76,500	80,500	85,000	90,500	95,500	101,000
53			77,500	81,000	86,000	91,000	96,500	102,000
54			78,000	81,500	86,500	91,500	97,000	102,500
55			78,500	82,500	87,000	92,000	97,500	103,000
56			79,500	83,000	87,500	92,500	98,000	103,500
57			80,000	83,500	88,000	93,000	98,500	104,000
58				84,000	89,000	94,000	99,000	104,500
59				85,000	89,500	94,500	99,500	105,000
60				85,500	90,000	95,000	100,500	105,500

* Tandem Axle by Definition.

\+ Exception to Federal Bridge Formula Table and Law. See Text for Explanation.

NOTE: All permissible load calculations are to the nearest 500 lbs. Maximum load on any single axle, 20,000 lbs. Weights over 80,000 lbs. are in excess of the Federal GVW on the National Highway Network.

COMMODITY AND MATERIAL WEIGHTS

Approximate Weights of Commodities and Materials

Product		Size of Container	Lbs. Per Cu. Ft.	No. of Lbs. / Per
Acetone		——	50	6.6 / gallon
Alcohol,	Commercial	——	51	6.8 / gallon
	Proof spirits	——	57	7.6 / gallon
Alfalfa seed		bushel	—	60 / bushel
Aluminum,	Pure (cast)	——	165	4,450 / cu. yard
Apples,	Fresh	basket-bushel	—	48 / bushel
	Western, box	11.5" x 12" x 20"	—	50 / box
	New England, box	11.25" x 14.5" x 17.5"	—	56 / box
	Standard barrel	17" head, 28.5" stave	—	160 / barrel
	Dried	bushel	—	24 / bushel
Apricots,	Fresh	bushel	—	48 / bushel
	Western, box	5.5" x 12" x 20"	—	23 / box
Artichokes,	Box	10" x 11.5" x 22"	—	44 / box
Asbestos		——	153	4,130 / cu. yard
Asparagus, crate,	Loose	11.5" high x 9.75" top	—	38 / crate
	Bunches	11" bottom x 19.38" long	—	31 / crate
Avocados,	Box	5.75" x 11.25" x 17.5"	—	16 / box
Bananas,	Single stem	bunch	—	45-65 / bunch
Barley		bushel	—	48 / bushel
Barytes,	Mineral	——	280	7,560 / cu. yard
Basalt,	Rock	——	185	5,000 / cu. yard
Beans, dry,	Lima	bushel	—	56 / bushel
	White	bushel	—	60 / bushel
	Castor	bushel	—	46 / bushel
Beans, fresh,	Lima	bushel	—	39 / bushel
	String	bushel	—	36 / bushel
		hamper, 5 peck	—	45 / hamper

Product		Size of Container	Lbs. Per Cu. Ft.	No. of Lbs. / Per
Beef,	Slack barrel	21" x 30" stave (200 lbs. net)	—	254 / barrel
Beer,	Wood barrel	.5 barrel (16 gal.)	—	205 / barrel
	Wood barrel	.25 barrel (8 gal.)	—	105 / barrel
	Steel barrel	.5 barrel (16 gal.)	—	190 / barrel
	Steel barrel	.25 barrel (8 gal.)	—	95 / barrel
	Dutchman	.13 barrel (4 gal.)	—	51 / barrel
Case carton,*	Regular bottles	17.25" x 11.5" x 9.88"	—	45 / case
24, 12 oz.	Steinie bottles	18.38" x 12.13" x 7.38"	—	40 / case
	Tin cans	16.13" x 11" x 5.13"	—	28 / case
Wooden case,*	Regular bottles	21" x 13.5" x 10"	—	35 / case
24, 12 oz.	Steinie bottles	22" x 13.75" x 7.5"	—	46 / case
Beets		bushel	—	50-60 / bushel
	Small crate	9.75" x 13.25" x 24"	—	50 / crate
	Western crate	14" x 19" x 24.5"	—	95 / crate
Berries, crate,	24 pint	9.75" x 9.97" x 20"	—	25 / crate
	24 quart	11.75" x 11.75" x 24"	—	48 / crate
	32 quart	15.5" x 11.75" x 24"	—	63 / crate
Bluegrass seed		bushel	—	44 / bushel
Bluestone		——	120	3,240 / cu. yard
Bone		——	115	3,110 / cu. yard
Borax		——	110	2,970 / cu. yard
Bran		bushel	—	20 / bushel
Brick,	Soft	2.25" x 4" x 8.25"	—	4,320 / thousand
	Common	2.25" x 4" x 8.25"	—	5,400 / thousand
	Hard	2.25" x 4.25" x 8.5"	—	6,480 / thousand
	Pressed	2.38" x 4" x 8.38"	—	7,500 / thousand
	Paving	2.25" x 4" x 8.5"	—	6,750 / thousand
	Paving block	3.5" x 4" x 8.5"	—	8,750 / thousand
	Fire	2.5" x 4.5" x 9"	—	7,000 / thousand

* **Note:** Beer cases vary as to size and shape. Suggest checking with local source.

Product		Size of Container	Lbs. Per Cu. Ft.	No. of Lbs. / Per
Broccoli,	Bushel crate	12.75" x 12.75" x 17"	—	30 / bushel
Brussels sprouts,	Crate	7.75" x 10.5" x 21.38"	—	26 / crate
Buckwheat		bushel	—	49 / bushel
Butter, tub,	Small	15" dia. x 5.75"	—	25 / tub
	Standard	15" dia. x 15"	—	70 / tub
Butter, case,	30 – 1-lb. bricks	10.75" x 8.75" x 10.5"	—	32 / case
	9-lb. pail	pail	—	10 / pail
Cabbage		bushel	—	38 / bushel
	Hamper	1.5 bushel	—	58 / hamper
	Crate	12.75" x 18.5" x 19"	—	60 / crate
	Western crate	14" x 19" x 24.5"	—	85 / crate
	Barrel crate	12.75" x 18.75" x 37.38"	—	110 / crate
Calf,	Live (average)	per head	—	140-160 / head
Cantaloupe, crate,	Pony	11.75" x 11.75" x 23.5"	—	58 / crate
	Standard	12.75" x 12.75" x 23.5"	—	68 / crate
	Jumbo	13.75" x 13.75" x 23.5"	—	78 / crate
	Pony flat	4.75" x 12.75" x 23.5"	—	26 / crate
	Standard flat	5.25" x 14.25" x 23.5"	—	28 / crate
	Jumbo flat	5.75" x 15.25" x 23.5"	—	32 / crate
	Honeydew (Casaba)	6.38" x 15.13" x 23.5"	—	35 / crate
Carbolic acid		——	60	8 / gallon
Carrots,	Topped	bushel	—	55 / bushel
	With tops	bushel	—	40 / bushel
	Crate	11.75" x 14.13" x 24"	—	60 / crate
Castor oil		——	61	8.1 / gallon
Cauliflower		bushel	—	30 / bushel
	Crate	9.38" x 19" x 24"	—	50 / crate
Cedar*	(lumber)	——	30	2,500 / M. Bd. ft.
Celery,	Standard crate	11.63" x 22" x 22.63"	—	70 / crate
	Half crate	10.75" x 13" x 20.38"	—	35 / crate
	Northern crate	16.5" x 21.25" x 22"	—	85 / crate

*Kiln dried lumber averages 10% to 15% lighter, and green lumber 40% to 50% heavier, than air dried.

Product		Size of Container	Lbs. Per Cu. Ft.	No. of Lbs. / Per
Cement,	Block	8" x 8" x 16"	—	42 / each
	Block	8" x 12" x 16"	—	58 / each
	Portland	sack	—	94 / sack
	Portland	barrel (4 sacks per)	—	376 / barrel
Chalk		——	137	3,700 / cu. yard
Charcoal,	Oak	——	33	890 / cu. yard
	Pine	——	23	620 / cu. yard
Cheese,	Small box	15" dia. x 5.25"	—	25 / box
	Medium box	15" dia. x 7.5"	—	35 / box
	Large box	15" dia. x 15"	—	70 / box
Cherries,	Unstemmed	bushel	—	56 / bushel
	Stemmed	bushel	—	64 / bushel
	Lug box	5.63" x 11.88" x 19.75"	—	17 / box
Chestnut*	(lumber)	——	37	3,080 / M. Bd. ft.
Chestnuts		bushel	—	50 / bushel
Chickens,	Live, broilers (20 avg.)	standard crate	—	58 / crate
	Fowl (12 avg.)	standard crate	—	78 / crate
	Standard crate, empty	24" x 35" x 13"	—	18 / each
Cinder blocks		8" x 8" x 16"	—	35 / each
		8" x 12" x 16"	—	45 / each
Cinders		——	50	1,350 / cu. yard
Clay,	Dry lumps	——	85	2,300 / cu. yard
	Wet lumps	——	110	2,970 / cu. yard
	Wet packed	——	135	3,650 / cu. yard
	Fire	——	125	3,375 / cu. yard
Cork		——	15	405 / cu. yard
Corn,	Ear	bushel	—	35 / bushel
	Shelled	bushel	—	56 / bushel
	Sweet corn (green)	bushel	—	43 / bushel
	Crate	12.88" x 12.88" x 24"	—	60 / crate
Corn meal		bushel	—	44 / bushel

Product		Size of Container	Lbs. Per Cu. Ft.	No. of Lbs. / Per
Corn oil		——	58	7.8 / gallon
Corn syrup		——	86	11.5 / gallon
Cotton,	Gin bale	30" x 48" x 54"	—	515 / bale
	Standard bale	24" x 28" x 56"	—	515 / bale
	Comp. bale	20" x 24" x 56"	—	515 / bale
Cotton seed		bushel	—	32 / bushel
Cottonseed oil		——	58	7.8 / gallon
Cottonwood*	(lumber)	——	37	3,080 / M. Bd. ft.
Cow,	Live-Feeder (average)	per head	—	600 / head
	Butcher (average)	per head	—	800 / head
	Butcher steer (average)	per head	—	1100 / head
Cranberries,	1/4 barrel box	9.5" x 11" x 14"	—	28 / box
	1/2 barrel box	12.25" x 14.75" x 22"	—	60 / box
Cream		——	64	8.5 / gallon
Creosote		——	68	9.2 / gallon
Crude oil		——	56	7.5 / gallon
Cucumbers		bushel	—	55 / bushel
	Crate	9.75" x 13.75" x 24"	—	75 / crate
	Case	5" x 13.25" x 19"	—	26 / case
Earth,	Loose, dry loam	——	76	2,050 / cu. yard
	Packed	——	95	2,565 / cu. yard
	Wet	——	125	3,375 / cu. yard
Eggplant,	Hamper	bushel	—	40 / bushel
	Crate	14" x 11.75" x 24"	—	54 / crate
Eggs,	30 dozen crate	12" x 12" x 26"	—	55 / crate
Elm,*	Soft	——	38	3,170 / M. Bd. ft.
	Rock	——	45	3,750 / M. Bd. ft.
Fertilizer,	Commercial	burlap bag	—	100-200 / bag
Fir,*	Douglas	——	32	2,670 / M. Bd. ft.
	Eastern	——	25	2,080 / M. Bd. ft.

*Kiln dried lumber averages 10% to 15% lighter, and green lumber 40% to 50% heavier, than air dried.

Product		Size of Container	Lbs. Per Cu. Ft.	No. of Lbs. / Per
Fish, fresh,	Barrel	19" head, 29" stave	—	300 / barrel
	1/2 Barrel	18.5" head, 23.5" stave	—	160 / 1/2 barrel
Flour,	Barrel	19.13" head, 30" stave	—	215 / barrel
Fuel oil,	Furnace grade	——	56	7.5 / gallon
	Diesel engine	——	52	7 / gallon
Furniture,	Household	——	7	1,915 / cu. yard
Garbage,	Dry, paper wrapped	——	15-30	405-810 / cu. yard
	Wet	——	50	1,240 / cu. yard
Gasoline		——	45	6 / gallon
Glass,	Common window	——	—	162 / cu. foot
	Plate or crown	——	—	161 / cu. foot
	1/4" plate	——	—	3.3 / sq. foot
Glue		——	80	2,160 / cu. yard
Glycerine		——	79	10.5 / gallon
Grapefruit,	Western box	11.5" x 11.5" x 24"	—	68 / box
	Southern box	12.75" x 12.75" x 27"	—	90 / box
Grapes,	Basket	bushel	—	48 / box
	Lug box	5.63" x 16.38" x 17.5"	—	30 / box
	Western keg	15.5" dia. x 14"	—	45 / keg
	Basket	12 quart	—	18 / basket
Gravel,	Dry	——	95	2,565 / cu. yard
	Wet	——	125	3,375 / cu. yard
Greens		bushel	—	25 / bushel
Groceries,	Misc. assorted	——	30	810 / cu. yard
Hay,	Bale	26" x 30" x 46"	—	210 / bale
	Bale	17" x 22" x 43"	—	115 / bale
	Bale	14" x 16" x 43"	—	85 / bale
Hog,	Live (average)	per head	—	225-250 / head
Honey		——	90	12 / gallon
Horse,	Live (average)	per head	—	1,200-1,500 / head

Product		Size of Container	Lbs. Per Cu. Ft.	No. of Lbs. / Per
Horseradish roots		bushel	—	35 / bushel
Ice		——	57	1,540 / cu. yard
Ice (mfg.),	Block	11" x 22" x 32"	—	250 / block
	Block	14" x 14" x 40"	—	255 / block
	Block	11" x 22" x 56"	—	440 / block
Ice Cream,	2.5 gallon can, Full	9" dia. x 11"	—	18 / can
	Empty	——	—	6 / can
	5 gallon can, Full	9" dia. x 21"	—	35 / can
	Empty	——	—	11 / can
Kale		bushel	—	25 / bushel
Kerosene		——	50	6.6 / gallon
Lamb,	Live (average)	per head	—	75-85 / head
Lard,	Barrel	18" head, 30" stave	—	425 / barrel
Lath,	Standard length 29"	Packed in bundles of 50 Average bundle, dia. 9"	—	25 / bundle
Leather,	Dry	——	55	1,485 / cu. yard
	Wet	——	65	1,755 / cu. yard
Lemons,	Western box	10" x 13" x 25"	—	80 / box
	Southern box	12.75" x 12.75" x 27"	—	90 / box
Lentils		bushel	—	60 / bushel
Lettuce,	Hamper	bushel	—	25 / bushel
	Hamper	1.5 bushel	—	38 / hamper
	Basket	8.5" x 11.75" x 21.38"	—	17 / basket
	Crate	18.75" x 17.5" x 24.5"	—	75 / crate
	1/2 crate	9.5" x 13.5" x 24.5"	—	40 / 1/2 crate
Lime,	Hydrated	bushel	—	30 / bushel
	Barrel (small)	16.5" head, 27.5" stave	62	210 / barrel
	Barrel (large)		62	320 / barrel
Limes,	Western box	10" x 13" x 25"	—	80 / box
	Southern box	12.75" x 12.75" x 27"	—	90 / box

*Kiln dried lumber averages 10% to 15% lighter, and green lumber 40% to 50% heavier, than air dried.

Product		Size of Container	Lbs. Per Cu. Ft.	No. of Lbs. / Per
Linseed oil		——	59	7.9 / gallon
Lubricating oil		——	52	7 / gallon
Malt,	Barley	bushel	—	28 / bushel
	Rye	bushel	—	32 / bushel
	Brewer's grain	bushel	—	40 / bushel
Maple syrup		gallon	82	11 / gallon
Maple,*	Hard (lumber)	——	44	3,670 / M. Bd. ft.
	Soft	——	34	2,830 / M. Bd. ft.
Meal-corn		bushel	—	44 / bushel
Milk,	Bulk	——	64	8.6 / gallon
	5 gallon can	10.25" dia. x 19"	—	62 / can
	10 gallon can	13" dia. x 23"	—	115 / can
	Crate, 20.5 pt. bottles	8.5" x 12.75" x 16.75"	—	33 / crate
	20 pt. bottles	8.5" x 12.75" x 16.75"	—	54 / crate
Millet		bushel	—	50 / bushel
Molasses		——	90	12 / gallon
	Barrel	20.25" head, 34" stave	—	675 / barrel
Mortar,	Lime	——	110	2,970 / cu. yard
Mud,	Flowing	——	106	2,860 / cu. yard
	Packed	——	125	3,375 / cu. yard
Muriatic acid,	40%	——	40	10 / gallon
Naptha,	Petroleum	——	42	5.6 / gallon
Nitric acid,	91%	——	94	12.5 / gallon
Oak-red,*	Black	——	42	3,500 / M. Bd. ft.
	White	——	48	4,080 / M. Bd. ft.
Oats		bushel	—	32 / bushel
Okra,	Hamper	1/2 bushel	—	18 / hamper
	Hamper	bushel	—	34 / bushel
Oleomargarine,	(mfg.-tub)	21" head, 34" stave	—	70 / tub
	Cases	——	—	15-65 / case

Product		Size of Container	Lbs. Per Cu. Ft.	No. of Lbs. / Per
Olive oil		——	58	7.7 / gallon
Onions, dry,	Basket	bushel	—	55 / bushel
	Bag	17" x 32"	—	50 / bag
	Crate	20.5" x 11.5" x 10.5"	—	58 / crate
	Green (with tops)	bushel	—	32 / bushel
Oranges,	Western box	11.5" x 11.5" x 24"	—	80 / box
	Southern box	12.75" x 12.75" x 27"	—	90 / box
	Bushel box	10.75" x 10.75" x 23.5"	—	65 / box
Oysters (shucked or meats)				
	Crate with 5.1 gal. cans	18" x 12" x 24"	(11.5 lbs. per gal.)	67 / crate
	With shells (bags)	bushel	—	75 / bushel
Paint,	Lead and oil	——	127	17 / gallon
Paper,	Average solid	——	58	1,565 / cu. yard
	Newspaper rolls	34.25" x 35" dia.	—	500 / roll
		51.5" x 35" dia.	—	1,000 / roll
		64.25" x 35" dia.	—	1,300 / roll
Paraffin		——	56	1,510 / cu. yard
Parsley,	Bushel crate	12.75" x 12.75" x 17"	—	30 / crate
Parsnips		bushel	—	50 / bushel
Peaches,	Basket	bushel	—	48 / bushel
	1/2 bushel	——	—	25 / basket
	Crate	10.5" x 11.25" x 24"	—	50 / crate
	Western box	5.5" x 12.25" x 19.75"	—	22 / box
Peanuts,	Unshelled	bushel	—	22 / bushel
	Bag	——	—	100 / bag
Peanut oil		——	57	7.6 / gallon
Pears,	Basket	bushel	—	50 / bushel
	Western box	9.63" x 12.13" x 19.75"	—	51 / box
Peas,	Dry	bushel	—	60 / bushel
	Fresh hamper	bushel	—	35 / hamper
	Hamper	40 quarts	—	45 / hamper

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Product		Size of Container	Lbs. Per Cu. Ft.	No. of Lbs. / Per
Pecans,	Large bag	——	—	100 / bag
	Small bag	——	—	50 / bag
Peppers,	Basket	bushel	—	25 / basket
	Crate	14.13" x 11.75" x 24"	—	45 / crate
Petroleum		——	56	7.5 / gallon
Phosphate rock		——	200	5,400 / cu. yard
Pine,*	Long leaf	——	44	3,670 / M. Bd. ft.
	North Carolina	——	36	3,000 / M. Bd. ft.
	Oregon	——	32	2,670 / M. Bd. ft.
	Red	——	30	2,500 / M. Bd. ft.
	White	——	26	2,170 / M. Bd. ft.
	Yellow, long leaf	——	44	3,670 / M. Bd. ft.
	Short leaf	——	38	3,170 / M. Bd. ft.
Pineapples,	Crate	11" x 12.5" x 36"	—	85 / crate
Pitch		——	70	1,900 / cu. yard
Plums,	Basket	bushel	—	56 / bushel
	Western box	5.63" x 16.38" x 17.5"	—	25 / box
Pomegranates,	Box	6.5" x 12" x 24.63"	—	30 / box
Popcorn,	Ear	bushel	—	70 / bushel
	Shelled	bushel	—	56 / bushel
Poplar*		——	27	2,250 / M. Bd. ft.
Porcelain		——	150	4,050 / cu. yard
Pork (dressed),	Barrel (200 lbs. net)	18" head, 29" stave	—	240 / barrel
Potatoes,	Sweet	bushel	—	55 / bushel
	White or Irish	bushel	—	60 / bushel
	Bag	1.67 bushel	—	102 / bag
	Barrel	17.13" head, 28.5" stave	—	185 / barrel
Prunes,	Box	5.63" x 16.38" x 19.75"	—	25 / box
	Box	5.63" x 11.88" x 19.75"	—	22 / box
Quinces		bushel	—	50 / bushel

Product		Size of Container	Lbs. Per Cu. Ft.	No. of Lbs. / Per
Radishes,	Basket	bushel	—	34 / bushel
	Crate	9.75" x 13.75" x 24"	—	40 / crate
Redwood*		——	30	2,500 / M. Bd. ft.
Resin		——	68	1,835 / cu. yard
Rhubarb (pie plant)		bushel	—	50 / bushel
	Box	5.25" x 11.5" x 22"	—	24 / box
Rice,	Unhulled	bushel	—	43 / bushel
Rock,	Crushed (average)	——	100	2,700 / cu. yard
Romaine,	Crate	13.88" x 18.88" x 24.5"	—	64 / crate
	Crate	12.25" x 13" x 15.25"	—	27 / crate
Rubber goods		——	94	2,540 / cu. yard
Rutabagas		bushel	—	56 / bushel
Rye		bushel	—	56 / bushel
Salt, rock,	Solid	——	136	3,670 / cu. yard
	Coarse	——	45	1,215 / cu. yard
	Fine	——	50	1,350 / cu. yard
	Barrel (average)	——	—	280 / barrel
Sand, fine,	Dry	——	110	2,970 / cu. yard
	Wet	——	125	3,375 / cu. yard
Sand, coarse,	Dry	——	95	2,565 / cu. yard
	Wet	——	120	3,240 / cu. yard
Sand,	Mixed	——	115	3,100 / cu. yard
Sandstone,	Solid	——	147	3,970 / cu. yard
	Crushed	——	86	2,325 / cu. yard
Shale,	Solid	——	172	4,645 / cu. yard
	Crushed	——	92	2,485 / cu. yard
Sheep,	Live (average)	per head	—	125-150 / head
Shingles,	Bundle	Pkg. in bndls. of 200-250 Size (avg.) 24" x 20" x 10"	—	50 / bundle
Snow,	Moist-packed	——	50	1,350 / cu. yard

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Product		Size of Container	Lbs. Per Cu. Ft.	No. of Lbs. / Per
Soft drinks,	Half depth bottle box 24-6 to 8 oz. bottles	12.25" x 18.75" x 8.5"	—	39 / box
	Full depth bottle box 12-24 to 32 oz. bottles	13.38" x 18.5" x 12.25"	—	60 / box
Sorghum syrup		——	86	11.5 / gallon
Soybeans		bushel	—	60 / bushel
Soybean oil		——	58	7.7 / gallon
Spinach,	Hamper	bushel	—	20 / bushel
	Basket	bushel	—	27 / bushel
Spruce*		——	28	2,330 / M. Bd. ft.
Squash		bushel	—	46 / bushel
Starch		——	96	2,590 / cu. yard
Stone,	Crushed, (average)	——	100	2,700 / cu. yard
	Rip-rap	——	65	1,755 / cu. yard
Straw,	Bale	17" x 22" x 42"	—	110 / bale
	Bale	26" x 30" x 46"	—	180 / bale
Street sweepings		——	32	865 / cu. yard
Sugar		——	100	2,700 / cu. yard
Sugar,	Bag	(100 lbs. net)	—	101 / bag
	Barrel (22 lbs. empty)	19.13" head, 30" stave	—	345 / barrel
	Case	24 – 5-lb. cartons	—	135 / case
	Case	60 – 2-lb. cartons	—	135 / case
Sugar cane syrup		——	85	11.3 / gallon
Sulphur		——	125	3,375 / cu. yard
Sulfuric acid,	87%	——	112	15 / gallon
Sweet corn,	Basket	bushel	—	45 / bushel
	Crate	13" x 13" x 24"	—	60 / crate
Sycamore*		——	37	3,080 / M. Bd. ft.
Tallow		——	60	1,620 / cu. yard

Product		Size of Container	Lbs. Per Cu. Ft.	No. of Lbs. / Per
Tanks, Acetylene,	102 cu. foot	empty	—	70 / tank
		filled	—	75 / tank
	310 cu. foot	empty	—	200 / tank
		filled	—	220 / tank
Tanks, Oxygen,	150 cu. foot	empty	—	80 / tank
		filled	—	92 / tank
	300 cu. foot	empty	—	133 / tank
		filled	—	153 / tank
Tar		——	65	1755 / cu. yard
Tile,	Solid	——	115	3,100 / cu. yard
	Partition (construction)	——	40	1,080 / cu. yard
Tomatoes,	Basket	bushel	—	55 / bushel
	Lug box	7.25" x 14" x 17.5"	—	35 / box
	Crate	10.5" x 11.25" x 24"	—	48 / crate
	Basket	8.5" x 8.75" x 20"	—	18 / basket
	Basket (paper)	4.25" x 8.5" x 16.25"	—	9 / basket
	Basket (wood)	5.5" x 7.25" x 16.5"	—	10 / basket
Turpentine		——	54	7.2 / gallon
Turnips,	Basket	bushel	—	54 / bushel
Vetch seed		bushel	—	60 / bushel
Vinegar		——	64	8.5 / gallon
Walnuts,	Bulk	bushel	—	50 / bushel
	Bag	2 bushel	—	100 / bag
Water,	Fresh	——	63	8.4 / gallon
Wheat,	Bulk	bushel	—	60 / bushel
	Bag	1.5 bushel	—	90 / bag
Wool,	Pressed	——	82	2,215 / cu. yard

*Kiln dried lumber averages 10% to 15% lighter, and green lumber 40% to 50% heavier, than air dried.

VEHICLE SPECIFICATIONS INDEX

NPR, NPR HD/W3500, W4500 GAS

Specifications

Model	NPR/W3500 Gas	NPR HD/W4500 Gas
GVWR	12,000 lbs.	14,050 lbs.
WB	109 in., 132.5 in., 150 in., 176 in.	
Engine	GMPT 8-cylinder, V Block 4-cycle, OHV, water-cooled, Sequential Port Fuel Injection	
Model/Displacement	GMPT-V8/350 CID (5.7 liters)	
HP (Gross)	250 HP @ 4,200 RPM	
Torque (Gross)	330 lbs.-ft. torque @ 2,800 RPM	
Equipment	Sequential Port Fuel Injection (SFI), mass air flow meter, powertrain control module (VCM), onboard diagnostics, oxygen sensors, catalytic convertor, map sensor, with external oil cooler.	
Transmission	4L80-E Hydra-Matic 4-speed automatic w/lock-up converter & overdrive	4L30-E Hydra-Matic 4-speed automatic w/lock-up converter & overdrive
Steering	Integral power steering 20.9:1 ratio. Tilt and telescoping steering column.	
Front Axle	Reverse Elliot "I" Beam rated at 6,380 lbs.	
Suspension	Semi-elliptical steel alloy leaf springs with stabilizer bar and shock absorbers.	
GAWR	4,700 lbs.	5,360 lbs.
Rear Axle	Full-floating single speed with hypoid gearing rated at 11,020 lbs.	
Suspension	Semi-elliptical steel alloy leaf springs and shock absorbers.	
GAWR	7,950 lbs.	9,880 lbs.
Wheels	16 x 6.0 6-hole disc wheels, painted white.	19.5 x 6.0 6-hole disc wheels, painted white.
Tires	215/85R 16-E (10 ply) tubeless steel-belted radials, all-season tread front and rear.	225/70R-19.5F (12 ply) tubeless steel-belted radials, premium highway tread front and rear.
Brakes	Dual-circuit, vacuum-assisted hydraulic service brakes with load sensing proportioning valve in rear brake circuit and a metering valve between the master cylinder and 6-way joint on the front brake lines. Disc front and self-adjusting outboard mounted drum rear. The parking brake is a mechanical, cable-actuated, internal expanding drum type, transmission mounted. Antilock brake system.	
Fuel Tank	30-gallon rectangular steel fuel tank. Mounted between the frame rails with electric type fuel pump (mounted in tank) through the rail fuel fill.	

NOTE: These selected specifications are subject to change without notice.

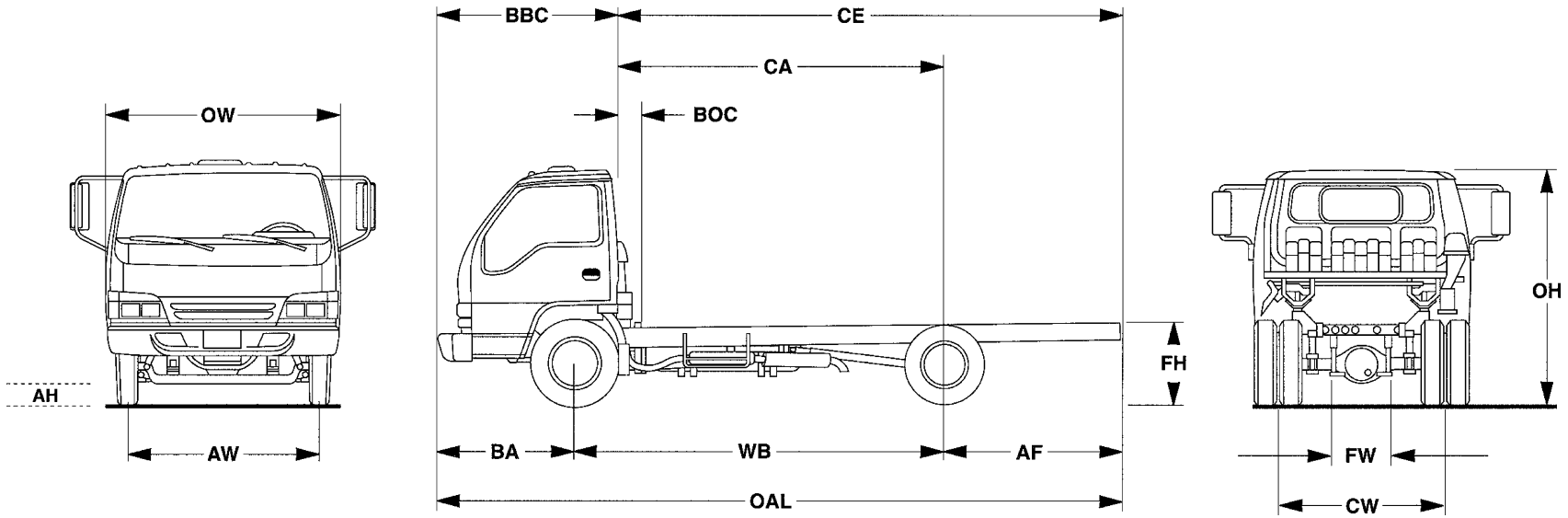
(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas – continued on next page)

(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas – continued from previous page)

Model	NPR/W3500 Gas	NPR HD/W4500 Gas
Frame	Ladder type channel section straight frame rail 33.5 in. wide through the total length of the frame. Yield strength 44,000 psi section modulus 7.20 $in.^3$, RBM 316,800 lbs.-ft./in. per rail.	
Cab	All-steel, low cab forward, BBC 68.0 in., 45° mechanical tilt with torsion assist.	
Equipment	Jersey knit covered high back driver's seat with two-occupant passenger seat. Two-way roof ventilator, dual cab mounted exterior mirrors. Tilt and telescoping steering column. Tinted glass.	
Electrical	12-volt, negative ground, Delco maintenance-free battery (located under cab), 600 CCA each, 80-amp alternator with integral regulator.	
Options	Air conditioning; AM/FM cassette stereo radio; spare wheel; 6" stainless steel mirrors. Power windows and door locks.	

NOTE: These selected specifications are subject to change without notice.

Vehicle Weights, Dimensions and Ratings



(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas – continued on next page)

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Variable Chassis Dimensions					
Unit	**WB**	**CA***	**CE***	**OAL**	**AF**
Inch	109.0	88.4	131.5	199.5	43.1
Inch	132.5	111.9	155.0	223.0	43.1
Inch	150.0	129.4	172.5	240.5	43.1
Inch	176.0	155.4	198.5	266.3	43.1

* Effective CA & CE are CA or CE less BOC.

Dimension Constraints 11,050 GVW					
Code	**Inches**	**Code**	**Inches**	**Code**	**Inches**
AH	7.9	BW	83.3	FH	32.0*
AW	65.6	CW	65.0		
BA	47.4	FW	33.5		
BBC	68.0	OH	87.4		
BOC	9.25	OW	78.5		

* 32.8 for 14,050 GVWR

12,000-lb. GVWR with 4L80-E Hydra-Matic Transmission Model Federal Chassis Cab and Maximum Payload Weights						
Model	**WB**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
BB1	109.0 in.	lb.	3,160	1,799	4,959	7,041
BB2	132.5 in.	lb.	3,204	1,821	5,025	6,975
BB3	150.0 in.	lb.	3,226	1,843	5,069	6,931
BB4	176.0 in.	lb.	3,270	1,865	5,135	6,865

(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas – continued on next page)

(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas – continued from previous page)

12,000-lb. GVWR with 4L80-E Hydra-Matic Transmission Model California Chassis Cab and Maximum Payload Weights						
Model	**WB**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
AB1	109.0 in.	lb.	3,160	1,799	4,959	7,041
AB2	132.5 in.	lb.	3,204	1,821	5,025	6,975
AB3	150.0 in.	lb.	3,226	1,843	5,069	6,931
AB4	176.0 in.	lb.	3,270	1,865	5,135	6,865

Dimension Constraints 14,050 GVW					
Code	**Inches**	**Code**	**Inches**	**Code**	**Inches**
AH	8.6	BW	84.0	FH	32.8
AW	65.6	CW	65.0		
BA	47.4	FW	33.5		
BBC	68.0	OH	88.1		
BOC	9.25	OW	78.5		

14,050-lb. GVWR with 4L30-E Hydra-Matic Transmission Model California/Federal Chassis Cab and Maximum Payload Weights						
Model	**WB**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
CE1	109.0 in.	lb.	3,230	1,874	5,104	8,946
CE2	132.0 in.	lb.	3,274	1,896	5,170	8,880
CE3	150.0 in.	lb.	3,296	1,918	5,214	8,836
CE4	176.0 in.	lb.	3,340	1,940	5,280	8,770

(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas – continued on next page)

(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas – continued from previous page)

Vehicle Weight Limits:

GVWR		
Designed Maximum	11,050 lbs.	14,050 lbs.
GAWR, Front	4,700 lbs.	5,360 lbs.
GAWR, Rear	7,950 lbs.	9,880 lbs.

Technical Notes:

Chassis Curb Weight reflects standard equipment and fuel but no driver or payload.

Maximum Payload Weight is the allowed maximum for equipment, body, payload and driver and is calculated by subtracting chassis curb weight from the GVWR.

(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas – continued on next page)

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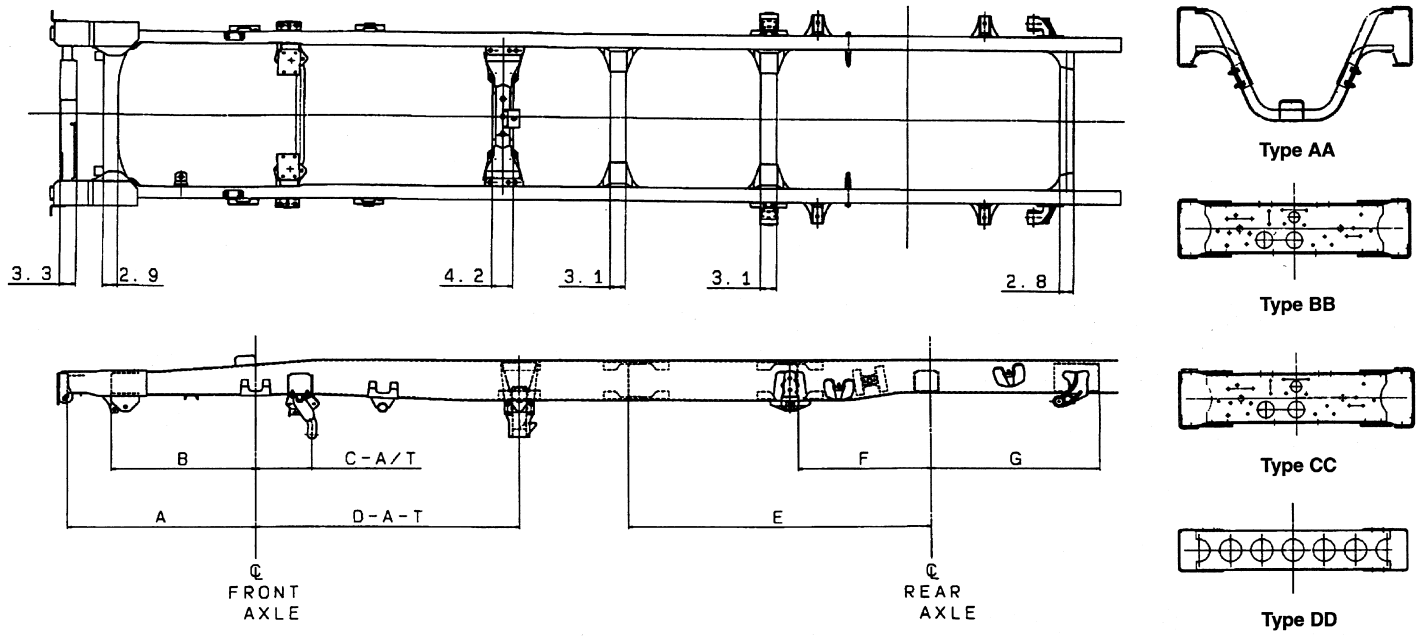
Frame and Crossmember Specifications



Wheelbase	Frame Thick	Crossmember Type/Location						
		A	B	C-A/T	D-A/T	E	F	G
109.0	0.24	37.0	28.3	11.1	AA 52.0	—	CC 26.0	DD 33.0
132.5	0.24	37.0	28.3	11.1	AA 52.0	BB 59.4	CC 26.0	DD 33.0
150.0	0.24	37.0	28.3	11.1	AA 52.0	BB 59.4	CC 26.0	DD 33.0
176.0	0.24	37.0	28.3	11.1	AA 52.0	BB 59.4	CC 26.0	DD 33.0

A/T = Automatic Transmission

(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas – continued on next page)

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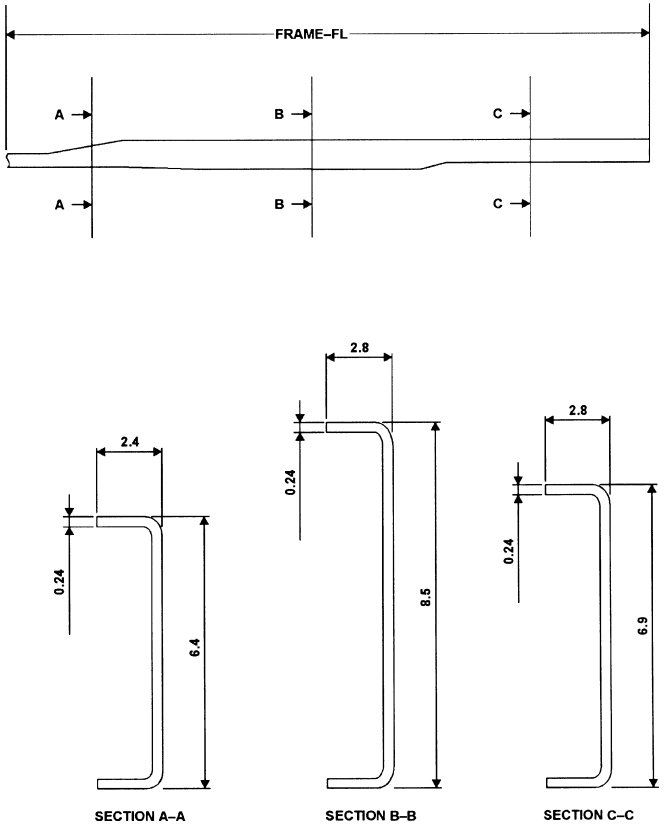
Frame Chart



Wheelbase	Frame FL	Frame Thickness
109.0	186.0	0.24
132.5	209.6	0.24
150.0	227.4	0.24
176.0	253.4	0.24

(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas – continued on next page)

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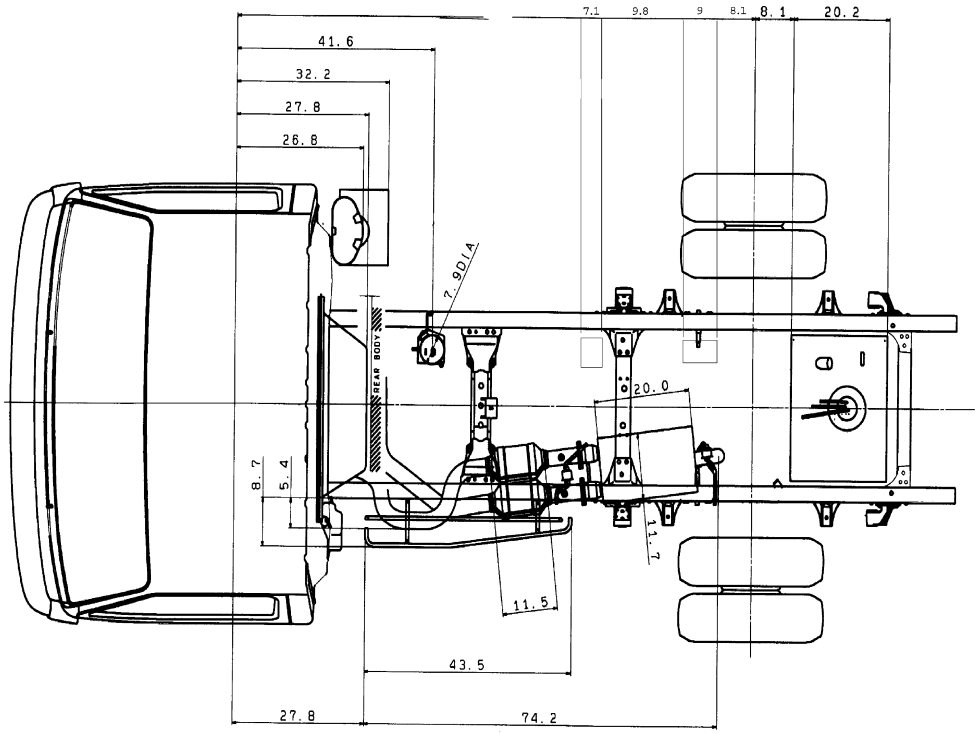
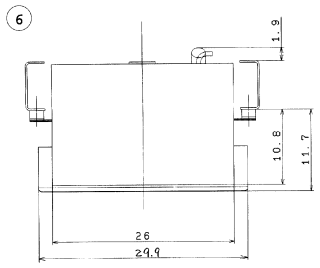
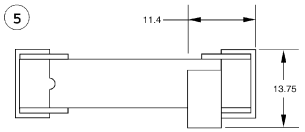
Auxiliary Views



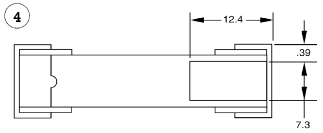
Unit: inch



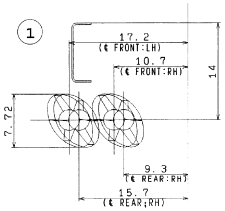
Rear View
In Frame Tank



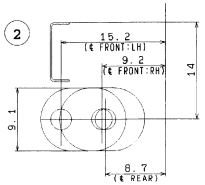
Rear View
Emission Canister



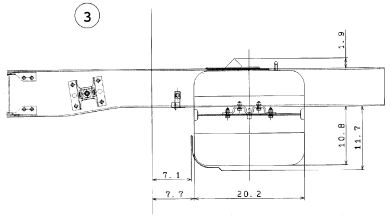
Rear View
ABS Controller



Rear View
Catalytic Converters



Rear View
Muffler



Side View
In Frame Tank

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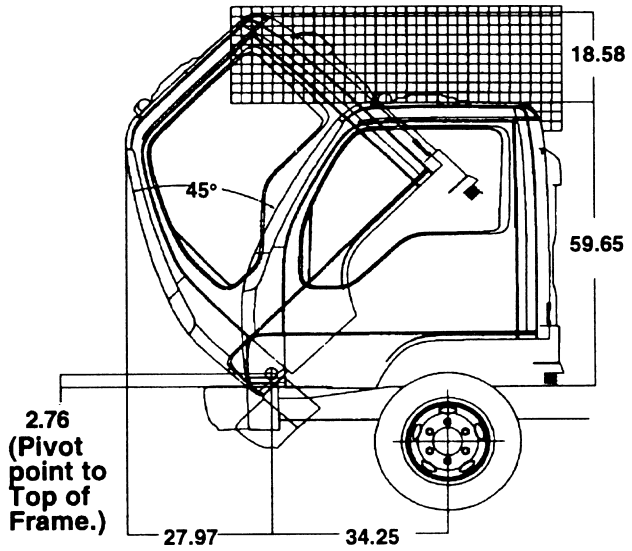
Body Builder Weight Information Chart

GVWR	Axle	Wheelbase				Unsprung Weight
		109 in.	132.5 in.	150 in.	176 in.	
		Auto. Trans.	Auto. Trans.	Auto. Trans.	Auto. Trans.	
12,000	Front	3,153	3,197	3,219	3,263	573
	Rear	1,742	1,764	1,786	1,808	871
	Total	4,895	4,961	5,005	5,071	1,444
14,050	Front	3,230	3,274	3,296	3,340	705
	Rear	1,874	1,896	1,918	1,940	1,134
	Total	5,104	5,170	5,214	5,280	1,839

Cab Tilt



GRID SCALE:
One sqare is 2 in x 2 in

NOTE: Roof vent adds 1.5 inches to overall cab height.

RADIUS FROM PIVOT TO OUTER EXTENT OF CAB:
Radius - 79.02

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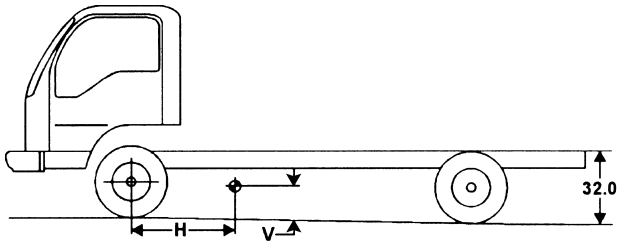
Center of Gravity

The center of gravity of the chassis cab.

GVWR	WB	V	H Auto. Trans.
12,000	109	21.7	38.8
	132.5	20.1	47.1
	150	19.7	53.5
	176	18.1	62.8
14,050	109	21.7	40.0
	132.5	20.0	48.6
	150	19.7	55.2
	176	18.1	64.7



V = Vertical Center of Gravity
H = Horizontal Center of Gravity

The center of gravity of the completed vehicle with a full load should not exceed 54 inches above ground level for the 12,000 lb. GVWR, 58 inches above ground level for the 14,050 lb. GVWR, and must be located horizontally between the centerlines of the front and rear axles.

NOTE: The maximum dimensions for a body installed on the NPR/W3500, W4500 are 96 inches wide (outside) by 90 inches high (inside). Any larger body applications must be approved by GMICT Application Engineering. In the West Coast, call 1-562-699-0500 and, in the East Coast, call 1-770-475-9195, extension 353.

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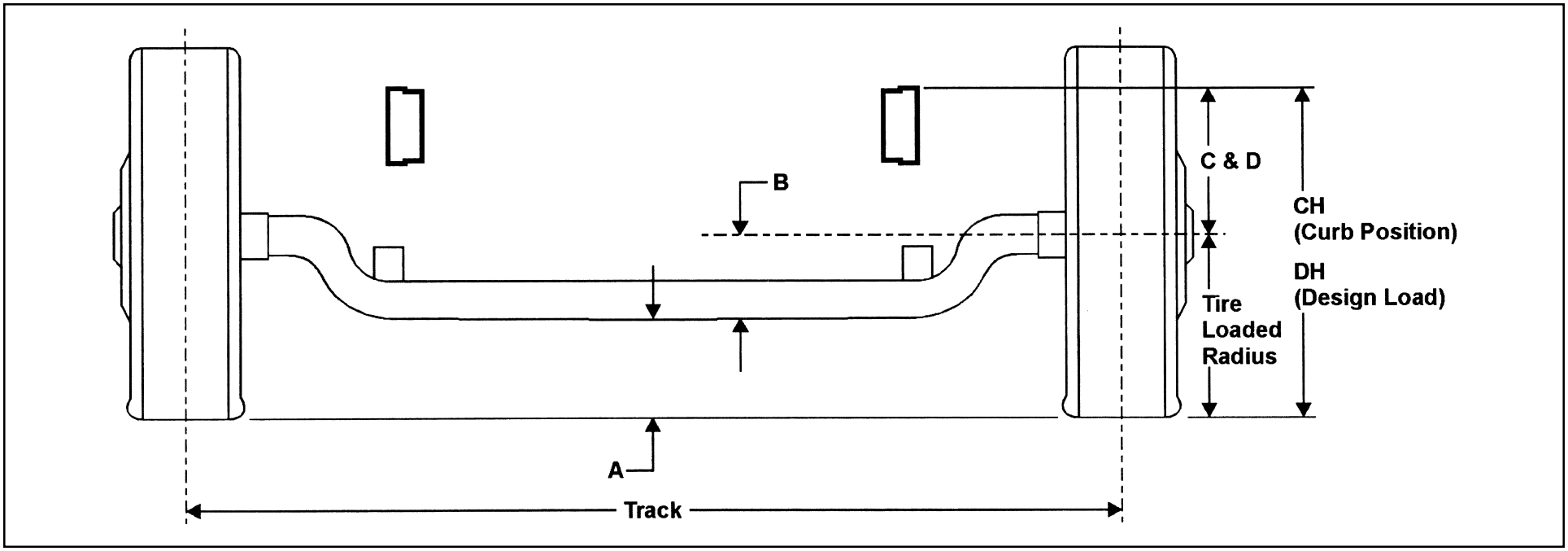
Front Axle Chart



Formulas for calculating height dimensions:

A = Tire Loaded Radius – B
C = Centerline of Axle to Top of Frame Rail at Curb Position
D = Centerline of Axle to Top of Frame Rail at Design Load
CH = C + Tire Unloaded Radius
DH = D + Tire Loaded Radius

Tire	GVWR	GAWR	A	B	C	D	CH	DH	Track	Tire Radius	
										Unload	Load
215/85R 16-E	11,050 lbs.	4,700 lbs.	7.7	6.4	13.0	12.5	27.3	26.6	65.6	15.2	14.1
225/70R 19.5	14,050 lbs.	5,360 lbs.	8.4	7.0	13.6	13.1	29	28.1	65.6	15.4	15

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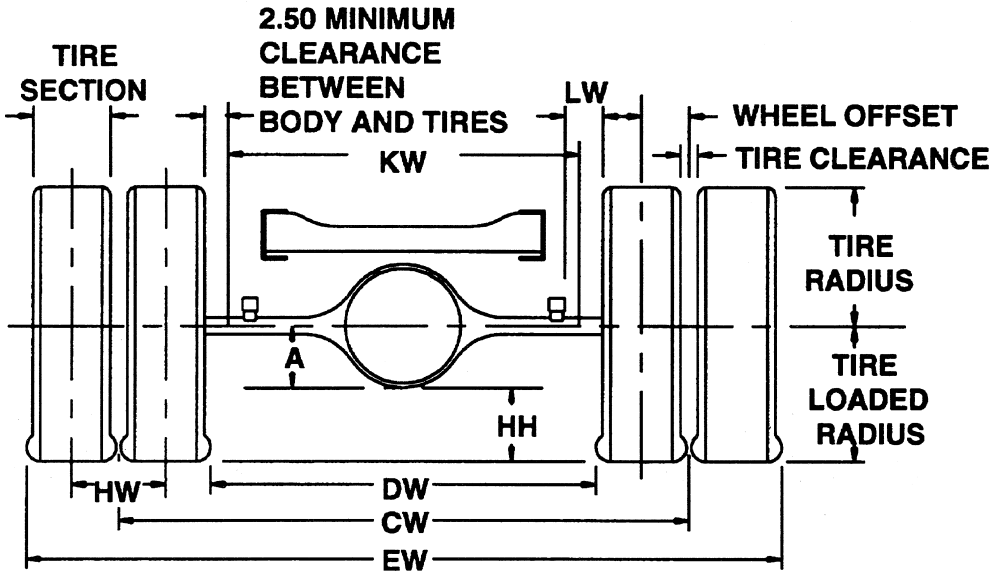
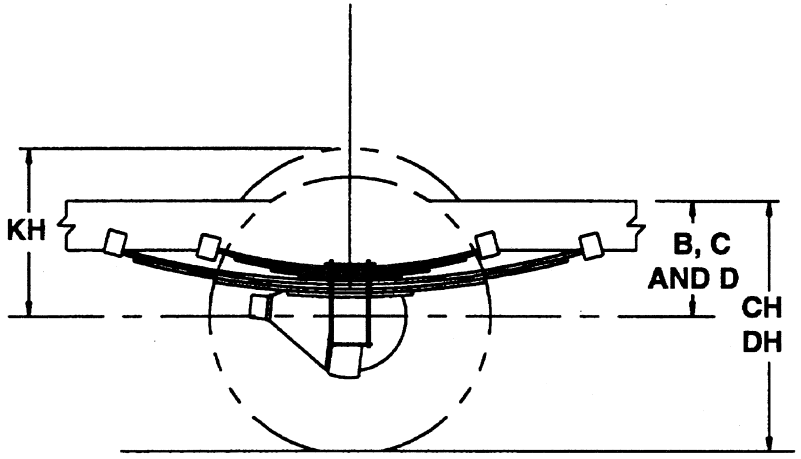
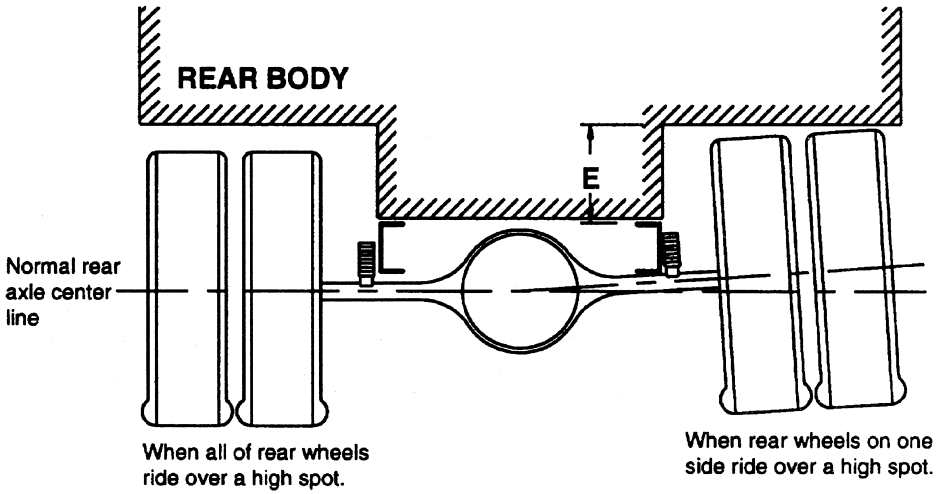
(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas – continued from previous page)

Rear Axle Chart







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Definitions			
A	Centerline of axle to bottom of axle bowl.	DW	Minimum distance between the inner surfaces of the rear tires.
B	Centerline of axle to top of frame rail at metal-to-metal position.	EW	Maximum Rear Width: Overall width of the vehicle measured at the outermost surface of the rear tires.
C	Centerline of axle to top of frame rail at curb position.		
D	Centerline of axle to top of frame rail at design load.	HH	Rear Tire Clearance: Minimum clearance between the rear axle and the ground-line.
E	Rear Tire Clearance: Minimum clearance required for tires and chain measured from the top of the frame at the vertical centerline of the rear axle, when rear wheels on one side ride over a high spot.	HW	Dual Tire Spacing: Distance between the centerlines of the tires in a set of dual tires.
CH	Rear Frame Height: Vertical distance between the normal top of frame rail and the ground-line through the centerline of the rear axle at curb position.	KH	Tire Bounce Clearance: Minimum distance required for tire bounce as measured from the centerline of the rear axle and the top of the rear tire when one wheel rides over a high spot.
DH	Rear Frame Height: Vertical distance between the normal top of frame rail and the ground-line through the centerline of the rear axle at design load.	CW	Track Dual Rear Wheel Vehicles: Distance between the centerlines of the dual wheels measured at the ground-line.
Tire Section, Tire Radius, Tire Loaded Radius, Tire Clearance		See Tire Chart for Values	

Formulas for Calculating Rear Width and Height Dimensions			
CW	= Track	HH	= Tire loaded radius – A
CH	= Tire loaded radius + C	JH	= KH – B
DH	= Tire loaded radius + D	KH	= Tire radius + 3.00 inches
DW	= Track + 2 tire sections – tire clearance	KW	= DW – 5.00 inches
EW	= Track + 2 tire sections + tire clearance	LW	= 1.00-inch minimum clearance between tires and springs

NOTE: Track and overall width may vary with optional equipment.

Tire	GAWR	Track CW	A	B	C	D	E
215/85R 16-E	7,950/8,760 lbs.	65.0	6.5	10.6	14.9	13.3	7.8
225/70R 19.5	9,880 lbs.	65.0	11.6	10.6	14.9	13.0	8.4

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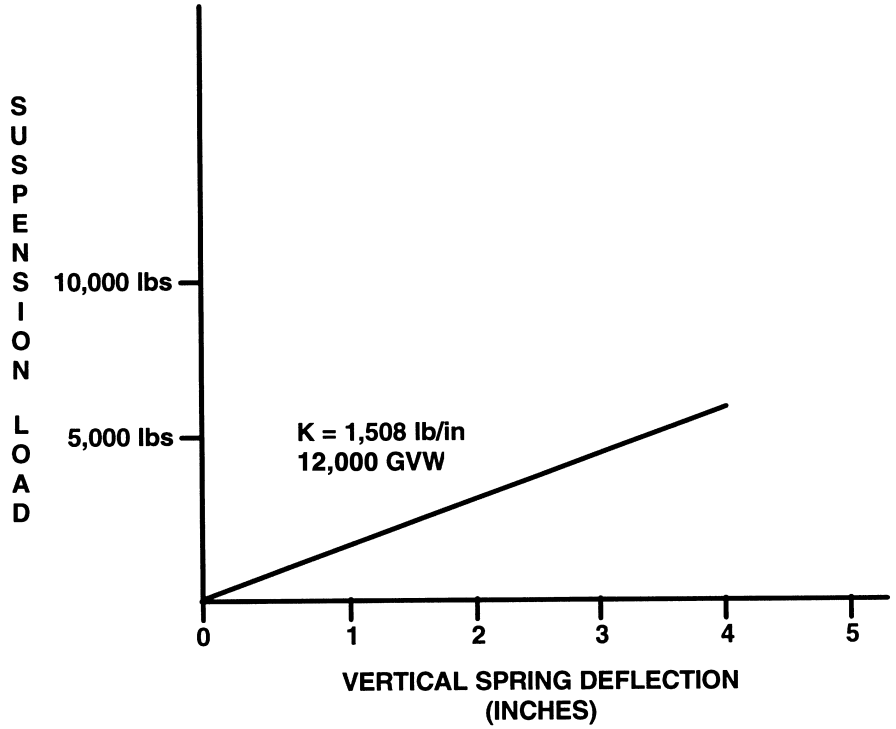
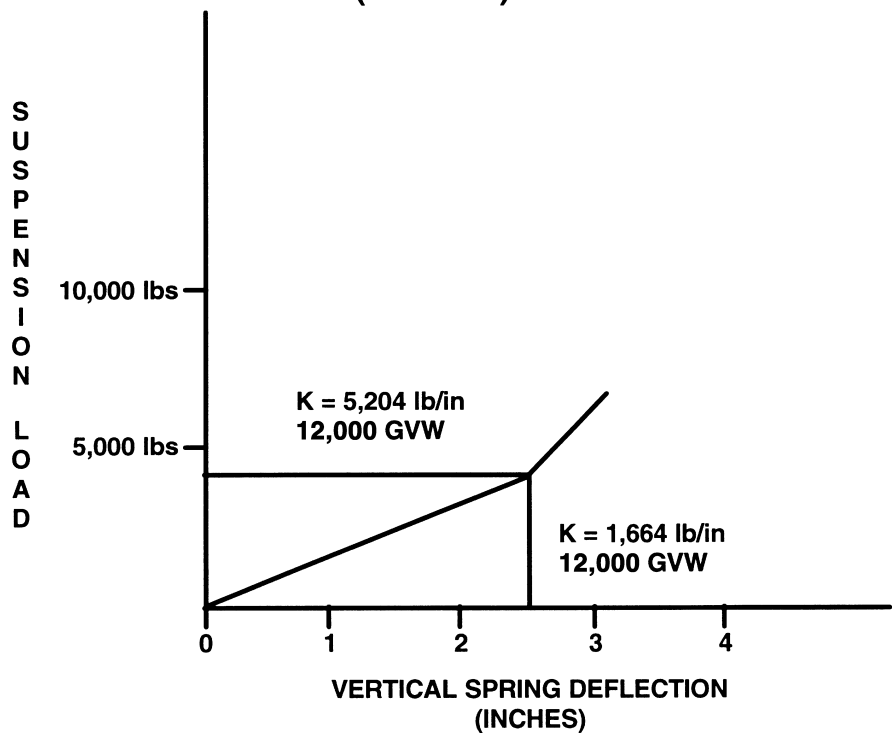
Suspension Deflection Charts – NPR/W3500 Gas

Front Leaf Spring Load vs. Deflection (Per Axle)



Rear Leaf Spring Load vs. Deflection (Per Axle)



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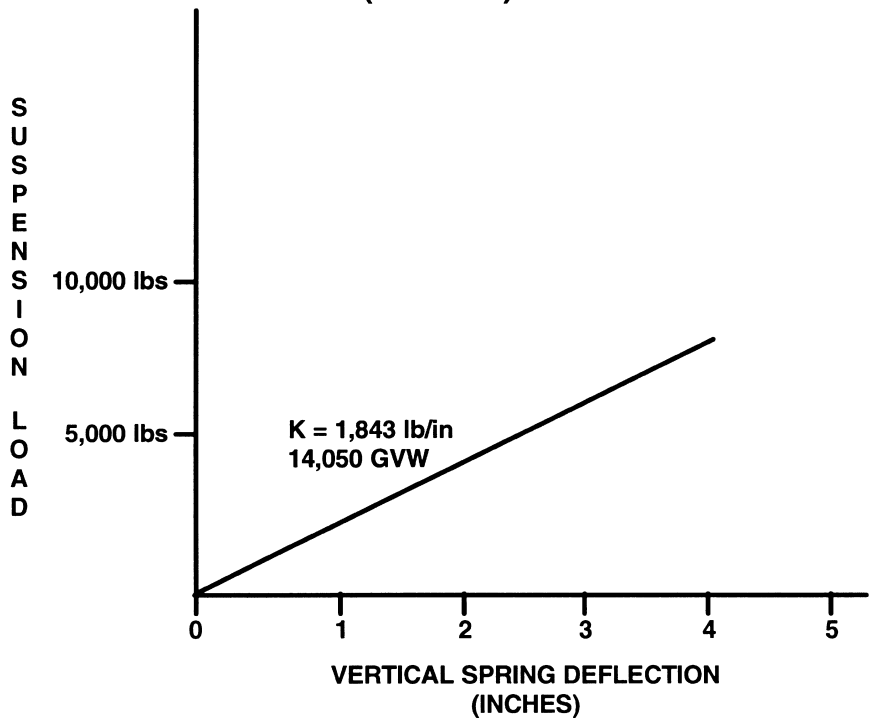
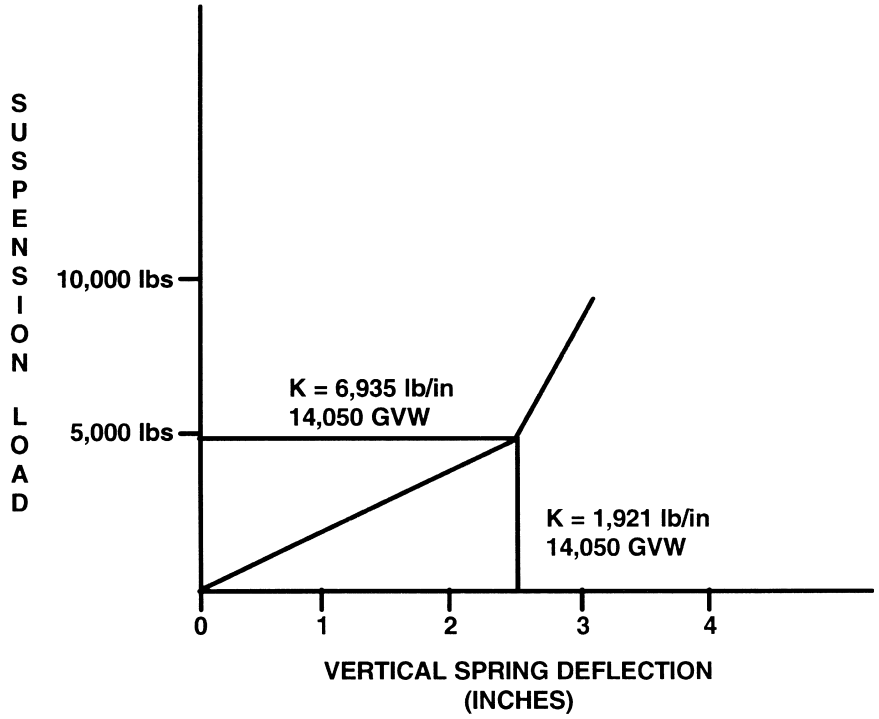
Suspension Deflection Charts – NPR HD/W4500 Gas

Front Leaf Spring Load vs. Deflection (Per Axle)



Rear Leaf Spring Load vs. Deflection (Per Axle)



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Tire and Disc Wheel Chart

Tire

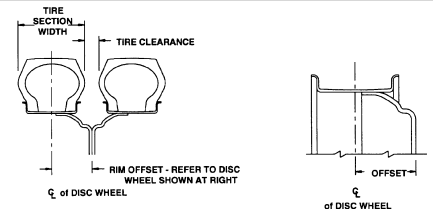
Tire Size	Tire Load Limit and Cold Inflation Pressures				Maximum Tire Load Limits		GVWR (Lb.)
	Single		Dual		Front	Rear	
	Lb.	PSI	Lb.	PSI	2 Single	4 Dual	
215/85R 16-E	2,430	70	2,210	70	4,860	8,840	12,000
225/70R 19.5	3,315	85	3,115	85	6,630	12,460	14,050

Tire Size	GVWR (Lb.)	Tire Radius				Tire Section Width	Tire Clearance	Design Rim Width
		Loaded		Unloaded				
		Front	Rear	Front	Rear			
215/85R 16-E	12,000	14.05	14.05	15.21	15.21	8.54	1.46	6.0
225/70R 19.5	14,050	15.00	15.20	15.40	15.80	8.8	1.2	6.0

Disc Wheel

Wheel Size	Bolt Holes	Bolt Circle Dia.	Ft./Rr. Nut Size*	Rear Stud Size*	Nut/Stud Torque Specs.	Inner Circle	Outside Offset	Disc Thickness	Rim Type	Material Mfg.
16 x 6.00K	6 JIS	8.75	1.6142 (41 mm) BUD HEX	0.8268 (21 mm) SQUARE	289 ft.-lb. (392 N•m)	6.46	5.0	0.35	5° DC	Steel TOPY
19.5 x 6.00	6 JIS	8.75	1.6142 (41 mm) BUD HEX	0.8268 (21 mm) SQUARE	325 ft.-lb. (440 N•m)	6.46	5.0	0.35	5° DC	Steel TOPY

* O.D. Wrench Sizes



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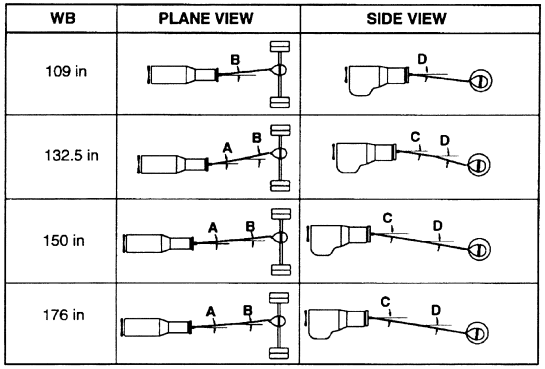
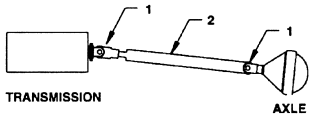
Propeller Shaft

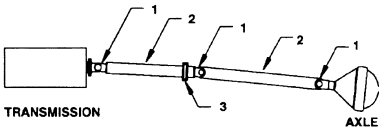


TYPICAL INSTALLATIONS SHOWING YOKES "IN PHASE". "IN PHASE" MEANS THAT THE YOKES AT EITHER END OF A GIVEN PROPELLER SHAFT ASSEMBLY ARE IN THE SAME PLANE.

NPR EFI
(109 in WB)



(132.5 in, 150 and 176 in WB)



1. UNIVERSAL JOINT
2. PROPELLER SHAFT
3. CENTER CARRIER BEARING

Wheelbase	Plane View		Side View	
	A Auto. Trans.	B Auto. Trans.	C Auto. Trans.	D Auto. Trans.
109 in.	—	3.5°	—	6.4°
132.5 in.	2.1°	0°	1.5°	2.4°
150 in.	0°	2.7°	0.7°	5.3°
176 in.	0°	1.8°	4.0°	6.0°

NOTE: All driveline angles are at unloaded condition (curb position with typical cargo body).

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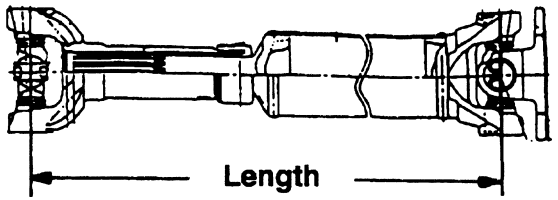
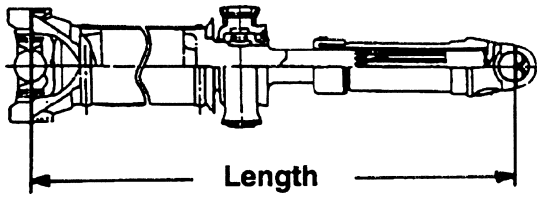
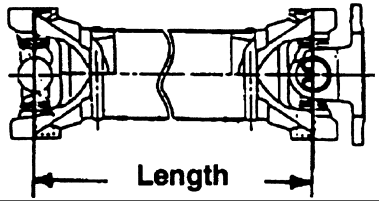
Wheelbase	109	132.5	150	176
No. of Shafts	1	2	2	2
Trans. Type	Automatic Transmission	Automatic Transmission	Automatic Transmission	Automatic Transmission
Shaft #1 O.D.	3.0			
Thickness	0.083			
Length	34.05	24.10	41.85	52.1
Type	A	B	B	B
Shaft #2 O.D.	3.0			3.5
Thickness	0.083			
Length	N/A	33.46	33.46	49.2
Type	N/A	C	C	C

Type	Description	Illustration
Type **A**	1st shaft in 1-piece driveline	
Type **B**	1st shaft in 2-piece driveline	
Type **C**	2nd shaft in 2-piece driveline	

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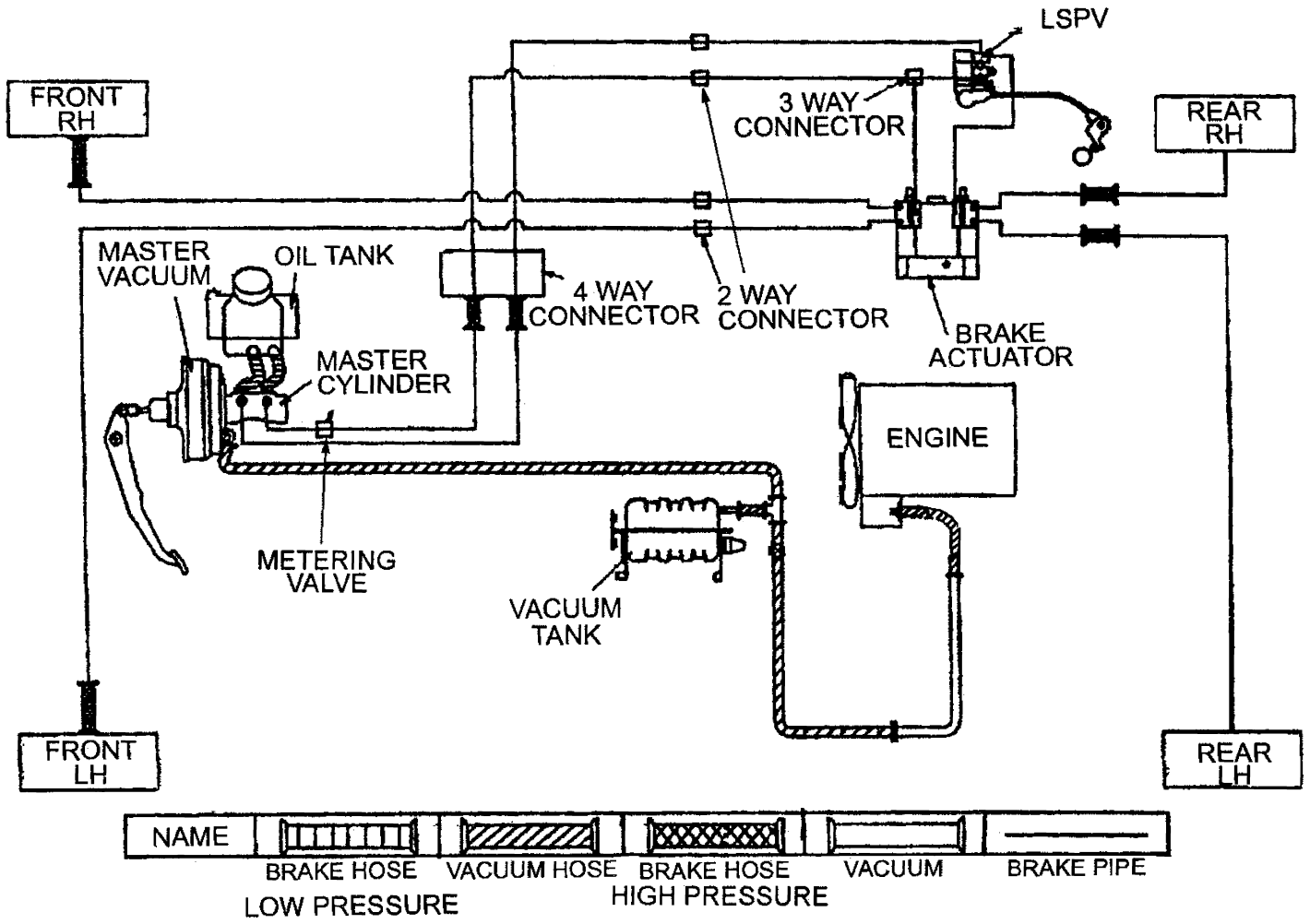
Brake System Schematic, 12,000 GVW

Vacuum Over Hydraulic

Please refer to Introduction Section of book for antilock system cautions and wheelbase modification requirements.



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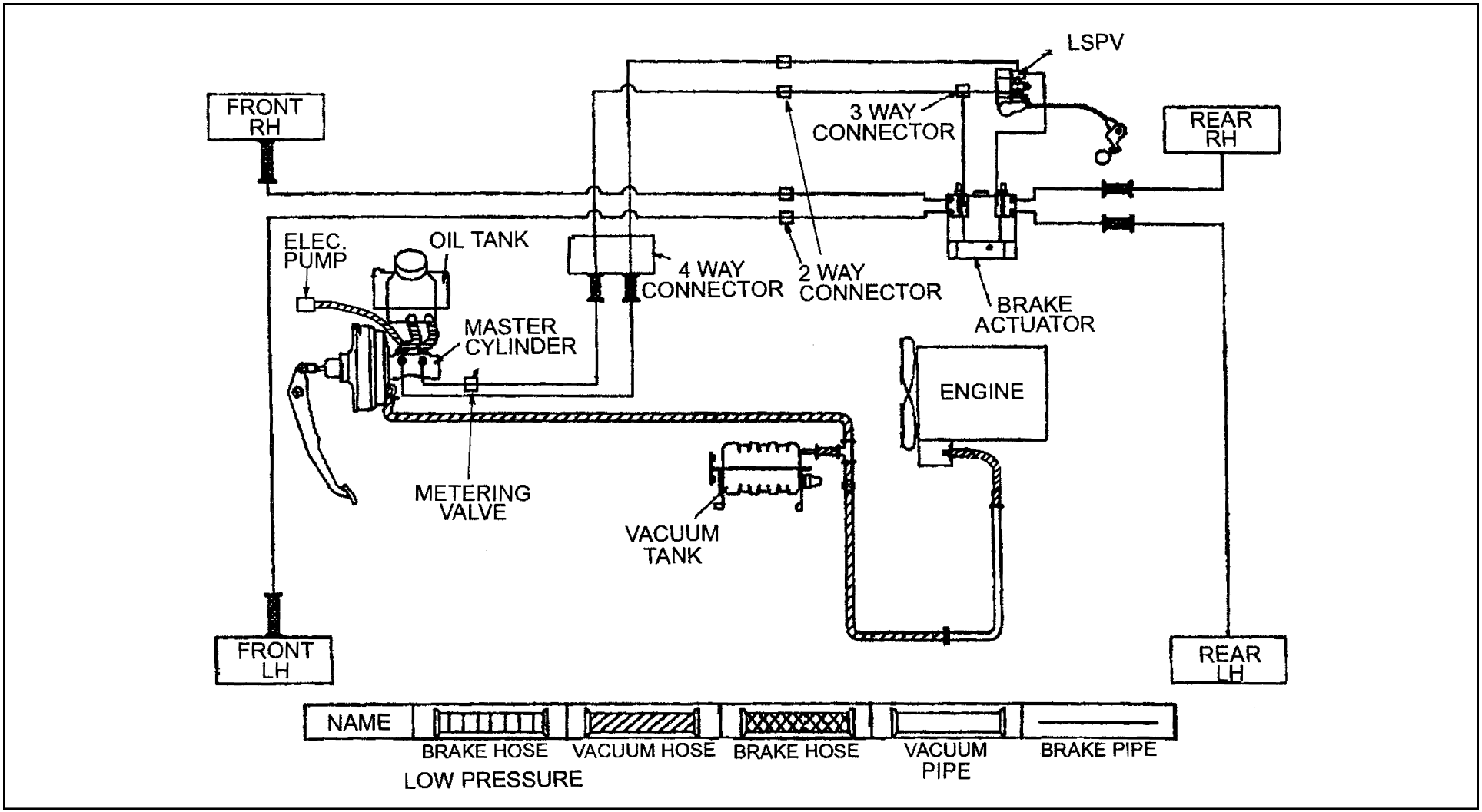
Brake System Schematic, 14,050 GVW

Vacuum Over Hydraulic

Please refer to Introduction Section of book for antilock system cautions and wheelbase modification requirements.



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Through the Rail Fuel Fill

Installation Instructions

1. Disconnect battery.
2. Loosen hose from the tie downs.
3. Remove shipping plate from chassis.
4. Extend hose out from the driver's side of the rail to body rail.
5. The filler neck must be mounted to allow the fill plate bracket to be parallel to the frame horizontal (see figure 1).
6. Filler hose is set for 96 inches outside width body.
7. Filler neck (Dimension A) must be between 6.85 inches and 8.5 inches above frame.
8. Secure the filler plate to the bottom of the body and check for leaks.
9. Ensure that fill hose does not sag, creating an area where the fuel could pool in the fill hose.
10. Reconnect battery.

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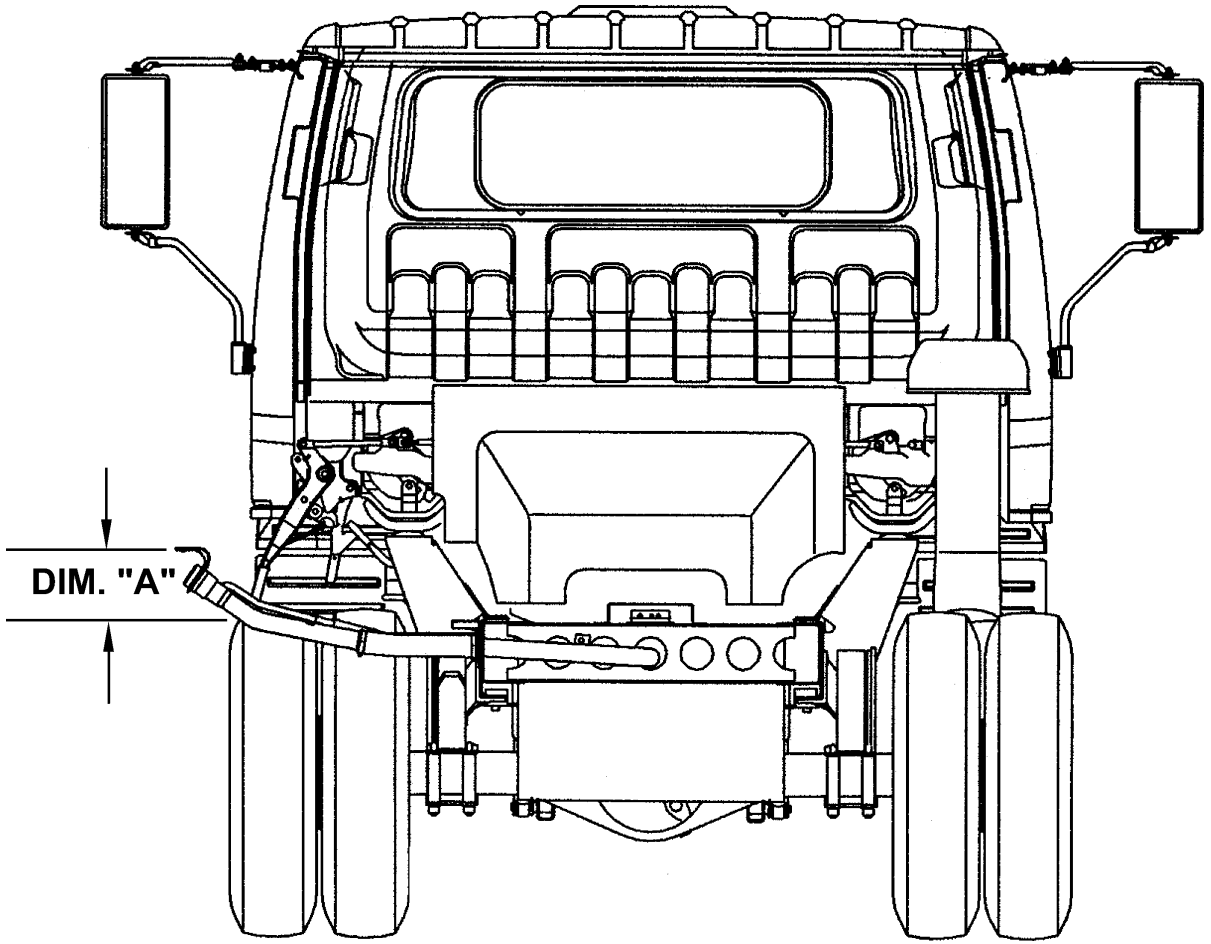
Rear View Fuel Fill



Dimension A = 6.85-8.5 inches (174-216 mm)

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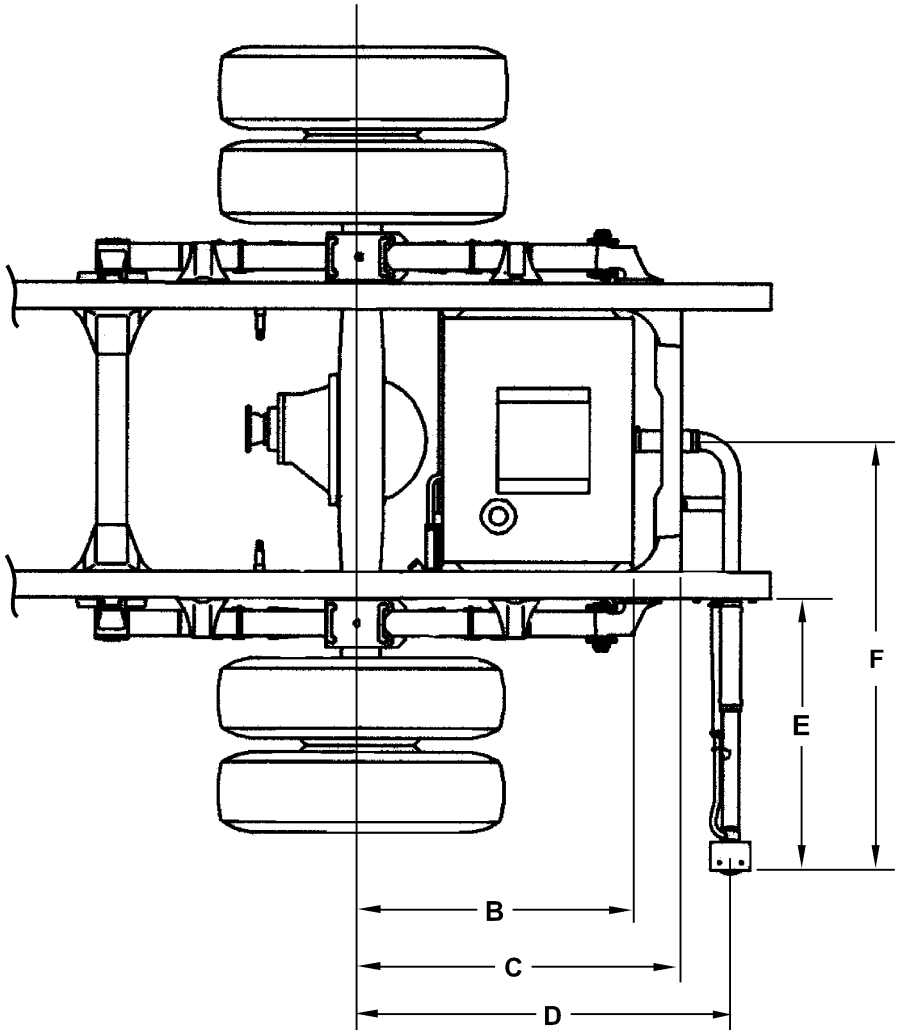
Top View Fuel Fill



Dimensions:
B = 28.85 inches (733 mm)
C = 34.00 inches (863 mm)
D = 39.29 inches (998 mm)
E = 46.61 inches (1,184 mm)
F = 96.00 inches (2,438 mm)

(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas – continued on next page)

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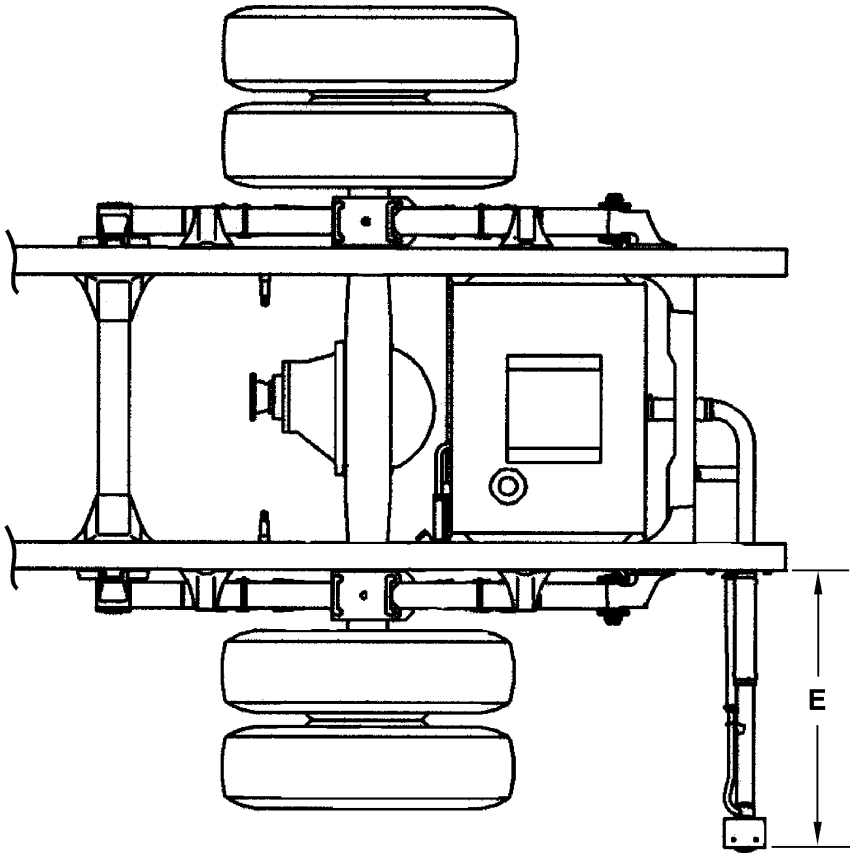
Top View



Body Width Adjustment:
90-inch Body Dim E = 682.8 mm
86-inch Body Dim E = 632.0 mm
80-inch Body Dim E = 555.8 mm

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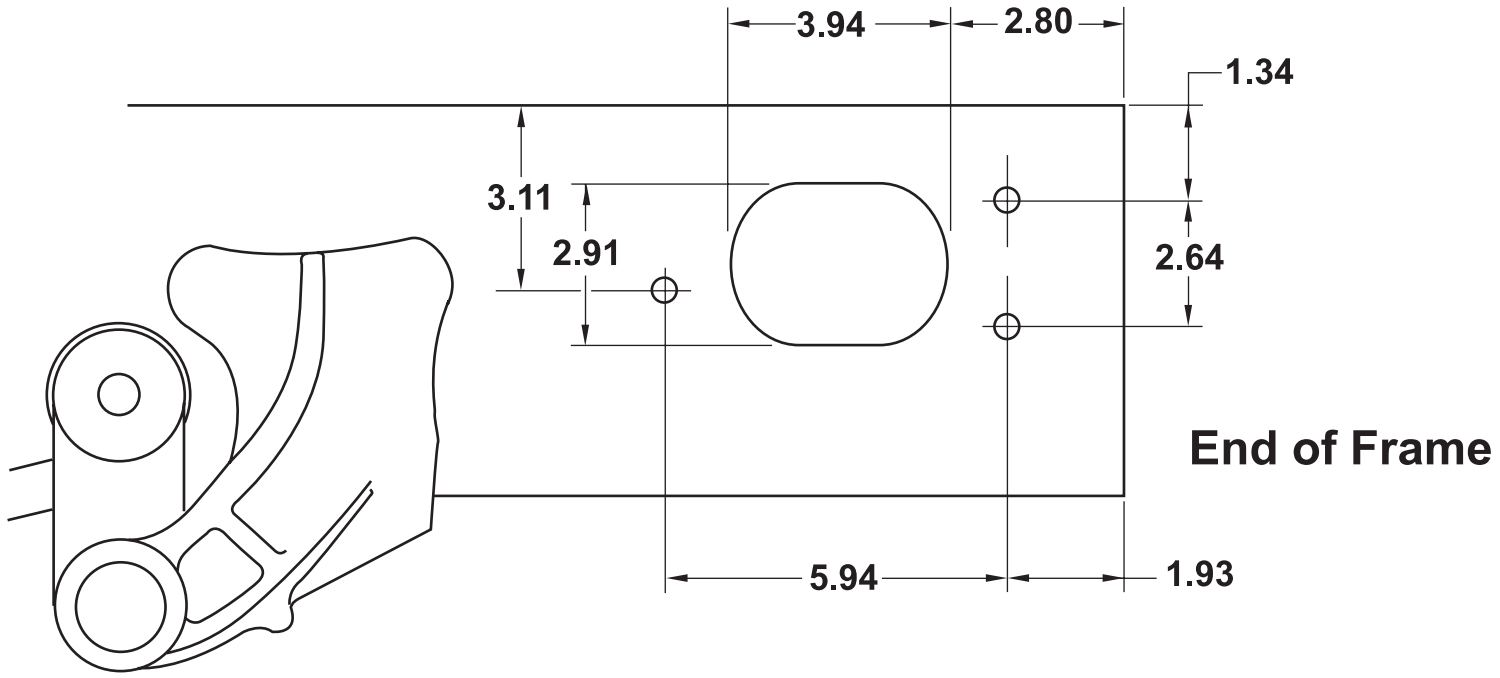
(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas – continued from previous page)

Through the Rail Fuel Fill Frame Hole



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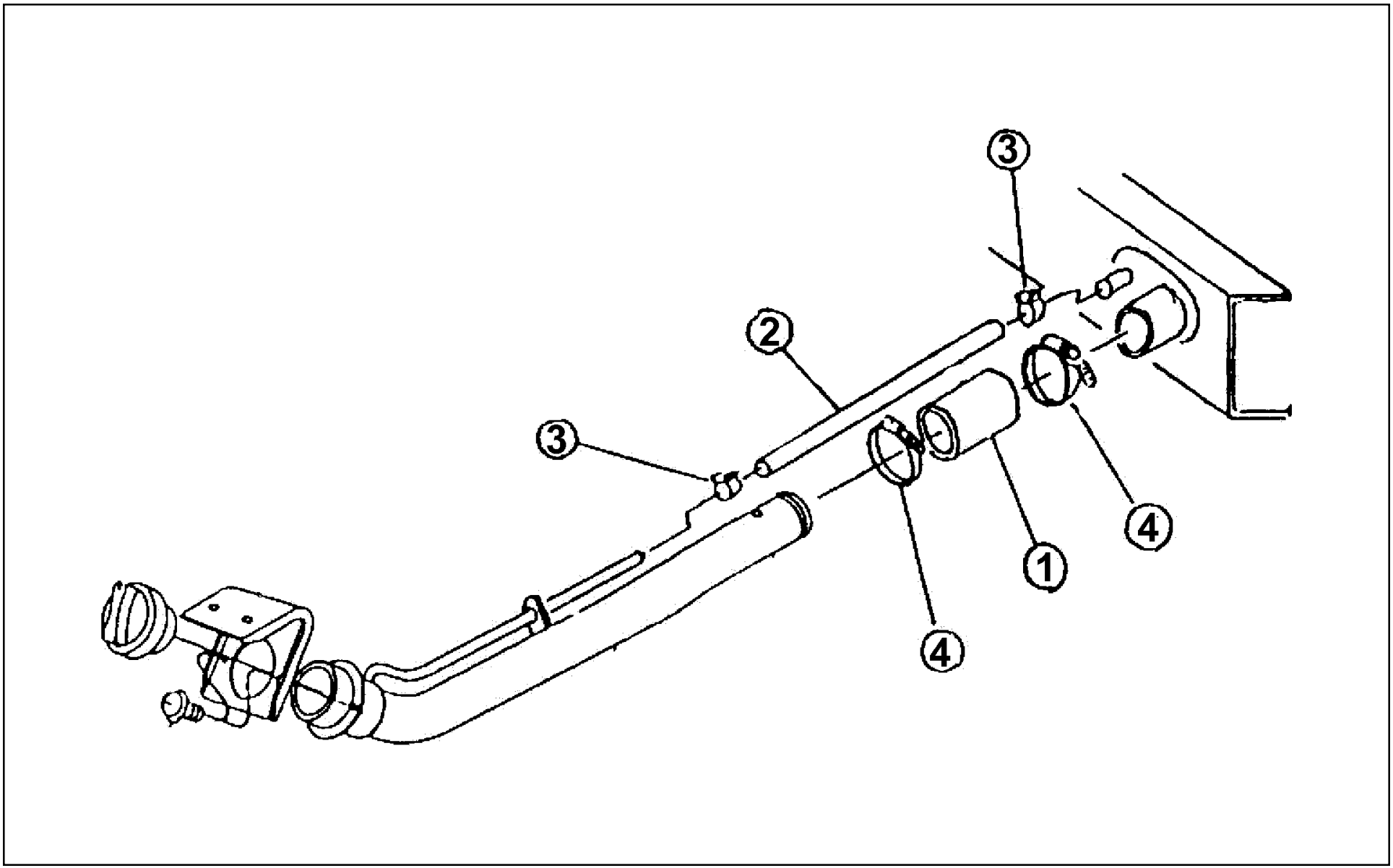
Fuel Fill Parts Illustration



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Fuel Fill Parts List

Number	Description	Part Number – Isuzu	Part Number – GM	Quantity
FEDERAL PARTS				
1	Hose, Fuel Filler	897213-6540	897213-6540	1
2	Hose, Breather	897214-2710	897214-2710	1
3	Clip, Rubber Hose	897177-5810	897177-5810	2
4	Clip, Filler Hose	802465-8140	802465-8140	2
CALIFORNIA PARTS				
1	Hose, Fuel Filler	897213-6540	897213-6540	1
2	Hose, Breather	897229-9180	897229-9180	1
3	Clip, Rubber Hose	815699-8250	815699-8250	2
4	Clip, Filler Hose	802465-8140	802465-8140	2

NPR, NPR HD/W3500, W4500 Diesel

Specifications

Model	NPR/W3500 Diesel	NPR HD/W4500 Diesel
GVWR	12,000 lbs.	14,500 lbs.
WB	109 in., 132.5 in., 150 in., 176 in.	
Engine	Isuzu 4-cylinder, in-line 4-cycle, turbocharged, intercooled, direct injection diesel	
Model/Displacement	4HE1-TC/290 CID (4.75 liters)	
HP (Gross)	142 HP @ 2,800 RPM (Manual Transmission)	175 HP @ 2,700 RPM (Automatic Transmission)
Torque (Gross)	275 lbs.-ft. torque @ 1,300 RPM	347 lbs.-ft. torque @ 2,000 RPM
Equipment	Dry element air cleaner with vertical intake; 2 rows 506 $in.^2$ radiator; 6-blade 18.7 in. diameter fan with viscous drive. Cold weather starting device and an oil cooler.	
Clutch	Single, dry plate, 11.8 in. dia., actuated by self-adjusting hydraulic master/slave cylinder.	
Transmission	MXA5C 5-speed manual, all forward gears synchronized. Fifth gear is direct. Available Optional Transmission: Aisin 450-43 LE 4-speed overdrive automatic transmission with lock-up capability in 2nd, 3rd and 4th and PTO capability.	
Steering	Integral power steering 20.9:1 ratio. Tilt and telescoping steering column.	
Front Axle	Reverse Elliot "I" Beam rated at 6,380 lbs.	
Suspension	Semi-elliptical steel alloy leaf springs and shock absorbers.	
GAWR	4,700 lbs.	5,360 lbs.
Rear Axle	Full-floating single speed with hypoid gearing rated at 11,020 lbs.	
Suspension	Semi-elliptical steel alloy leaf springs and shock absorbers.	
GAWR	7,950 lbs.	9,880 lbs.
Wheels	16 x 6.0 6-hole disc wheels, painted white.	
Tires	215/85R 16-E (10 ply) tubeless steel-belted radials, all-season front and rear.	
Brakes	Dual-circuit, vacuum-assisted hydraulic service brakes with load-sensing proportioning valve in rear brake circuit and a metering valve between the master cylinder and 6-way joint on the front brake lines. Disc front and self-adjusting outboard mounted drum rear. The parking brake is a mechanical, cable-actuated, internal expanding drum type, transmission mounted. The exhaust brake is standard and is vacuum-operated. Antilock brake system.	
Fuel Tank	30-gallon rectangular steel fuel tank mounted in frame rail behind rear axle. Fuel/water separator mounted on rail.	

NOTE: These selected specifications are subject to change without notice.

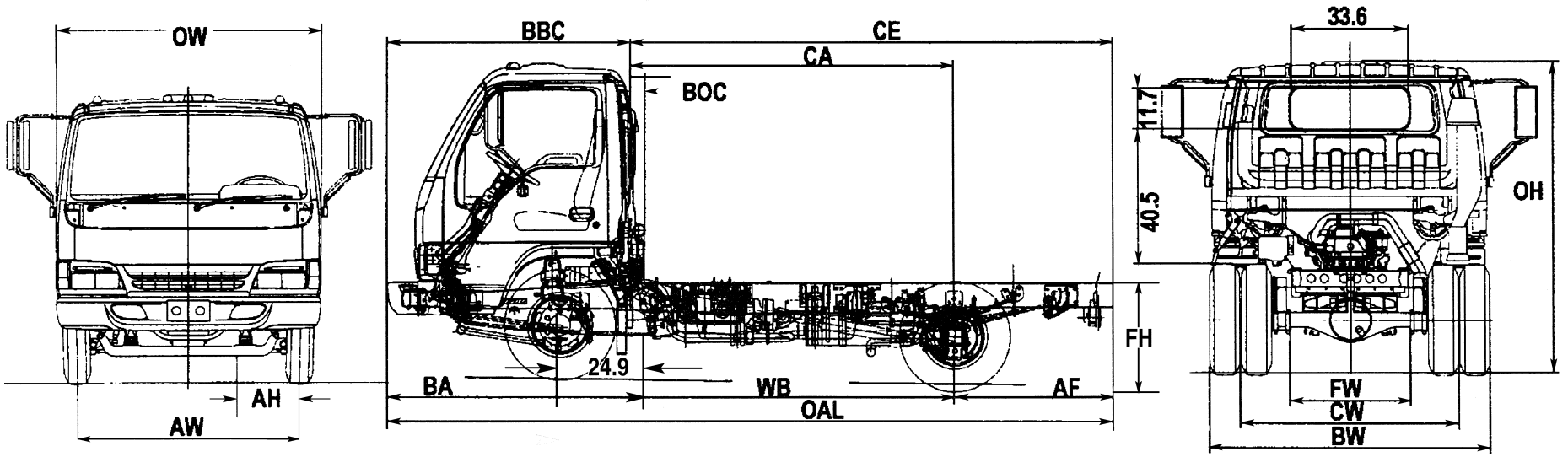
(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Diesel – continued on next page)

(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Diesel – continued from previous page)

Model	NPR/W3500 Diesel	NPR HD/W4500 Diesel
Frame	Ladder type channel section straight frame rail 33.5 in. wide through the total length of the frame. Yield strength 44,000 psi section modulus 7.20 in.^{3}, RBM 316,800 lbs.-ft./in. per rail.	
Cab	All-steel, low cab forward, BBC 68.0 in., 45° mechanical tilt with torsion assist.	
Equipment	Jersey knit covered high back driver's seat with two-occupant passenger seat. Two-way roof ventilator, dual cab mounted exterior mirrors. Tilt and telescoping steering column. Tinted glass.	
Electrical	12-volt, negative ground, dual Delco maintenance free batteries, 750 CCA each, 80-amp alternator with integral regulator.	
Options	Air conditioning; AM/FM cassette stereo radio; PTO; engine block heater; engine oil pan heater; fuel tank mounted on right hand rail (33 gallon); spare wheel; 6" stainless steel convex mirrors. Power windows and door locks.	

NOTE: These selected specifications are subject to change without notice.

Vehicle Weights, Dimensions and Ratings



(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Diesel – continued on next page)

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Variable Chassis Dimensions					
Unit	**WB**	**CA***	**CE***	**OAL**	**AF**
Inch	109.0	88.4	131.5	199.5	43.1
Inch	132.5	111.9	155.0	223.0	43.1
Inch	150.0	129.4	172.5	240.5	43.1
Inch	176.0	155.4	198.5	266.3	43.1

* Effective CA & CE are CA or CE less BOC.

Dimension Constants					
Code	**Inches**	**Code**	**Inches**	**Code**	**Inches**
AH	7.9	BW	83.3	FH	32.0
AW	65.6	CW	65.0		
BA	47.4	FW	33.5		
BBC	68.0	OH	87.4		
BOC	9.25	OW	78.5		

In-Frame Tank 12,000-lb. GVWR Manual Transmission Model Chassis Cab and Maximum Payload Weights						
Model	**WB**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
NA1	109.0 in.	lb.	3,450	1,852	5,302	6,698
NA2	132.5 in.	lb.	3,494	1,874	5,368	6,632
NA3	150.0 in.	lb.	3,538	1,896	5,434	6,566
NA4	176.0 in.	lb.	3,582	1,918	5,500	6,500

(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Diesel – continued on next page)

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In-Frame Tank 14,500-lb. GVWR Manual Transmission Model
Chassis Cab and Maximum Payload Weights

Model	WB	Unit	Front	Rear	Total	Payload
NE1	109.0 in.	lb.	3,461	1,852	5,313	9,187
NE2	132.5 in.	lb.	3,505	1,874	5,379	9,121
NE3	150.0 in.	lb.	3,549	1,896	5,445	9,055
NE4	176.0 in.	lb.	3,593	1,918	5,511	8,989

In-Frame Tank 12,000-lb. GVWR Automatic Transmission Model
Chassis Cab and Maximum Payload Weights

Model	WB	Unit	Front	Rear	Total	Payload
NB1	109.0 in.	lb.	3,516	1,896	5,412	6,588
NB2	132.5 in.	lb.	3,560	1,918	5,478	6,522
NB3	150.0 in.	lb.	3,605	1,940	5,545	6,455
NB4	176.0 in.	lb.	3,649	1,962	5,611	6,389

In-Frame Tank 14,500-lb. GVWR Automatic Transmission Model
Chassis Cab and Maximum Payload Weights

Model	WB	Unit	Front	Rear	Total	Payload
NF1	109.0 in.	lb.	3,527	1,896	5,423	9,077
NF2	132.5 in.	lb.	3,571	1,918	5,489	9,011
NF3	150.0 in.	lb.	3,616	1,940	5,556	8,944
NF4	176.0 in.	lb.	3,660	1,962	5,622	8,878

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Side-Mounted Tank 12,000-lb. GVWR Manual Transmission Model
Chassis Cab and Maximum Payload Weights

Model	WB	Unit	Front	Rear	Total	Payload
NA1	109.0 in.	lb.	3,660	1,620	5,280	6,720
NA2	132.5 in.	lb.	3,704	1,642	5,346	6,654
NA3	150.0 in.	lb.	3,748	1,664	5,412	6,588
NA4	176.0 in.	lb.	3,792	1,687	5,479	6,521

Side-Mounted Tank 14,500-lb. GVWR Manual Transmission Model
Chassis Cab and Maximum Payload Weights

Model	WB	Unit	Front	Rear	Total	Payload
NE1	109.0 in.	lb.	3,671	1,620	5,291	9,209
NE2	132.5 in.	lb.	3,715	1,642	5,357	9,143
NE3	150.0 in.	lb.	3,759	1,664	5,423	9,077
NE4	176.0 in.	lb.	3,803	1,687	5,490	9,010

Side-Mounted Tank 12,000-lb. GVWR Automatic Transmission Model
Chassis Cab and Maximum Payload Weights

Model	WB	Unit	Front	Rear	Total	Payload
NB1	109.0 in.	lb.	3,726	1,664	5,390	6,610
NB2	132.5 in.	lb.	3,770	1,687	5,457	6,543
NB3	150.0 in.	lb.	3,814	1,709	5,523	6,477
NB4	176.0 in.	lb.	3,858	1,731	5,589	6,411

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Side-Mounted Tank 14,500-lb. GVWR Automatic Transmission Model Chassis Cab and Maximum Payload Weights						
Model	**WB**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
NF1	109.0 in.	lb.	3,737	1,664	5,401	9,099
NF2	132.5 in.	lb.	3,781	1,687	5,468	9,032
NF3	150.0 in.	lb.	3,825	1,709	5,534	8,966
NF4	176.0 in.	lb.	3,869	1,731	5,600	8,900

Vehicle Weight Limits:

GVWR		
Designed Maximum	12,00 lbs.	14,500 lbs.
GAWR, Front	4,700 lbs.	5,360 lbs.
GAWR, Rear	7,950 lbs.	9,880 lbs.

Technical Notes:

Chassis Curb Weight reflects standard equipment and fuel but no driver or payload.

Maximum Payload Weight is the allowed maximum for equipment, body, payload and driver and is calculated by subtracting chassis curb weight from the GVWR.

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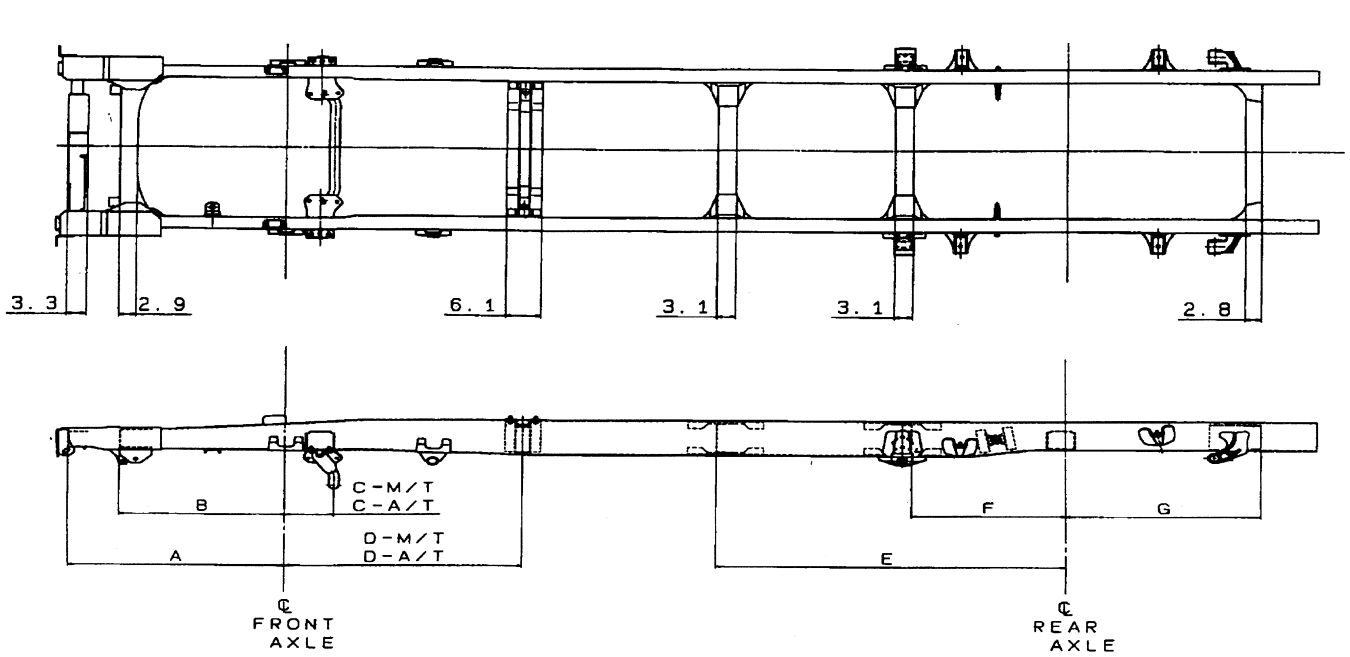
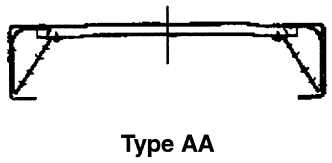
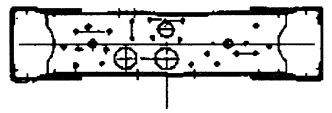
Frame and Crossmember Specifications

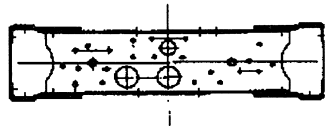




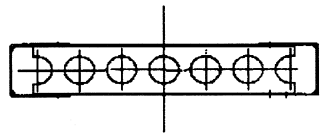
Type AA



Type BB



Type CC



Type DD

Wheelbase	Frame Thick	Crossmember Type/Location								
		A	B	C-M/T	C-A/T	D-M/T	D-A/T	E	F	G
109.0	0.24	37.0	28.3	8.4	8.4	AA 40.5	AA 44.7	—	CC 26.0	DD 33.0
132.5	0.24	37.0	28.3	8.4	8.4	AA 40.5	AA 44.7	BB 59.4	CC 26.0	DD 33.0
150.0	0.24	37.0	28.3	8.4	8.4	AA 40.5	AA 44.7	BB 59.4	CC 26.0	DD 33.0
176.0	0.24	37.0	28.3	8.4	8.4	AA 40.5	AA 44.7	BB 59.4	CC 26.0	DD 33.0

M/T = Manual Transmission A/T = Automatic Transmission

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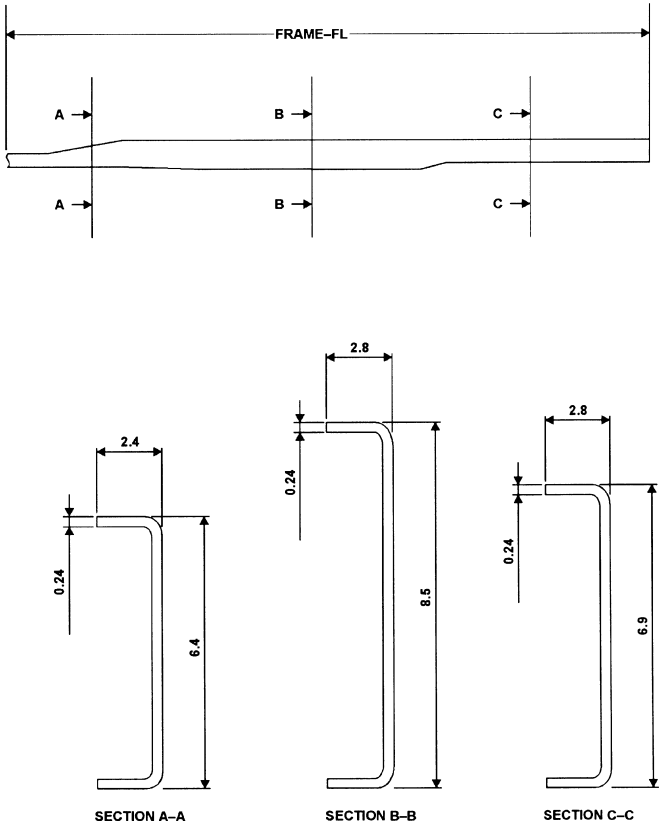
Frame Chart



Wheelbase	Frame FL	Frame Thickness
109.0	186.0	0.24
132.5	209.6	0.24
150.0	227.4	0.24
176.0	253.4	0.24

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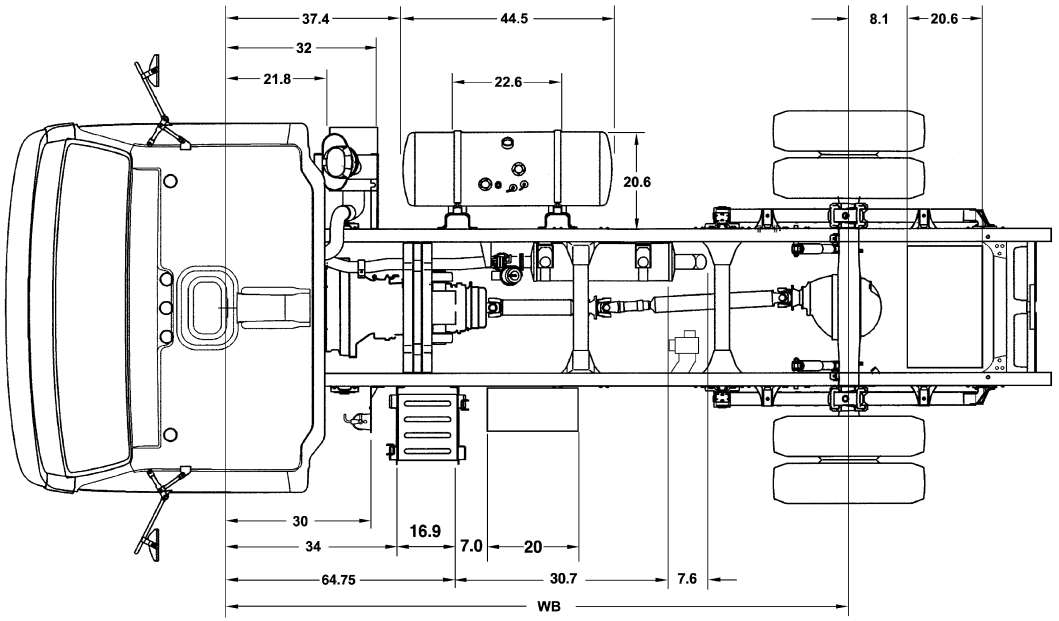
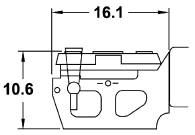
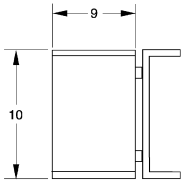
Auxiliary Views

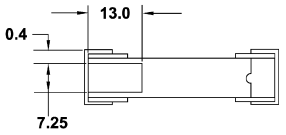




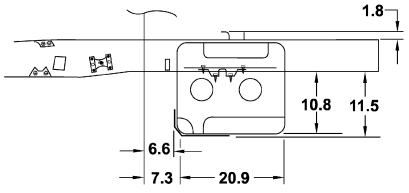
Side View Battery Box



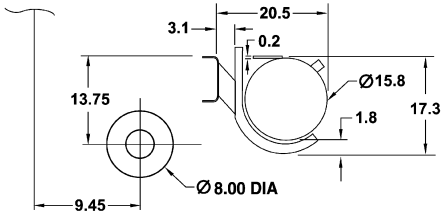
Side View Aux. Battery Tray



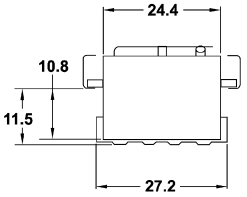
Rear View ABS Controller



Side View In Frame Tank



Side View Fuel Tank



Side View In Frame Tank

NOTE: Frame-mounted fuel tank available on 109", 132.5", 150" and 176" WB as an option replacing the In-Frame Tank.

* Allow 3" additional for battery box opening clearance.

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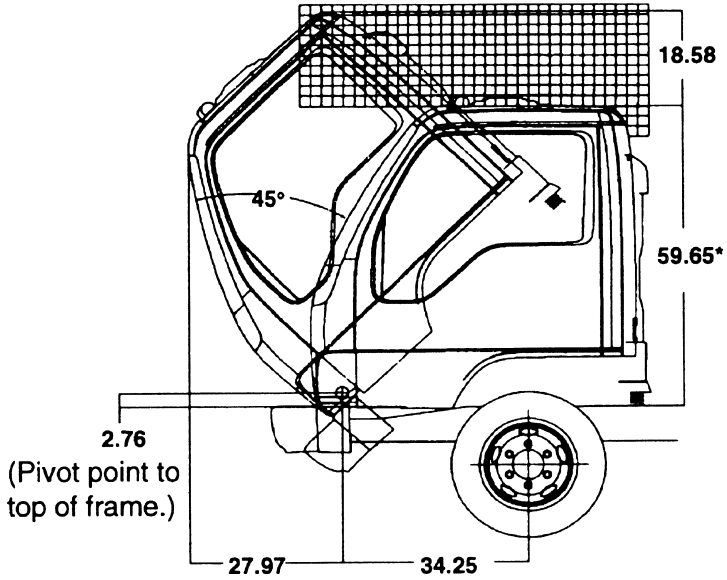
Body Builder Weight Information Chart

GVWR	Axle	Wheelbase								Unsprung Weight
		109 in.		132.5 in.		150 in.		176 in.		
		Man. Trans.	Auto. Trans.	Man. Trans.	Auto. Trans.	Man. Trans.	Auto. Trans.	Man. Trans.	Auto. Trans.	
12,000	Front	3,638	3,704	3,628	3,748	3,729	3,792	3,770	3,836	573
	Rear	1,587	1,631	1,609	1,653	1,631	1,675	1,653	1,698	871
	Total	5,225	5,335	5,291	5,401	5,357	5,467	5,423	5,534	1,444
14,500	Front	3,649	3,715	3,693	3,759	3,737	3,803	3,781	3,847	573
	Rear	1,587	1,631	1,609	1,653	1,631	1,675	1,653	1,698	904
	Total	5,236	5,346	5,302	5,412	5,368	5,478	5,434	5,545	1,477

Cab Tilt



GRID SCALE:
One sqare is 2 in x 2 in

NOTE: Roof vent adds 1.5 inches to overall cab height.

RADIUS FROM PIVOT TO OUTER EXTENT OF CAB:
Radius - 79.02

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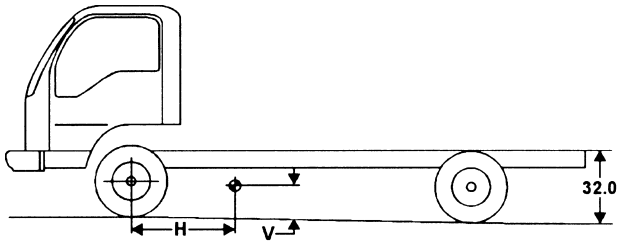
Center of Gravity

The center of gravity of the chassis cab.

GVWR	WB	V	H	
			Manual Trans.	Auto. Trans.
12,000	109	22.1	33.1	33.3
	132.5	20.6	40.3	40.6
	150	20.5	45.7	46.5
	176	18.9	53.6	54.0
14,500	109	22.1	33.0	33.3
	132.5	20.6	40.2	40.5
	150	20.5	45.6	45.9
	176	18.9	53.5	53.6



V = Vertical Center of Gravity
H = Horizontal Center of Gravity

The center of gravity of the completed vehicle with a full load should not exceed 54 inches above ground level for the 12,000 lb. GVWR, 58 inches above ground level for the 14,500 GVWR, and must be located horizontally between the centerlines of the front and rear axles.

NOTE: The maximum dimensions for a body installed on the NPR/W3500, W4500 are 96 inches wide (outside) by 90 inches high (inside). Any larger body applications must be approved by GMICT Application Engineering. In the West Coast, call 1-562-229-5314 and, in the East Coast, call 1-407-257-3013.

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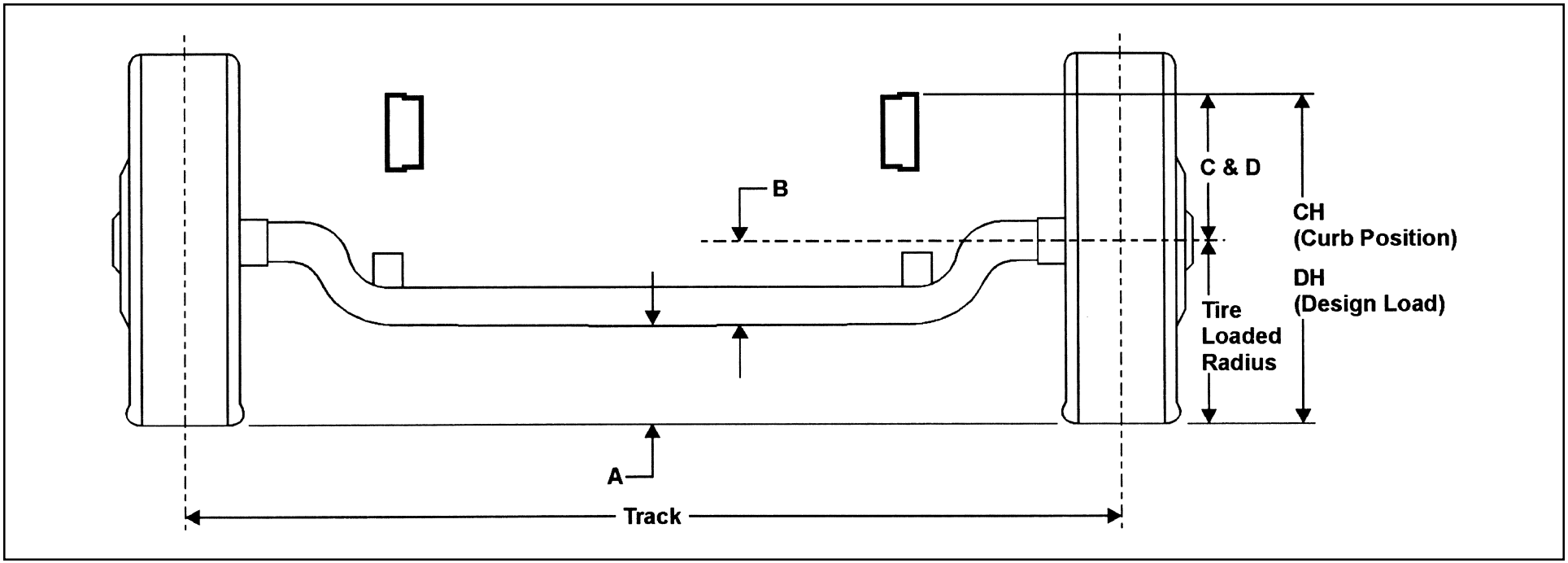
Front Axle Chart



Formulas for calculating height dimensions:

A = Tire Loaded Radius – B
C = Centerline of Axle to Top of Frame Rail at Curb Position
D = Centerline of Axle to Top of Frame Rail at Design Load
CH = C + Tire Unloaded Radius
DH = D + Tire Loaded Radius

Tire	GVWR	GAWR	A	B	C	D	CH	DH	Track	Tire Radius	
										Unload	Load
215/85R 16-E	12,000 lbs.	4,700 lbs.	7.7	6.4	13.0	12.5	27.3	26.6	65.6	14.3	14.1
	14,500 lbs.	5,360 lbs.	7.7	6.4	13.0	12.5	27.3	26.6	65.6	14.3	14.1

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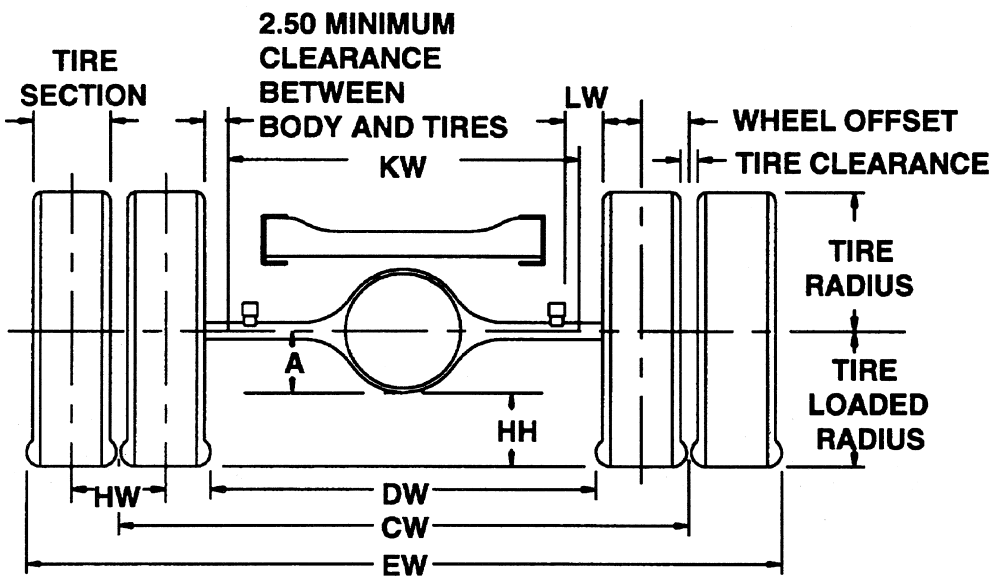
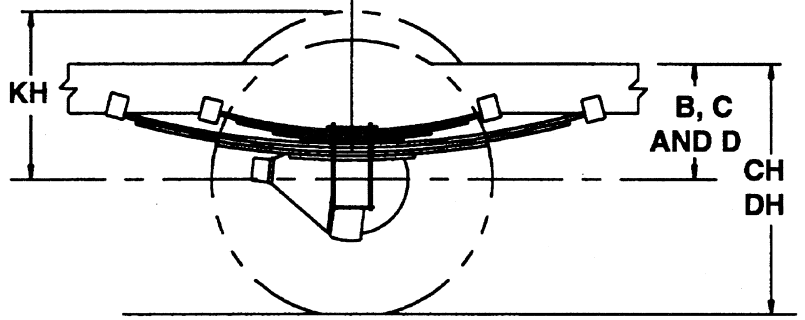
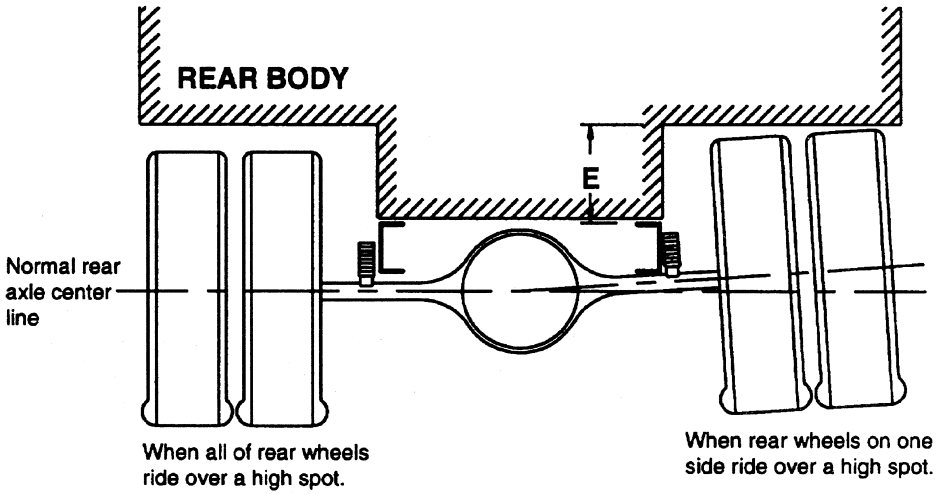
Rear Axle Chart







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Definitions			
A	Centerline of axle to bottom of axle bowl.	DW	Minimum distance between the inner surfaces of the rear tires.
B	Centerline of axle to top of frame rail at metal-to-metal position.	EW	Maximum Rear Width: Overall width of the vehicle measured at the outermost surface of the rear tires.
C	Centerline of axle to top of frame rail at curb position.		
D	Centerline of axle to top of frame rail at design load.	HH	Rear Tire Clearance: Minimum clearance between the rear axle and the ground-line.
E	Rear Tire Clearance: Minimum clearance required for tires and chain measured from the top of the frame at the vertical centerline of the rear axle, when rear wheels on one side ride over a high spot.	HW	Dual Tire Spacing: Distance between the centerlines of the minimum distance required for tire bounce as measured from the centerline of the rear axle and the top of the rear tire when one wheel rides over a high spot.
CH	Rear Frame Height: Vertical distance between the normal top of frame rail and the ground-line through the centerline of the rear axle at curb position.	CW	Track Dual Rear Wheel Vehicles: Distance between the centerlines of the dual wheels measured at the ground-line.
DH	Rear Frame Height: Vertical distance between the normal top of frame rail and the ground-line through the centerline of the rear axle at design load.		
Tire Section, Tire Radius, Tire Loaded Radius, Tire Clearance		See Tire Chart for Values	

Formulas for Calculating Rear Width and Height Dimensions			
CW	= Track	HH	= Tire loaded radius – A
CH	= Tire loaded radius + C	JH	= KH – B
DH	= Tire loaded radius + D	KH	= Tire radius + 3.00 inches
DW	= Track + 2 tire sections – tire clearance	KW	= DW – 5.00 inches
EW	= Track + 2 tire sections + tire clearance	LW	= 1.00-inch minimum clearance between tires and springs

NOTE: Track and overall width may vary with optional equipment.

Tire	GAWR	Track CW	A	B	C	D	E
215/85R 16-E	7,950/9,880 lbs.	65.0	10.6	10.6	14.9	13.3	7.8

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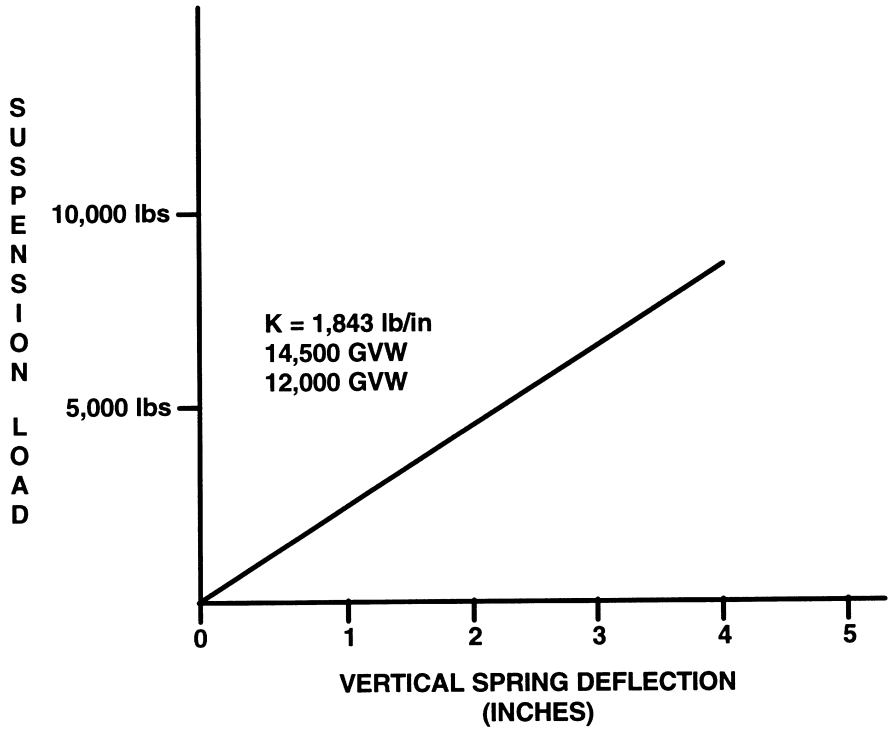
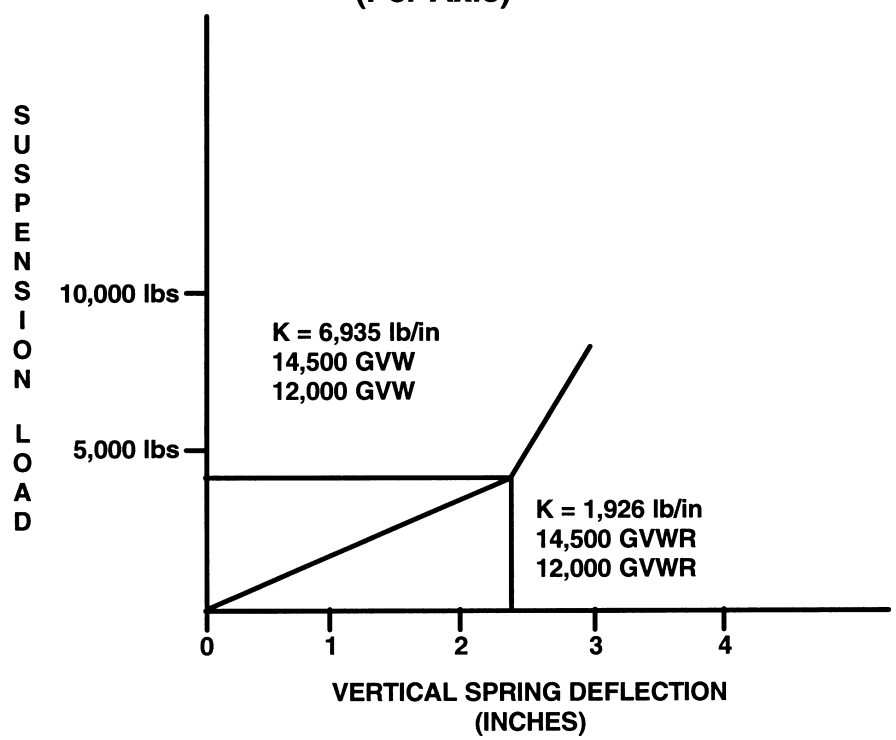
Suspension Deflection Charts

Front Leaf Spring Load vs. Deflection (Per Axle)



Rear Leaf Spring Load vs. Deflection (Per Axle)



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(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Diesel – continued from previous page)

Tire and Disc Wheel Chart

Tire

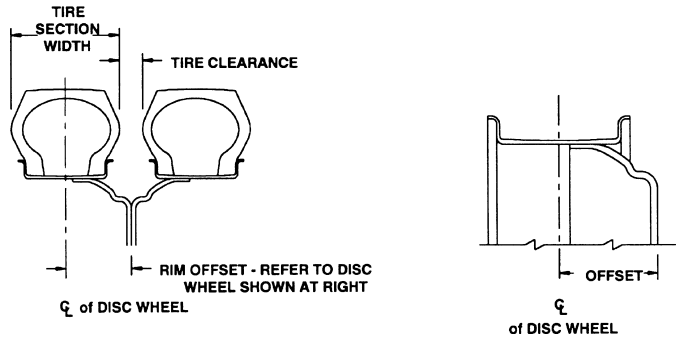
Tire Size	Tire Load Limit and Cold Inflation Pressures				Maximum Tire Load Limits		GVWR (Lb.)
	Single		Dual		Front	Rear	
	Lb.	PSI	Lb.	PSI	2 Single	4 Dual	
215/85R 16-E	2,430	70	2,210	70	4,860	8,840	12,000
215/85R 16-E	2,680	80	2,470	80	5,360	9,880	14,500

Tire Size	GVWR (Lb.)	Tire Radius				Tire Section Width	Tire Clearance	Design Rim Width
		Loaded		Unloaded				
		Front	Rear	Front	Rear			
215/85R 16-E	12,000	14.1	14.1	14.3	14.7	8.2	1.8	6.0
215/85R 16-E	14,500	14.1	14.1	14.3	14.7	8.2	1.8	6.0

Disc Wheel

Wheel Size	Bolt Holes	Bolt Circle Dia.	Ft./Rr. Nut Size*	Rear Stud Size*	Nut/Stud Torque Specs.	Inner Circle	Outside Offset	Disc Thickness	Rim Type	Material Mfg.
16 x 6.00K	6 JIS	8.75	1.6142 (41 mm) BUD HEX	0.8268 (21 mm) SQUARE	289 ft.-lb. (392 N•m)	6.46	5.0	0.35	5° DC	Steel TOPY

* O.D. Wrench Sizes



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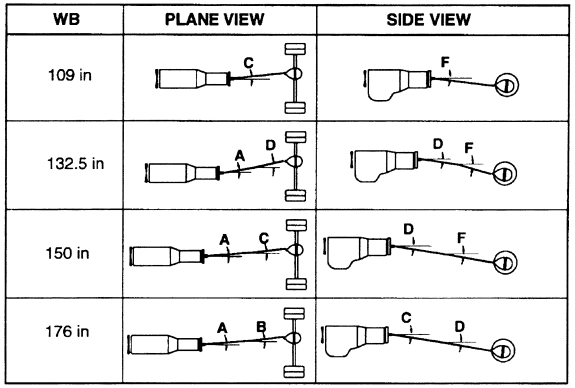
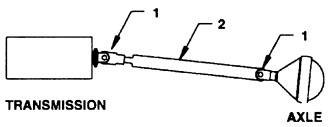
Propeller Shaft



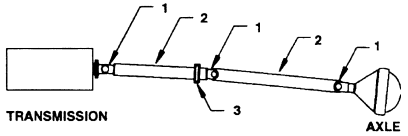
TYPICAL INSTALLATIONS SHOWING YOKES "IN PHASE". "IN PHASE" MEANS THAT THE YOKES AT EITHER END OF A GIVEN PROPELLER SHAFT ASSEMBLY ARE IN THE SAME PLANE.

NPR

(109 in WB)



(132.5 in, 150 and 176 in WB)



1. UNIVERSAL JOINT
2. PROPELLER SHAFT
3. CENTER CARRIER BEARING

Wheelbase	Plane View				Side View			
	A Manual Trans.	A Auto. Trans.	B Manual Trans.	B Auto. Trans.	C Manual Trans.	C Auto. Trans.	D Manual Trans.	D Auto. Trans.
109 in.	—	—	2.0°	2.3°	—	—	8.3°	—
132.5 in.	0°	0°	2.4°	2.4°	4.4°	5°	6.2°	6.1°
150 in.	0°	0°	2.4°	2.4°	2.5°	2.6°	6.4°	6.4°
176 in.	0°	0°	1.7°	1.7°	2.8°	2.8°	4.5°	4.5°

NOTE: All driveline angles are at unloaded condition (curb position with typical cargo body).

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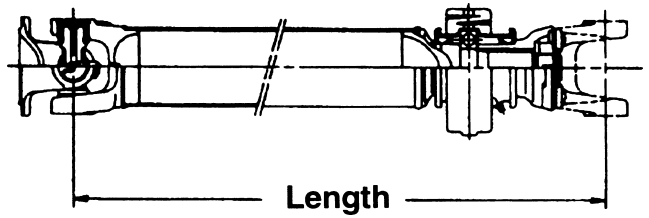
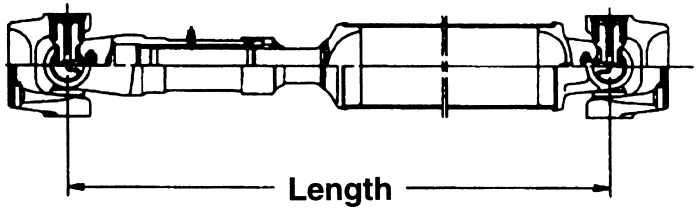
Wheelbase	109		132.5		150		176	
No. of Shafts	1		2		2		2	
Trans. Type	5 Manual Trans.	4 Auto. Trans.	5 Manual Trans.	4 Auto. Trans.	5 Manual Trans.	4 Auto. Trans.	5 Manual Trans.	4 Auto. Trans.
Shaft #1 O.D.	3.25							
Thickness	0.091							
Length	44.5	39.1	29.7	24.3	47.4	41.9	59.1	53.7
Type	B	B	A	A	A	A	A	A
Shaft #2 O.D.	3.25							
Thickness	0.091							
Length	N/A	N/A	38.3	38.3	38.3	38.3	52.6	52.6
Type	N/A	N/A	B	B	B	B	B	B

Type	Description	Illustration
Type **A**	1st shaft in 2-piece driveline	
Type **B**	1st shaft in 1-piece driveline 2nd shaft in 2-piece driveline	

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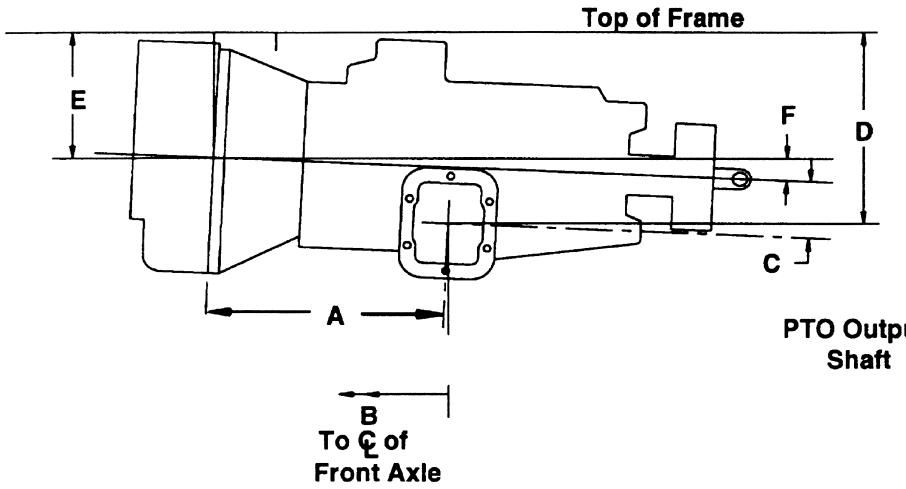
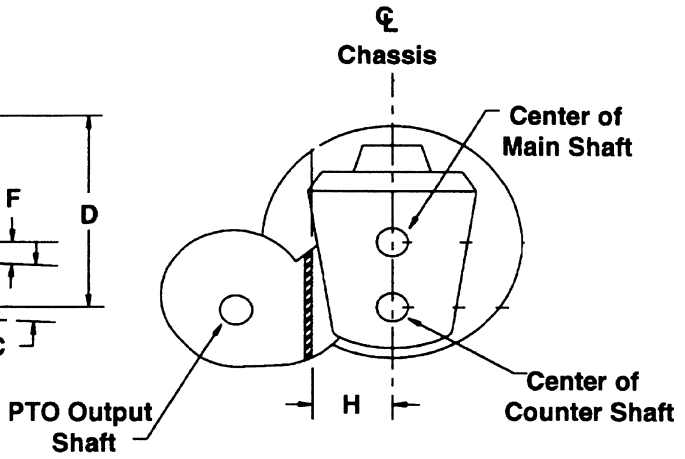
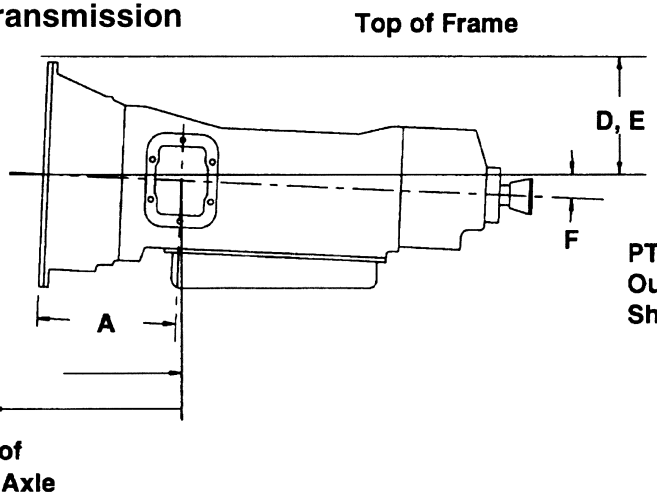
PTO Location, Drive Gear and Opening Information

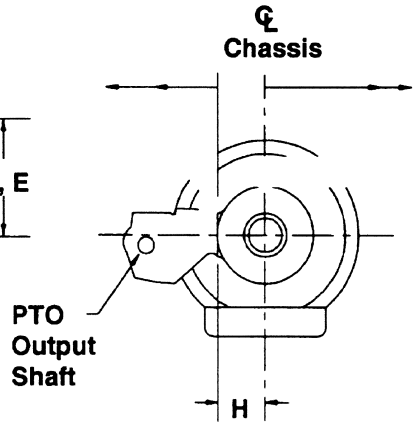
Manual Transmission





Automatic Transmission





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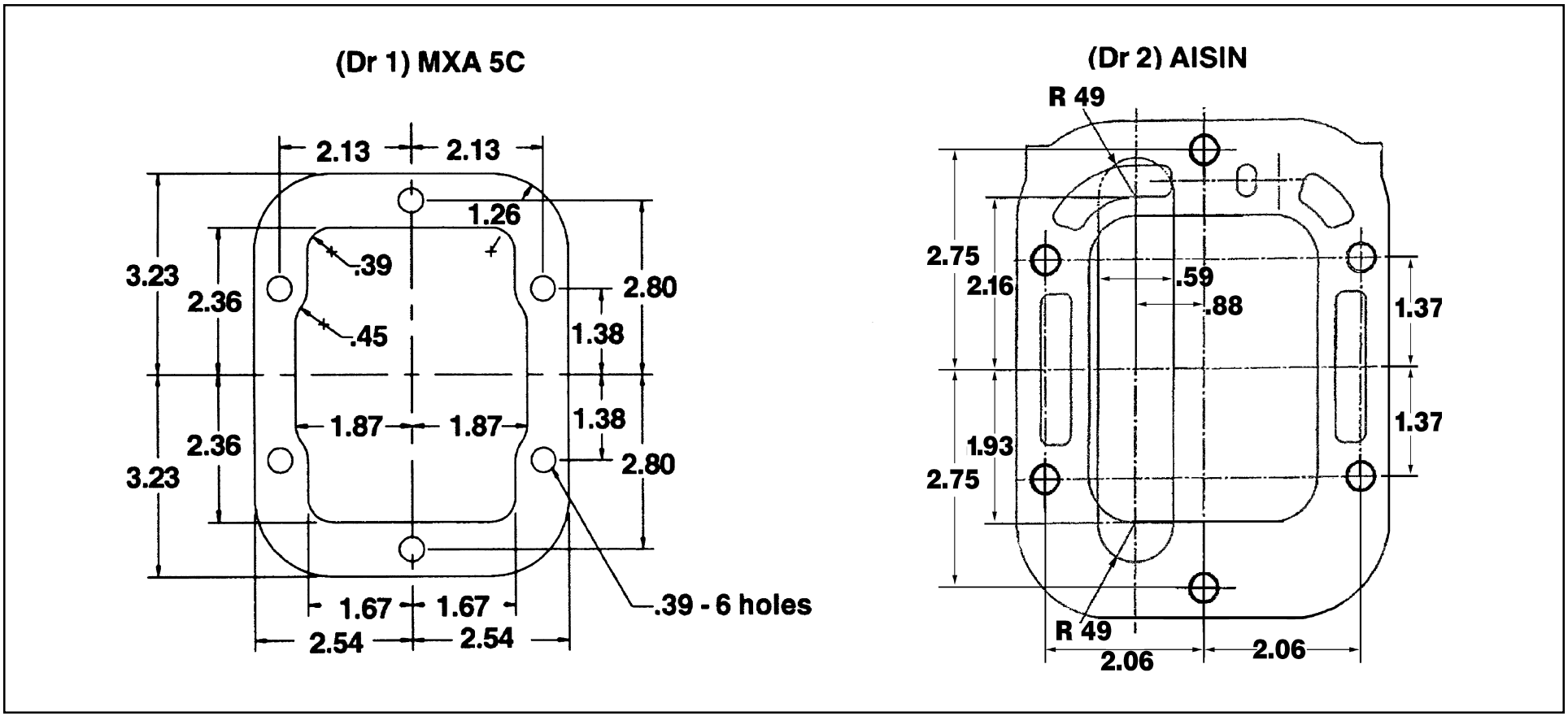
Trans.	Opening Location	Bolt Pattern	A	B	C	D	E	F	H	PTO Drive Gear Location	Ratio of PTO Drv. Gear Spd. to Eng. Spd.	No. of Teeth	Pitch	Helix Angle	Max. Output Torque
MXA 5C	Left	(Dr 1)	13.2	39	3.4	11.2	7.1	2.5º	4.1	2nd Gear Trans. Countershaft	25/49 = .51	20	3.175	15º	145 lbs.-ft. @ 1,000 RPM
Aisin[1)]	Left	(Dr 2)	12.6	38.59	0	8	7.5	2.5º	4.48	PTO Gear	1:1 with turbine	58	N/A	0	134 lbs.-ft. @ 1,000 RPM

1) No PTO gear in the 150" WB models.

Opening Diagram



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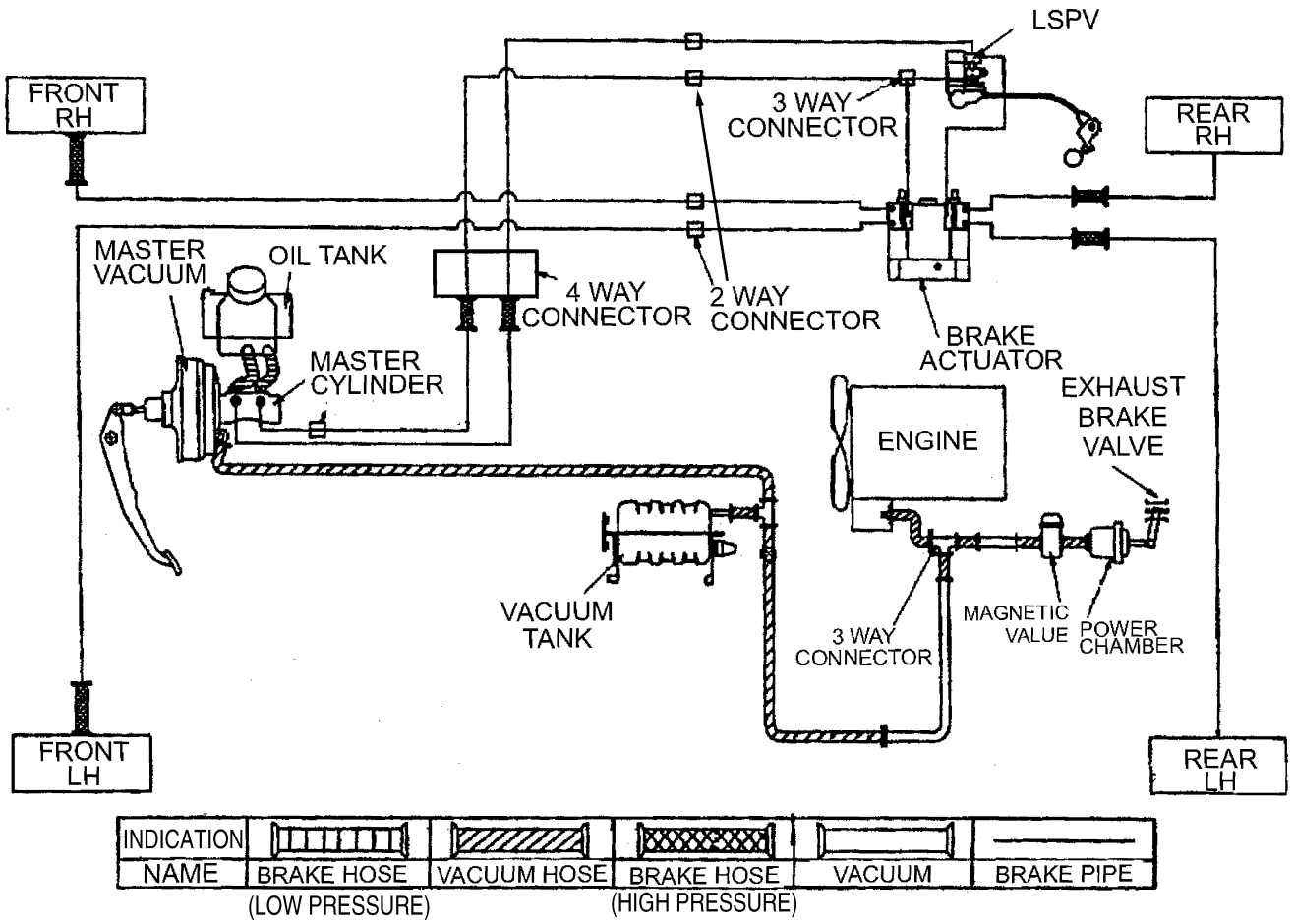
Brake System Schematic, 12,000 GVW

Vacuum Over Hydraulic

Please refer to Introduction Section of book for antilock system cautions and wheelbase modification requirements.



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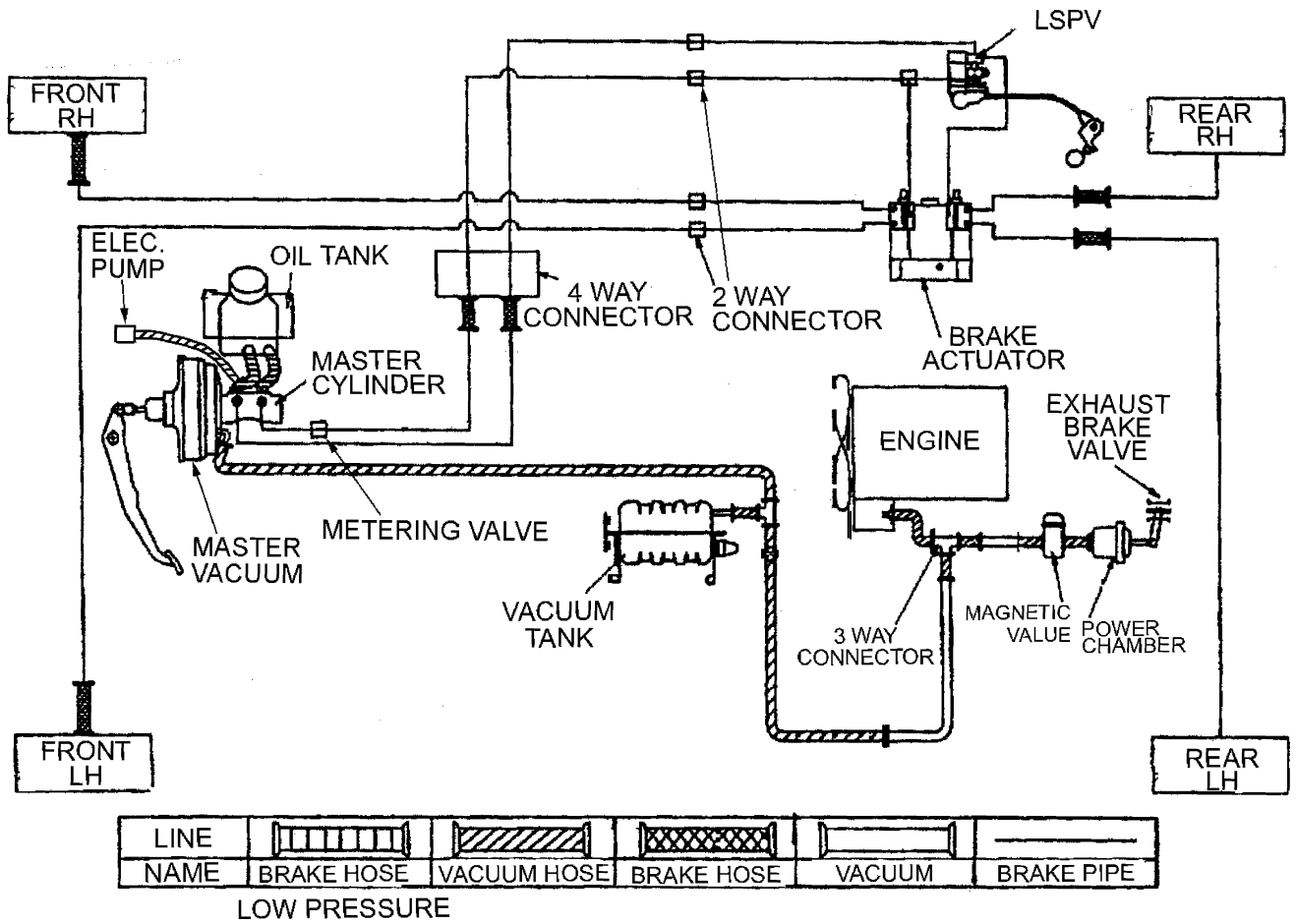
Brake System Schematic, 14,500 GVW

Vacuum Over Hydraulic

Please refer to Introduction Section of book for antilock system cautions and wheelbase modification requirements.



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In-Frame Diesel Fuel Fill

Installation Instructions

1. Disconnect battery.
2. Loosen hose from the tie downs. Remove caps from plate on rail.
3. Install hoses onto the plate.
4. Extend hose out from the driver side of the rail to body rail.
5. The filler neck must be mounted to allow the fill plate bracket to be parallel to the frame horizontal (see figure 4).
6. Cover with protector wrap and secure with tie wraps.
7. Filler hose is set for 96 inches outside width body.
8. Filler neck (dimension A) must be between 6.85 inches and 8.5 inches above frame.
9. Secure the filler plate to the bottom of the body and check for leaks.
10. Ensure that fill hose does not sag, creating an area where the fuel could pool in the fill hose.
11. Reconnect battery.

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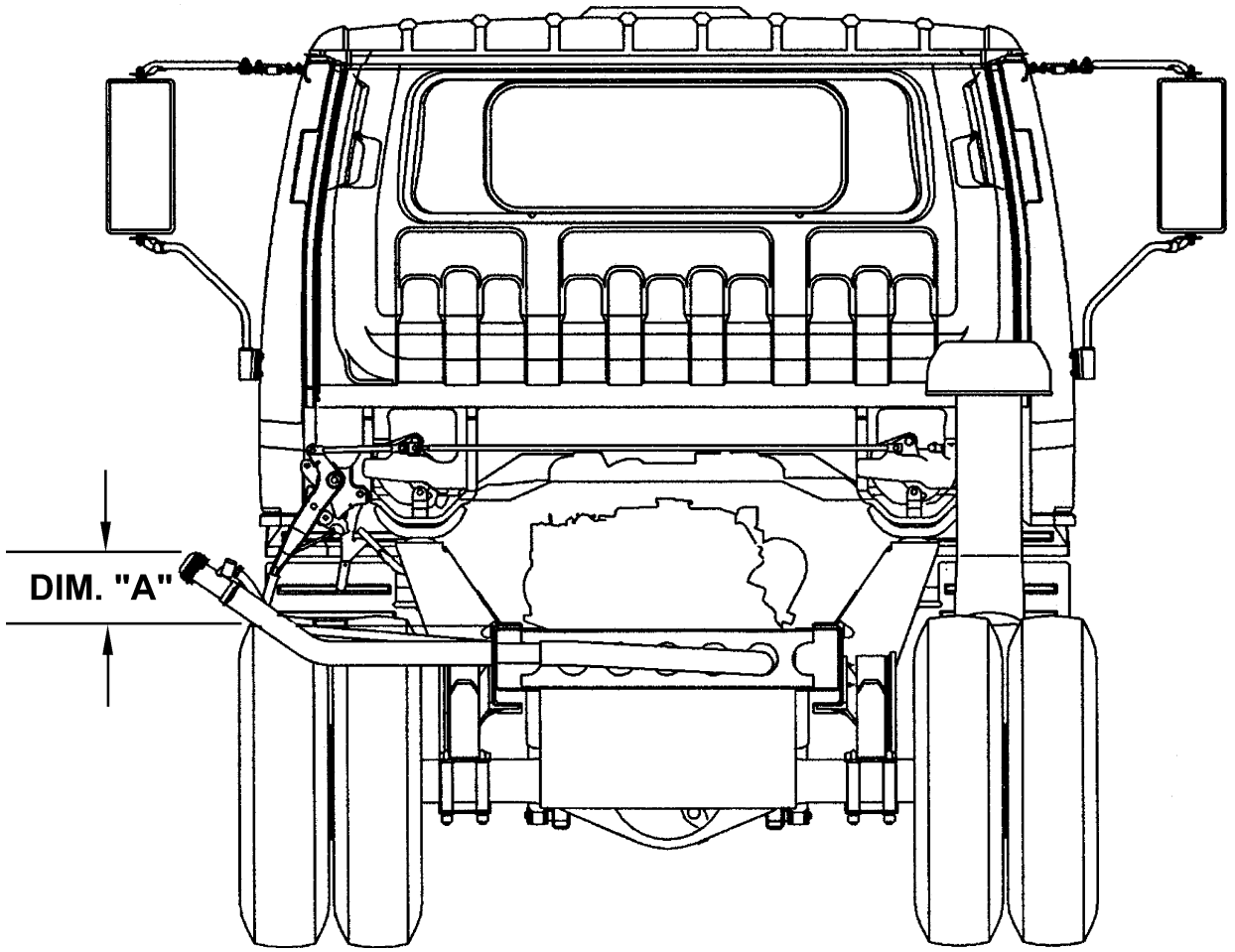
Rear View Fuel Fill



Dimension A = 6.85-8.5 inches (174-216 mm)

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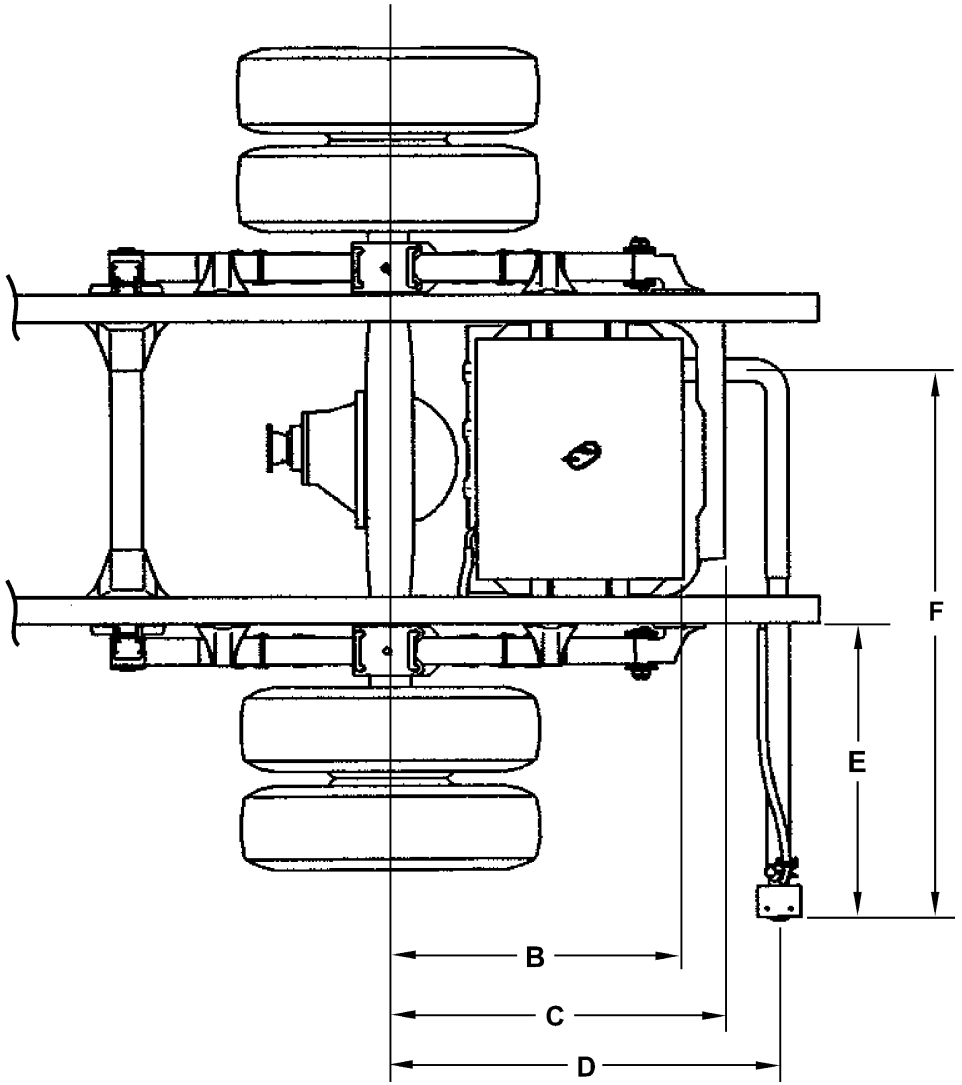
Top View Fuel Fill



Dimensions:
B = 29.75 inches (756 mm)
C = 34.00 inches (863 mm)
D = 39.29 inches (998 mm)
E = 30.86 inches (784 mm)
F = 56.60 inches (1,438 mm)

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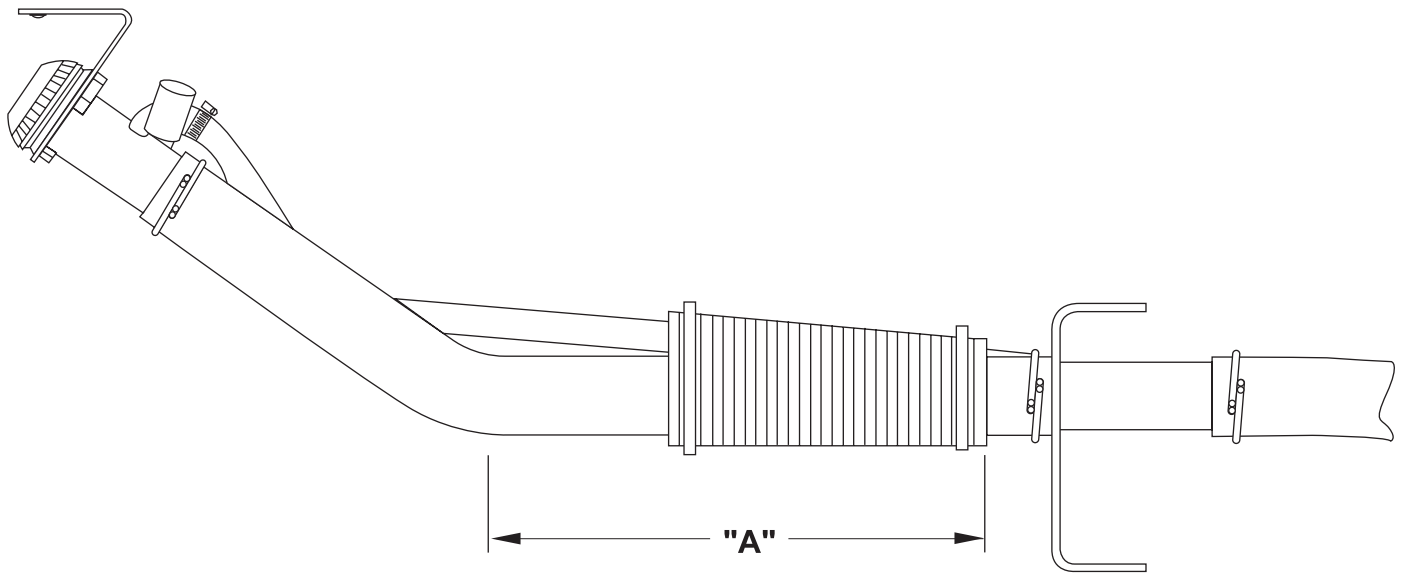
Hose Modification for Various Width Bodies



NOTE: Shorten Hose at "A" Area only.

96 remove 0 inches
90 remove 3 inches
86 remove 5 inches
80 remove 8 inches

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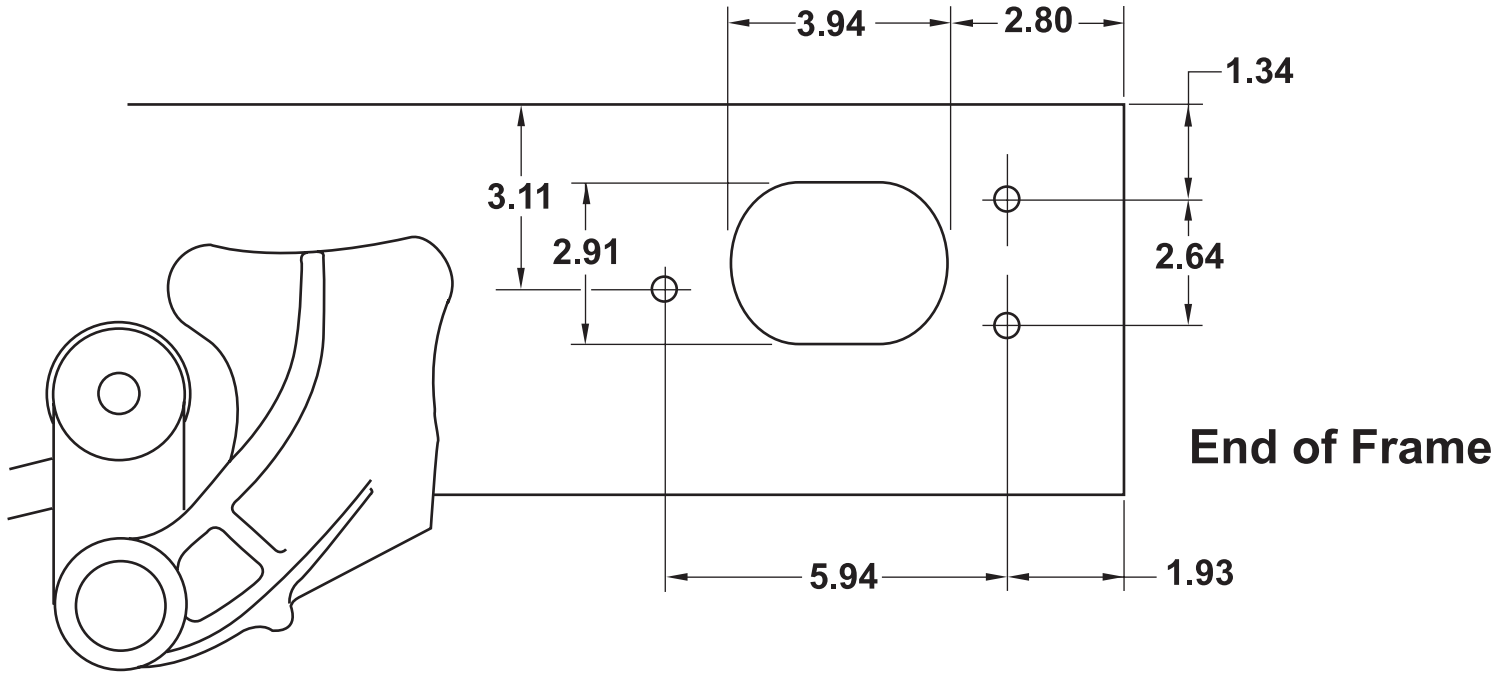
Through the Rail Fuel Fill Frame Hole



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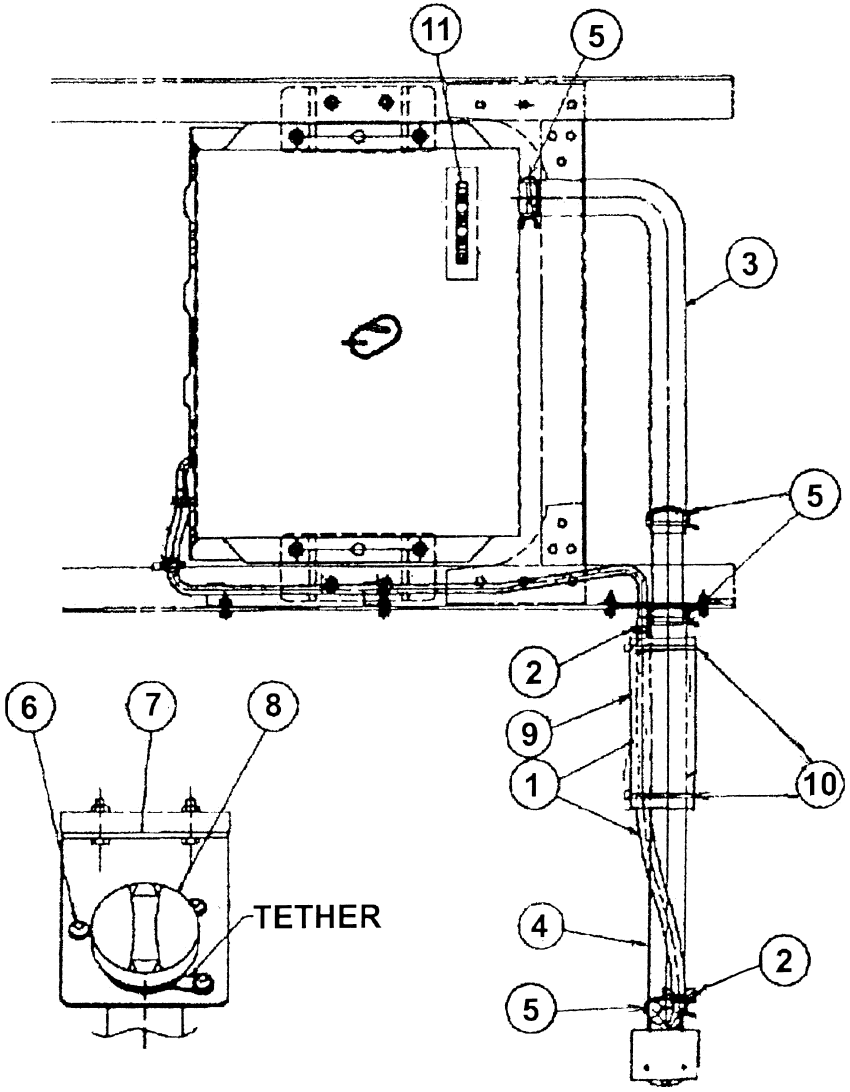
Fuel Fill Parts Illustration



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Fuel Fill Parts List

Number	Part Name	Isuzu Part Number	GM Part Number	Quantity
1	Breather Hose	897206-0420	N/A	1
2	Clip, Rubber Hose	894242-0340	94242034	2
3	Hose, Fuel Filler	897187-8750	97187875	1
4	Hose, Fuel Filler	897253-1400	97253140	1
5	Clip, Filler Hose	894435-8760	97724373	4
6	Screw, Filler Hose	894384-6460	N/A	3
7	Bracket, Filler Neck	897116-621Y	97116621	1
8	Cap, Filler	897118-7020	N/A	1
9	Protector	897114-0630	97114063	1
10	Clip	109707-1070	94062296	2
11	Caution Plate	894414-3530	94414353	1

NQR/W5500 Diesel

Specifications

Model	NQR/W5500
GVWR	17,950 lbs.
WB	109 in., 132.5 in., 150 in., 176 in.
Engine	Isuzu 4-cylinder, in-line 4-cycle, turbocharged, intercooled, direct injection diesel.
Model/Displacement	4HE1-TC/290 CID (4.75 liters)
HP (Gross)	175 HP @ 2,700 RPM
Torque (Gross)	347 lbs.-ft. torque @ 2,000 RPM
Equipment	Dry element air cleaner with vertical intake; 2 rows 511.2 in.^{2} radiator; 6-blade 18.7 in. diameter fan with viscous drive. Cold weather starting device and an oil cooler.
Clutch	Single, dry plate, 12.8 in. dia. ceramic, actuated by self-adjusting hydraulic master/slave cylinder.
Transmission	MBP6P 6-speed manual, all forward gears synchronized. Sixth gear is overdrive. Available Optional Transmission: Aisin 450-43 LE 4-speed overdrive automatic transmission with lock-up capability in 2nd, 3rd and 4th. PTO capability all chassis and wheelbases.
Steering	Integral power steering 20.9:1 ratio. Tilt and telescoping steering column.
Front Axle	Reverse Elliot "I" Beam rated at 6,830 lbs.
Suspension	Semi-elliptical steel alloy leaf springs with stabilizer bar and shock absorbers.
GAWR	6,830 lbs.
Rear Axle	Full-floating, single speed with hypoid gearing rated at 14,550 lbs.
Suspension	Semi-elliptical steel alloy leaf springs and shock absorbers.
GAWR	12,980 lbs.
Wheels	19.5 x 6.0 6-hole disc wheels, painted white.
Tires	225/70R 19.5F (12 ply) tubeless steel-belted radials, highway tread front and rear.
Brakes	Dual-circuit, power-assisted hydraulic service brakes with load-sensing proportioning valve in rear brake circuit. Disc front and self-adjusting outboard mounted drum rear. The parking brake is a mechanical, cable-actuated, internal expanding drum type, transmission mounted. The exhaust brake is standard and is vacuum-operated. Antilock brake system.
Fuel Tank	30-gallon rectangular steel fuel tank mounted in frame rail behind rear axle. Fuel/water separator mounted on rail.

NOTE: These selected specifications are subject to change without notice.

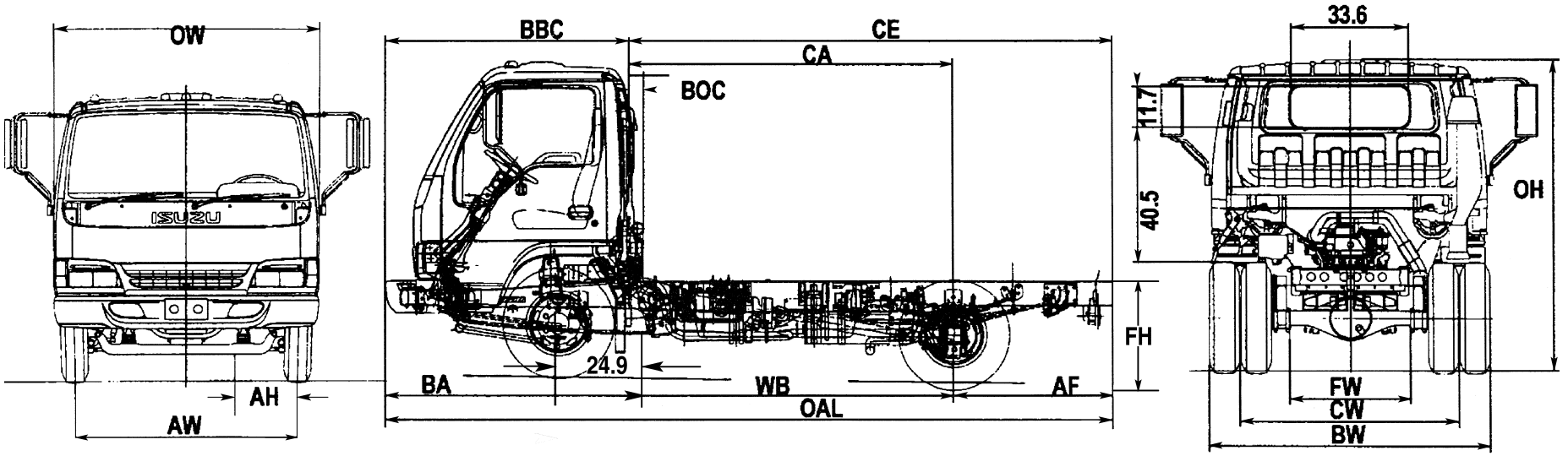
(Vehicle Specifications Index Section – NQR/W5500 Diesel – continued on next page)

(Vehicle Specifications Index Section – NQR/W5500 Diesel – continued from previous page)

Model	NQR/W5500
Frame	Ladder type channel section straight frame rail 33.5 in. wide through the total length of the frame. Yield strength 44,000 psi section modulus 7.20 in.^{3}, RBM 316,800 lbs.-ft./in. per rail.
Cab	All-steel, low cab forward, BBC 68.0 in., 45° mechanical tilt with torsion assist.
Equipment	Jersey knit covered high back driver's seat with two-occupant passenger seat. Two-way roof ventilator, dual cab mounted exterior mirrors. Tilt and telescoping steering column. Tinted glass.
Electrical	12-volt, negative ground, dual Delco maintenance free batteries, 750 CCA each, 80-amp alternator with integral regulator.
Options	Air conditioning; AM/FM cassette stereo radio; PTO; engine block heater; engine oil pan heater; heated fuel/water separator; spare wheel; 6" stainless steel convex mirrors. Auxilliary transmission oil cooler, mandatory for 20,950 GCWR. Power windows and door locks. 33-gallon fuel tank mounted on right hand rail, in place of 30-gallon in frame tank.

NOTE: These selected specifications are subject to change without notice.

Vehicle Weights, Dimensions and Ratings



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Variable Chassis Dimensions					
Unit	**WB**	**CA***	**CE***	**OAL**	**AF**
Inch	109.0	88.4	131.5	199.5	43.1
Inch	132.5	111.9	155.0	223.0	43.1
Inch	150.0	129.4	172.5	240.5	43.1
Inch	176.0	155.4	198.5	266.3	43.1

* Effective CA & CE are CA or CE less BOC.

Dimension Constraints					
Code	**Inches**	**Code**	**Inches**	**Code**	**Inches**
AH	8.6	BW	83.3	FH	32.8
AW	65.6	CW	65.0		
BA	47.4	FW	33.5		
BBC	68.0	OH	88.1		
BOC	9.25	OW	78.5		

In-Frame Tank 17,950-lb. GVWR Manual Transmission Model Chassis Cab and Maximum Payload Weights						
Model	**WB**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
NQ1	109.0 in.	lb.	3,726	2,293	6,019	11,931
NQ2	132.5 in.	lb.	3,770	2,315	6,085	11,865
NQ3	150.0 in.	lb.	3,814	2,337	6,151	11,799
NQ4	176.0 in.	lb.	3,858	2,359	6,217	11,733

(Vehicle Specifications Index Section – NQR/W5500 Diesel – continued on next page)

(Vehicle Specifications Index Section – NQR/W5500 Diesel – continued from previous page)

In-Frame Tank 17,950-lb. GVWR Automatic Transmission Model Chassis Cab and Maximum Payload Weights						
Model	**WB**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
NR1	109.0 in.	lb.	3,715	2,293	6,008	11,942
NR2	132.5 in.	lb.	3,759	2,315	6,074	11,876
NR3	150.0 in.	lb.	3,803	2,337	6,140	11,810
NR4	176.0 in.	lb.	3,847	2,359	6,206	11,744

Side-Mounted Tank 17,950-lb. GVWR Manual Transmission Model Chassis Cab and Maximum Payload Weights						
Model	**WB**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
NQ1	109.0 in.	lb.	3,935	2,061	5,996	11,954
NQ2	132.5 in.	lb.	3,979	2,083	6,062	11,888
NQ3	150.0 in.	lb.	4,023	2,105	6,128	11,822
NQ4	176.0 in.	lb.	4,067	2,127	6,194	11,756

Side-Mounted Tank 17,950-lb. GVWR Automatic Transmission Model Chassis Cab and Maximum Payload Weights						
Model	**WB**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
NR1	109.0 in.	lb.	3,924	2,061	5,985	11,965
NR2	132.5 in.	lb.	3,968	2,083	6,051	11,899
NR3	150.0 in.	lb.	4,012	2,105	6,117	11,833
NR4	176.0 in.	lb.	4,056	2,127	6,183	11,767

(Vehicle Specifications Index Section – NQR/W5500 Diesel – continued on next page)

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Vehicle Weight Limits:

GVWR	
Designed Maximum	17,950 lbs.
GAWR, Front	6,830 lbs.
GAWR, Rear	12,980 lbs.

Technical Notes:

Chassis Curb Weight reflects standard equipment and fuel but no driver or payload.

Maximum Payload Weight is the allowed maximum for equipment, body, payload and driver and is calculated by subtracting chassis curb weight from the GVWR.

(Vehicle Specifications Index Section – NQR/W5500 Diesel – continued on next page)

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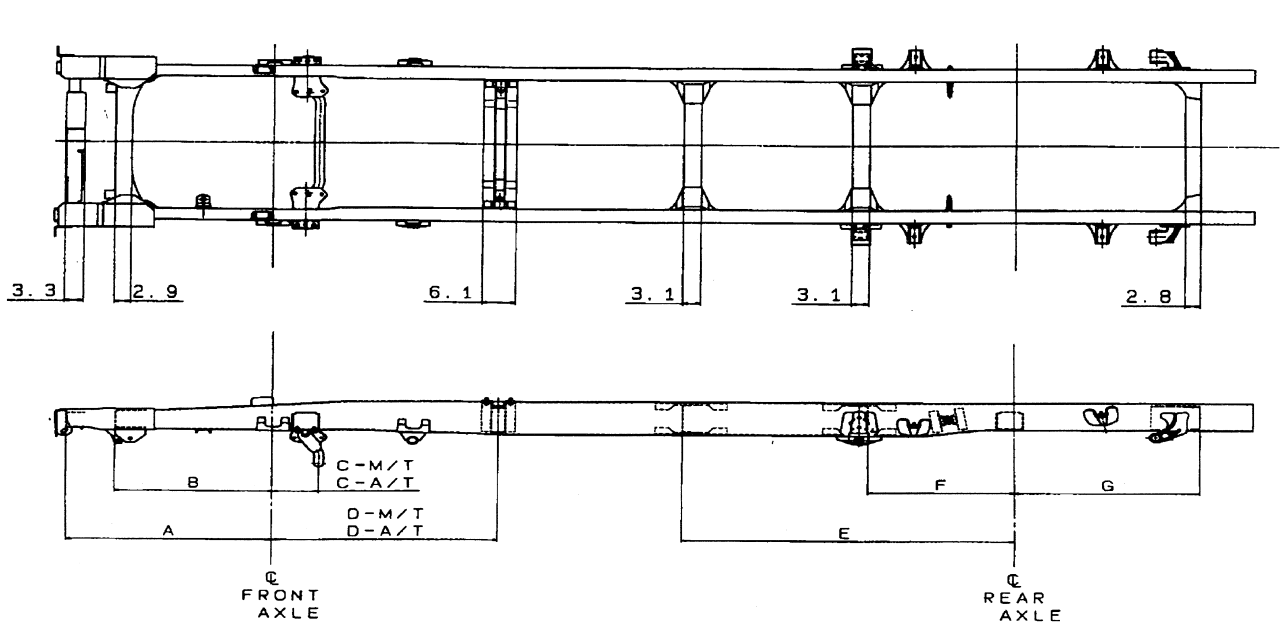
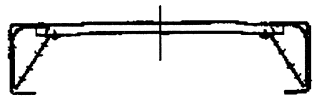
Frame and Crossmember Specifications





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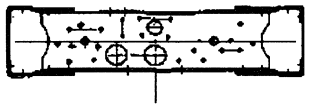

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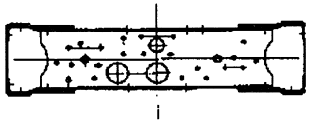

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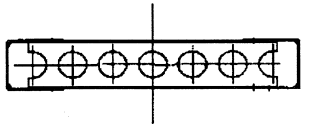

Type DD

Wheelbase	Frame Thick	Crossmember Type/Location								
		A	B	C-M/T	C-A/T	D-M/T	D-A/T	E	F	G
109.0	0.24	37.0	28.3	8.4	8.4	AA 40.5	AA 44.7	—	CC 26.0	DD 33.0
132.5	0.24	37.0	28.3	8.4	8.4	AA 40.5	AA 44.7	BB 59.4	CC 26.0	DD 33.0
150.0	0.24	37.0	28.3	8.4	8.4	AA 40.5	AA 44.7	BB 59.4	CC 26.0	DD 33.0
176.0	0.24	37.0	28.3	8.4	8.4	AA 40.5	AA 44.7	BB 59.4	CC 26.0	DD 33.0

M/T = Manual Transmission A/T = Automatic Transmission

(Vehicle Specifications Index Section – NQR/W5500 Diesel – continued on next page)

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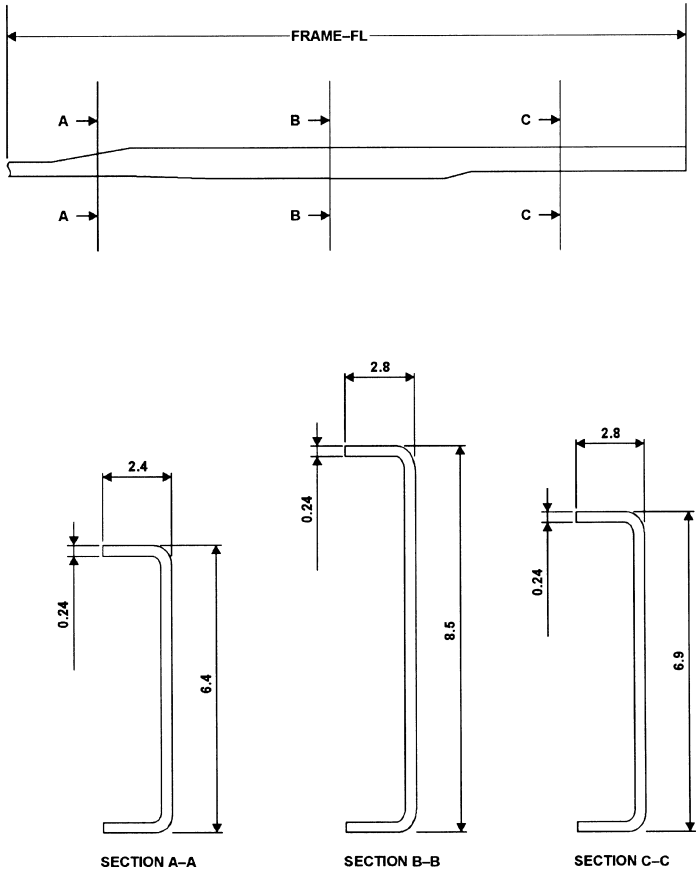
Frame Chart



Wheelbase	Frame FL	Frame Thickness
109.0	186.0	0.24
132.5	209.6	0.24
150.0	227.4	0.24
176.0	253.4	0.24

(Vehicle Specifications Index Section – NQR/W5500 Diesel – continued on next page)

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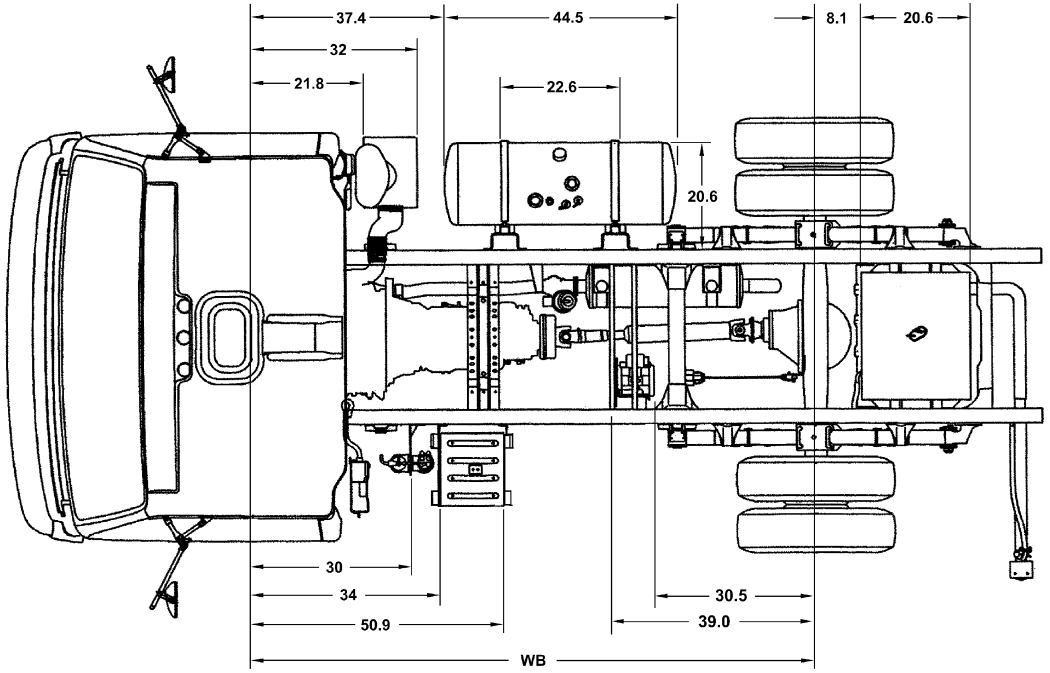
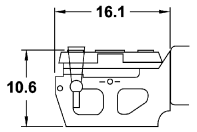
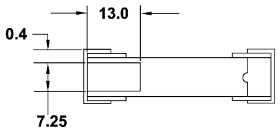
Auxiliary Views

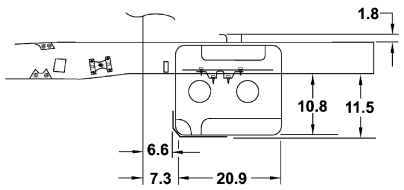




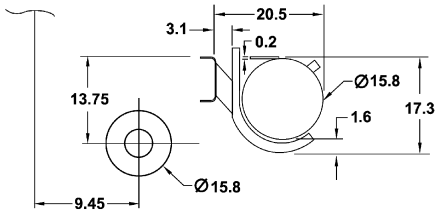
Rear View Battery Box



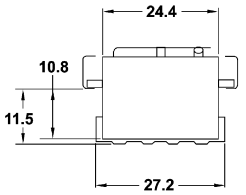
Rear View ABS Controller



Side View In Frame Tank



Rear View Fuel Tank



Rear View In Frame Tank

NOTE: Frame-mounted fuel tank available on 109", 132.5", 150" and 176" WB as an option. Allow 3" additional for battery box opening clearance.

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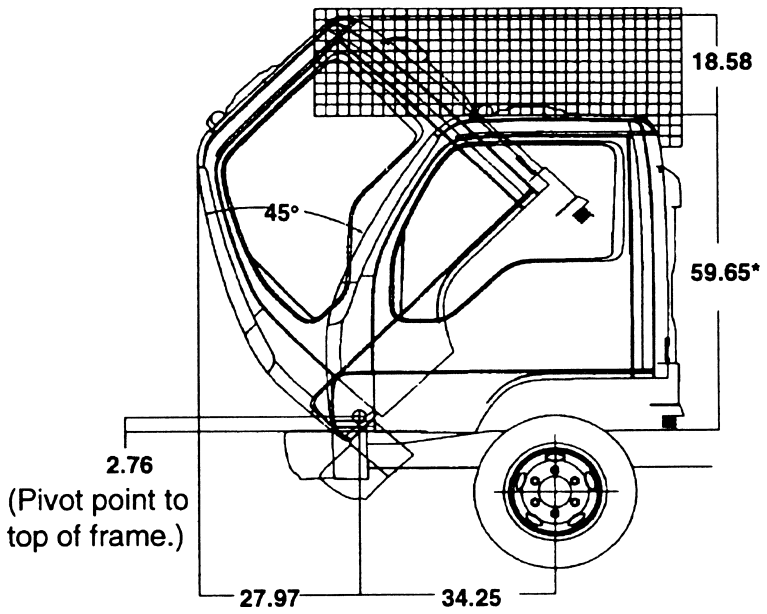
Body Builder Weight Information Chart

GVWR	Axle	Wheelbase								Unsprung Weight
		109 in.		132.5 in.		150 in.		176 in.		
		Man. Trans.	Auto. Trans.	Man. Trans.	Auto. Trans.	Man. Trans.	Auto. Trans.	Man. Trans.	Auto. Trans.	
17,950	Front	3,891	3,880	3,935	3,924	3,979	3,968	4,023	4,012	705
	Rear	2,028	2,028	2,050	2,050	2,072	2,072	2,094	2,094	1,366
	Total	5,919	5,908	5,985	5,974	6,051	6,040	6,117	6,106	2,071

Cab Tilt



GRID SCALE:
One sqare is 2 in x 2 in

NOTE: Roof vent adds 1.5 inches to overall cab height.

RADIUS FROM PIVOT TO OUTER EXTENT OF CAB:
Radius - 79.02

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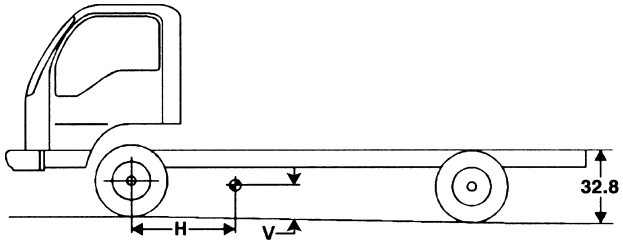
Center of Gravity

The center of gravity of the chassis cab.

GVWR	WB	V	H	
			Manual Trans.	Auto. Trans.
17,950	109	22.1	36.8	37.4
	132.5	20.6	44.7	44.8
	150	20.4	50.6	50.7
	176	18.9	59.4	59.5



V = Vertical Center of Gravity
H = Horizontal Center of Gravity

The center of gravity of the completed vehicle with a full load should not exceed 63 inches above ground level for the **17,950** lb. GVWR, and must be located horizontally between the centerlines of the front and rear axles.

NOTE: The maximum dimensions for a body installed on the NQR/W5500 are 96 inches wide (outside) by 90 inches high (inside). Any larger body applications must be approved by GMICT Application Engineering. In the West Coast, call 1-562-229-5314 and, in the East Coast, call 1-404-257-3013.

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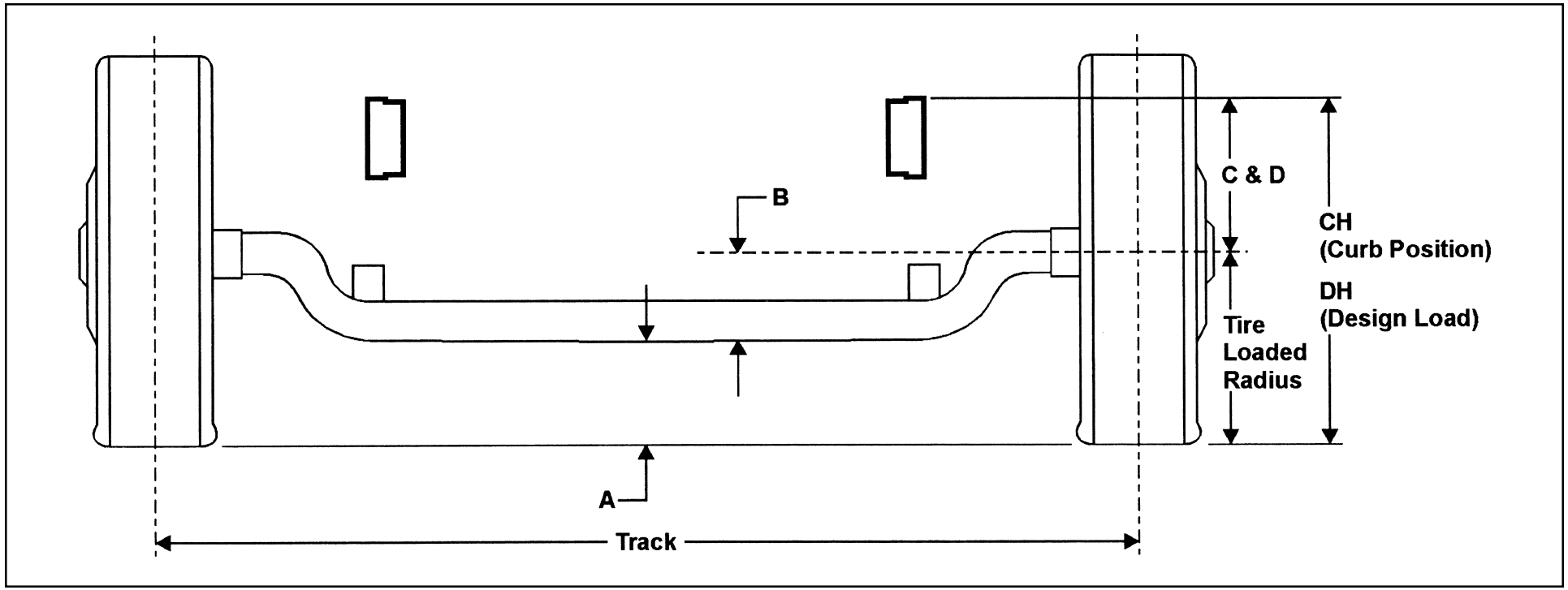
Front Axle Chart



Formulas for calculating height dimensions:

A = Tire Loaded Radius – B
C = Centerline of Axle to Top of Frame Rail at Curb Position
D = Centerline of Axle to Top of Frame Rail at Design Load
CH = C + Tire Unloaded Radius
DH = D + Tire Loaded Radius

Tire	GVWR	GAWR	A	B	C	D	CH	DH	Track	Tire Radius	
										Unload	Load
225/70R 19.5	17,950 lbs.	6,830 lbs.	8.4	7.0	13.6	13.1	29	28.1	66.1	15.4	15.0

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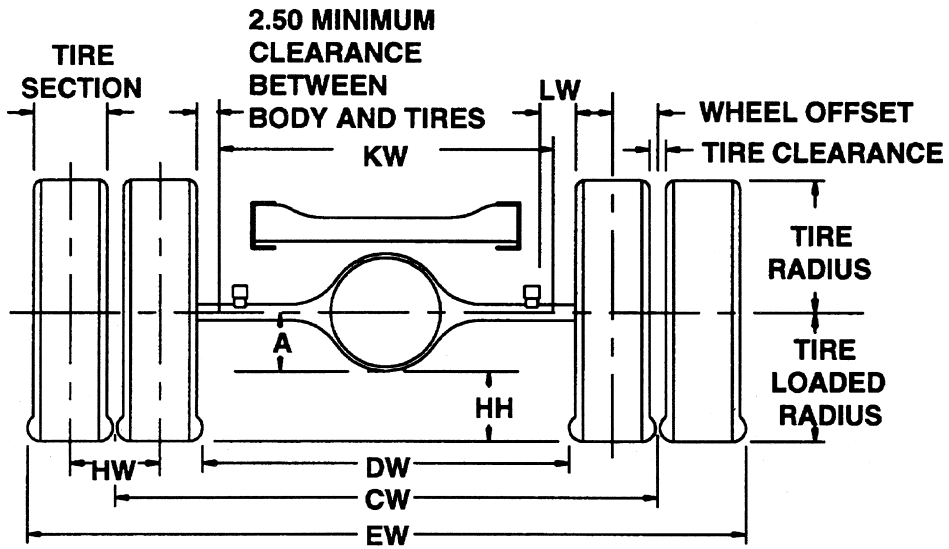
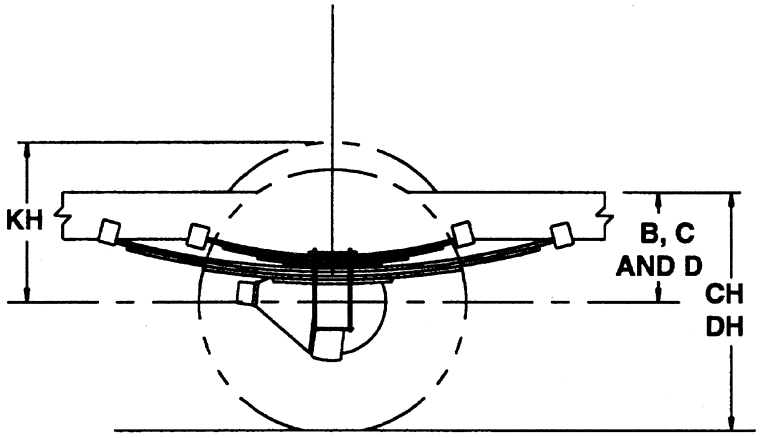
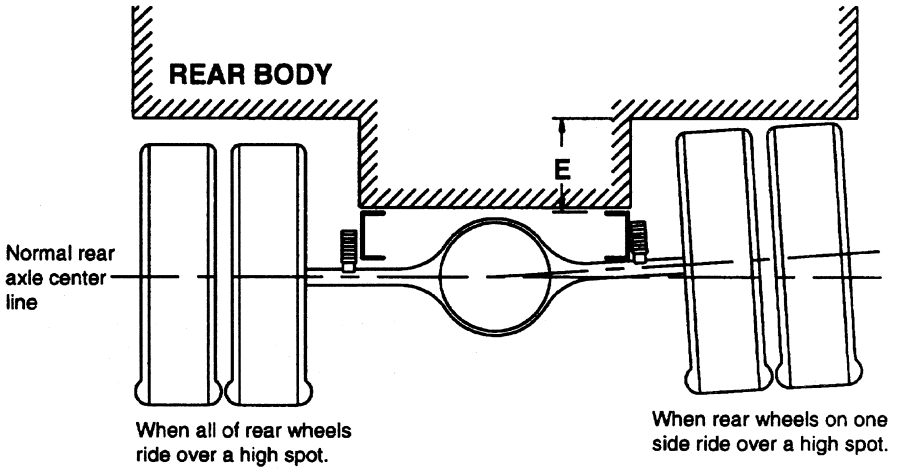
(Vehicle Specifications Index Section – NQR/W5500 Diesel – continued from previous page)

Rear Axle Chart







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Definitions			
A	Centerline of axle to bottom of axle bowl.	DH	Rear Frame Height: Vertical distance between the normal top of frame rail and the ground-line through the centerline of the rear axle at design load.
B	Centerline of axle to top of frame rail at metal-to-metal position.	DW	Minimum distance between the inner surfaces of the rear tires.
C	Centerline of axle to top of frame rail at curb position.	EW	Maximum Rear Width: Overall width of the vehicle measured at the outermost surface of the rear tires.
D	Centerline of axle to top of frame rail at design load.	HH	Rear Tire Clearance: Minimum clearance between the rear axle and the ground-line.
E	Rear Tire Clearance: Minimum clearance required for tires and chain measured from the top of the frame at the vertical centerline of the rear axle, when rear wheels on one side ride over a high spot.	HW	Dual Tire Spacing: Distance between the centerlines of the minimum distance required for tire bounce as measured from the centerline of the rear axle and the top of the rear tire when one wheel rides over a high spot.
CH	Rear Frame Height: Vertical distance between the normal top of frame rail and the ground-line through the centerline of the rear axle at curb position.	CW	Track Dual Rear Wheel Vehicles: Distance between the centerlines of the dual wheels measured at the ground-line.
Tire Section, Tire Radius, Tire Loaded Radius, Tire Clearance		See Tire Chart for Values	

Formulas for Calculating Rear Width and Height Dimensions			
CW	= Track	HH	= Tire loaded radius – A
CH	= Tire loaded radius + C	JH	= KH – B
DH	= Tire loaded radius + D	KH	= Tire radius + 3.00 inches
DW	= Track + 2 tire sections – tire clearance	KW	= DW – 5.00 inches
EW	= Track + 2 tire sections + tire clearance	LW	= 1.00-inch minimum clearance between tires and springs

NOTE: Track and overall width may vary with optional equipment.

Tire	GAWR	Track CW	A	B	C	D	E
225/70R 19.5	12,980 lbs.	65.0	11.6	10.6	14.9	13.0	8.4

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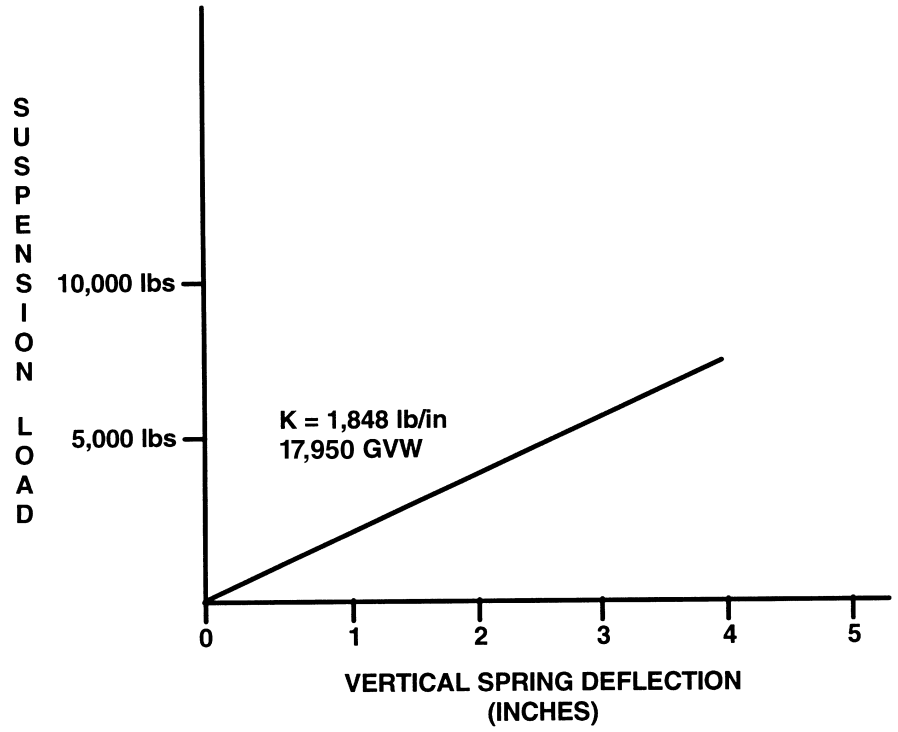
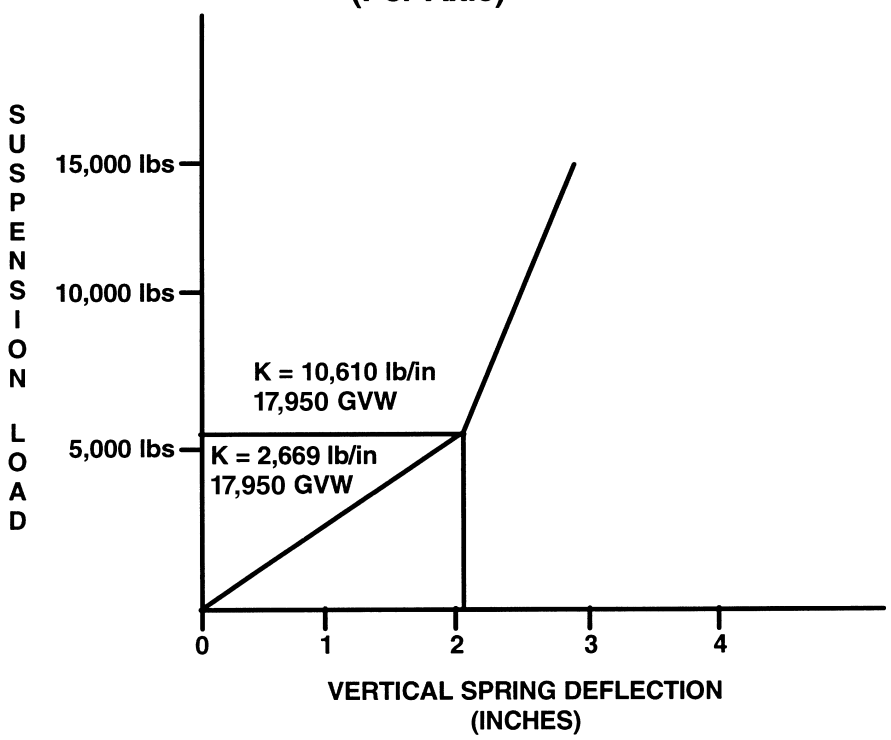
Suspension Deflection Charts

Front Leaf Spring Load vs. Deflection (Per Axle)



Rear Leaf Spring Load vs. Deflection (Per Axle)



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Tire and Disc Wheel Chart

Tire

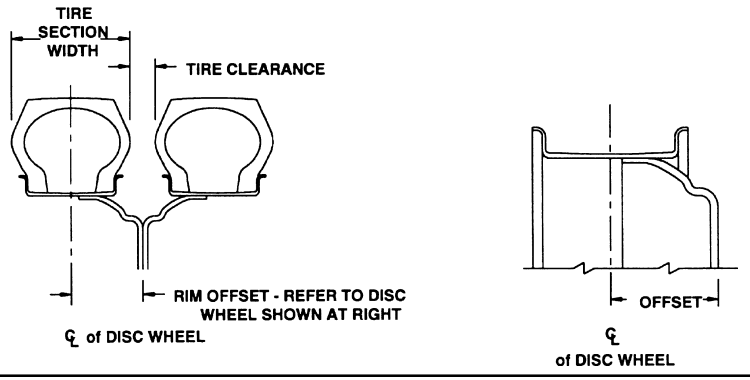
Tire Size	Tire Load Limit and Cold Inflation Pressures				Maximum Tire Load Limits		GVWR (Lb.)
	Single		Dual		Front	Rear	
	Lb.	PSI	Lb.	PSI	2 Single	4 Dual	
225/70R 19.5F	3,450	90	3,245	90	6,900	12,980	17,950

Tire Size	GVWR (Lb.)	Tire Radius				Tire Section Width	Tire Clearance	Design Rim Width
		Loaded		Unloaded				
		Front	Rear	Front	Rear			
225/70R 19.5F	17,950	15.0	15.2	15.4	15.8	8.8	1.2	6.0

Disc Wheel

Wheel Size	Bolt Holes	Bolt Circle Dia.	Ft./Rr. Nut Size*	Rear Stud Size*	Nut/Stud Torque Specs.	Inner Circle	Outside Offset	Disc Thickness	Rim Type	Material Mfg.
19.5 x 6.00 K	6 JIS	8.75	1.6142 (41 mm) BUD HEX	0.8268 (21 mm) SQUARE	325 ft.-lb. (440 N•m)	6.46	5.0	0.39	15° DC	Steel TOPY

* O.D. Wrench Sizes



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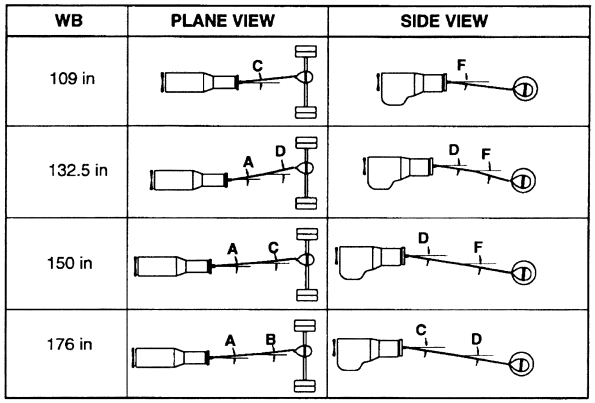
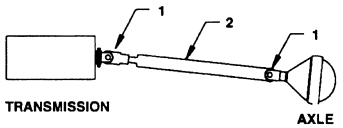
Propeller Shaft



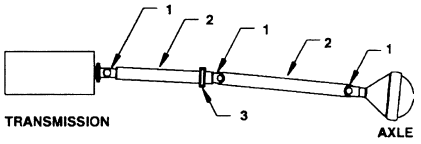
TYPICAL INSTALLATIONS SHOWING YOKES "IN PHASE". "IN PHASE" MEANS THAT THE YOKES AT EITHER END OF A GIVEN PROPELLER SHAFT ASSEMBLY ARE IN THE SAME PLANE.

NPR

(109 in WB)



(132.5 in, 150 and 176 in WB)



1. UNIVERSAL JOINT
2. PROPELLER SHAFT
3. CENTER CARRIER BEARING

Wheelbase	Plane View				Side View			
	A Manual Trans.	A Auto. Trans.	B Manual Trans.	B Auto. Trans.	C Manual Trans.	C Auto. Trans.	D Manual Trans.	D Auto. Trans.
109 in.	—	—	3.1°	3.1°	—	—	9.4°	9.4°
132.5 in.	0°	0°	3.1°	3.1°	4.9°	5.0°	7.3°	7.3°
150 in.	0°	0°	3.1°	3.1°	2.6°	2.6°	7.7°	7.7°
176 in.	0°	0°	2.3°	2.3°	2.8°	2.8°	4.8°	4.8°

NOTE: All driveline angles are at unloaded condition (curb position with typical cargo body).

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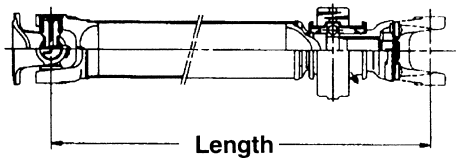
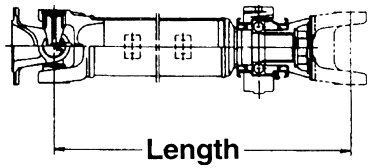
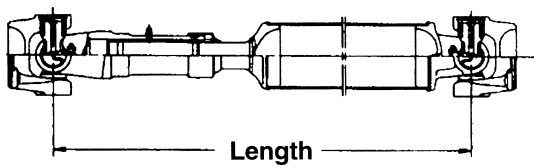
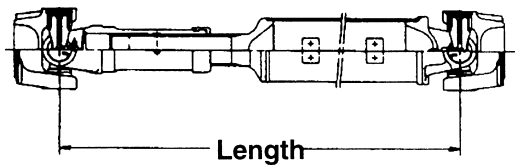
Wheelbase	109		132.5		150		176	
No. of Shafts	1		2		2		2	
Trans. Type	6 Manual Trans.	4 Auto. Trans.	6 Manual Trans.	4 Auto. Trans.	6 Manual Trans.	4 Auto. Trans.	6 Manual Trans.	4 Auto. Trans.
Shaft #1 O.D.	3.54	3.25	3.54	3.25	3.54	3.25	3.54	3.25
Thickness	0.126	0.091	0.126	0.091	0.126	0.091	0.126	0.091
Length	38.7	38.6	24.5	24.3	41.9	41.9	53.7	53.7
Type	D	C	B	A	B	A	B	A
Shaft #2 O.D.	3.54	3.25	3.54	3.25	3.54	3.25	3.54	3.25
Thickness	0.126	0.091	0.126	0.091	0.126	0.091	0.126	0.091
Length	N/A	N/A	38.3	38.3	38.3	38.3	52.6	52.6
Type	N/A	N/A	D	C	D	C	D	C

Type	Description	Model	Illustration
Type **A**	1st shaft in 2-piece driveline	P20	
Type **B**		P30	
Type **C**	1st shaft in 1-piece driveline 2nd shaft in 2-piece driveline	P20	
Type **D**		P30	

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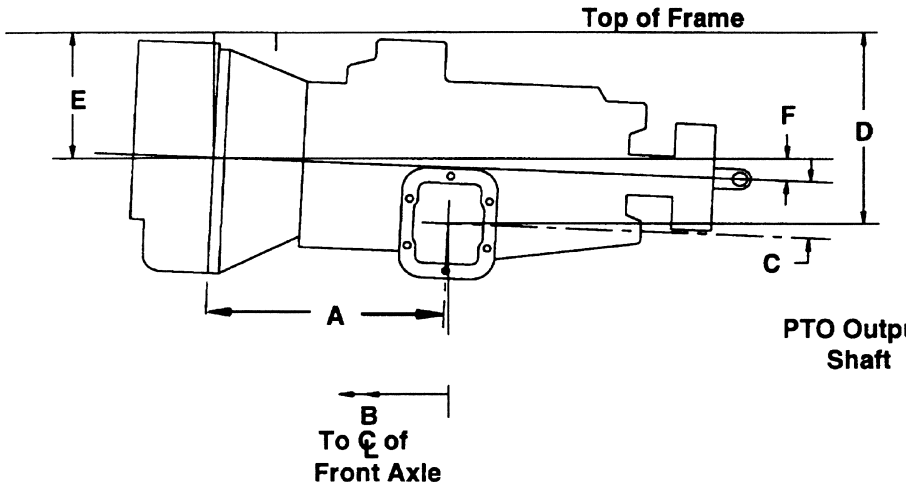
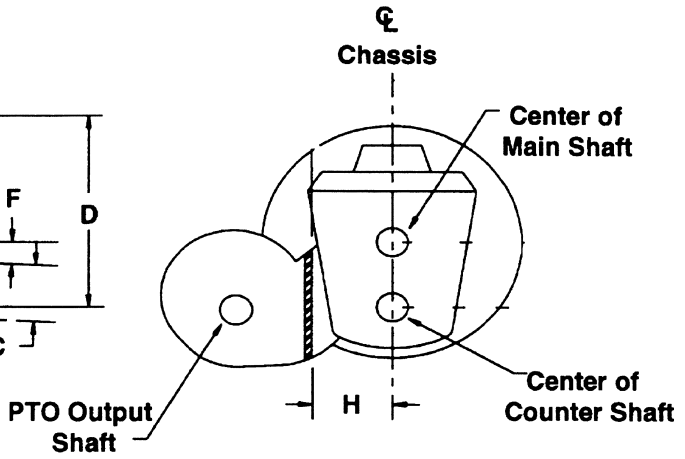
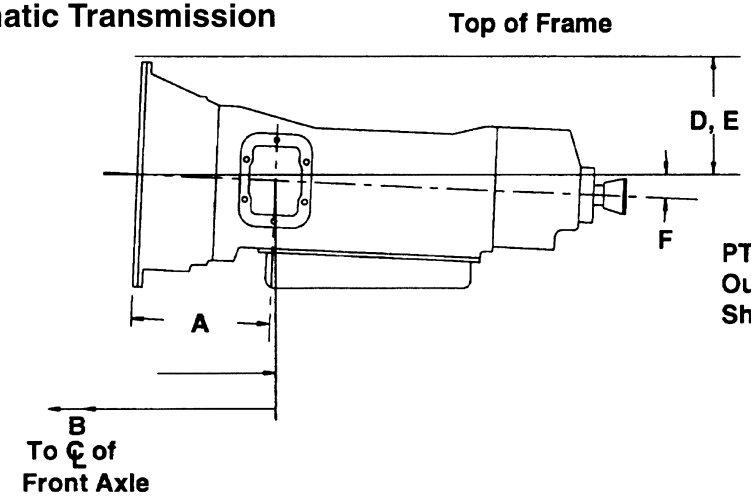
PTO Location, Drive Gear and Opening Information

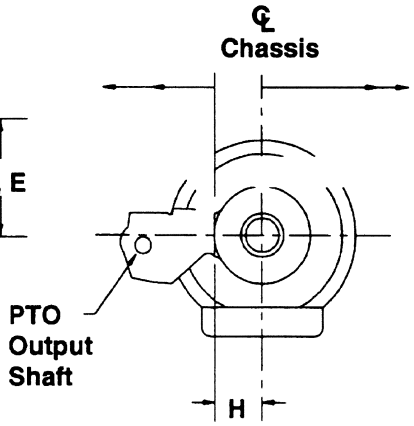
Manual Transmission





Automatic Transmission





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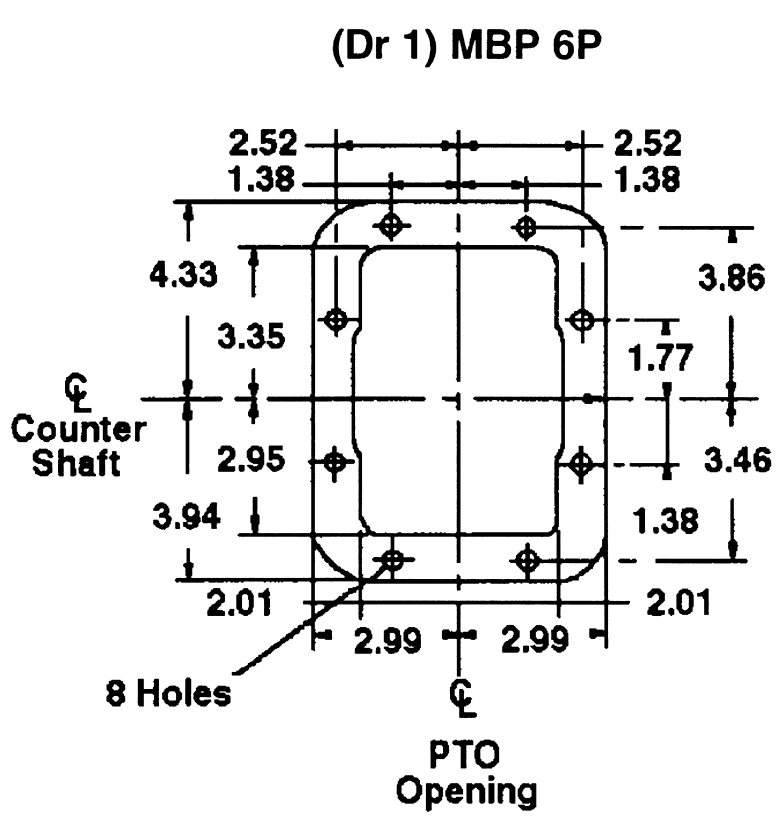
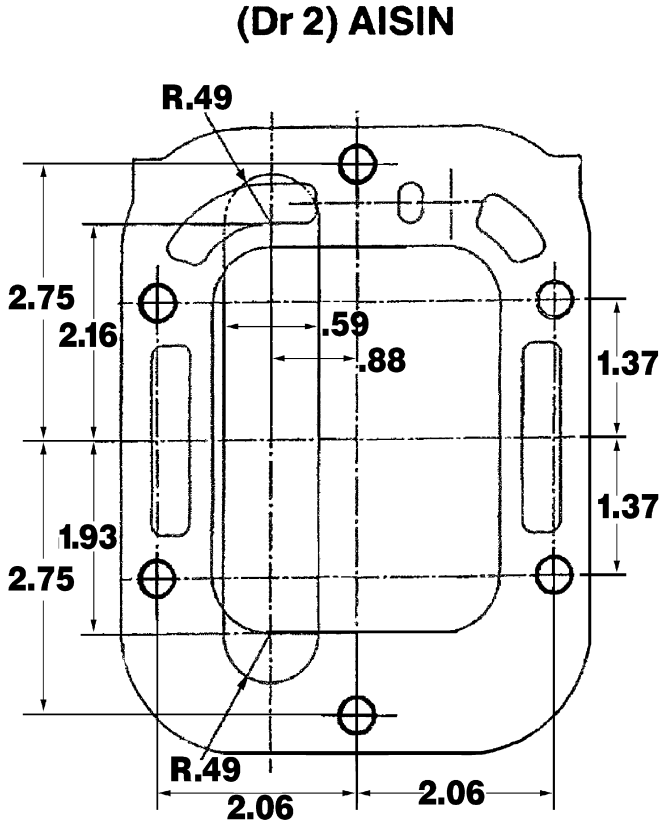
Trans.	Opening Location	Bolt Pattern	A	B	C	D	E	F	H	PTO Drive Gear Location	Ratio of PTO Drv. Gear Spd. to Eng. Spd.	No. of Teeth	Pitch	Helix Angle	Max. Output Torque
MBP 6P	Left	(Dr 1)	10.9	36.9	5.2	13.1	7.7	2.5°	3.9	3rd Gear Trans. Countershaft	20/38 = .526	28	3.5	22° RH	180 lbs.-ft. @ 1,500 RPM
Aisin[1)]	Left	(Dr 2)	12.6	38.59	0	8	7.5	2.5°	4.48	PTO Gear	1:1 with turbine	58	N/A	0°	134 lbs.-ft. @ 1,000 RPM

1) No PTO gear in the 150" WB models

Opening Diagram





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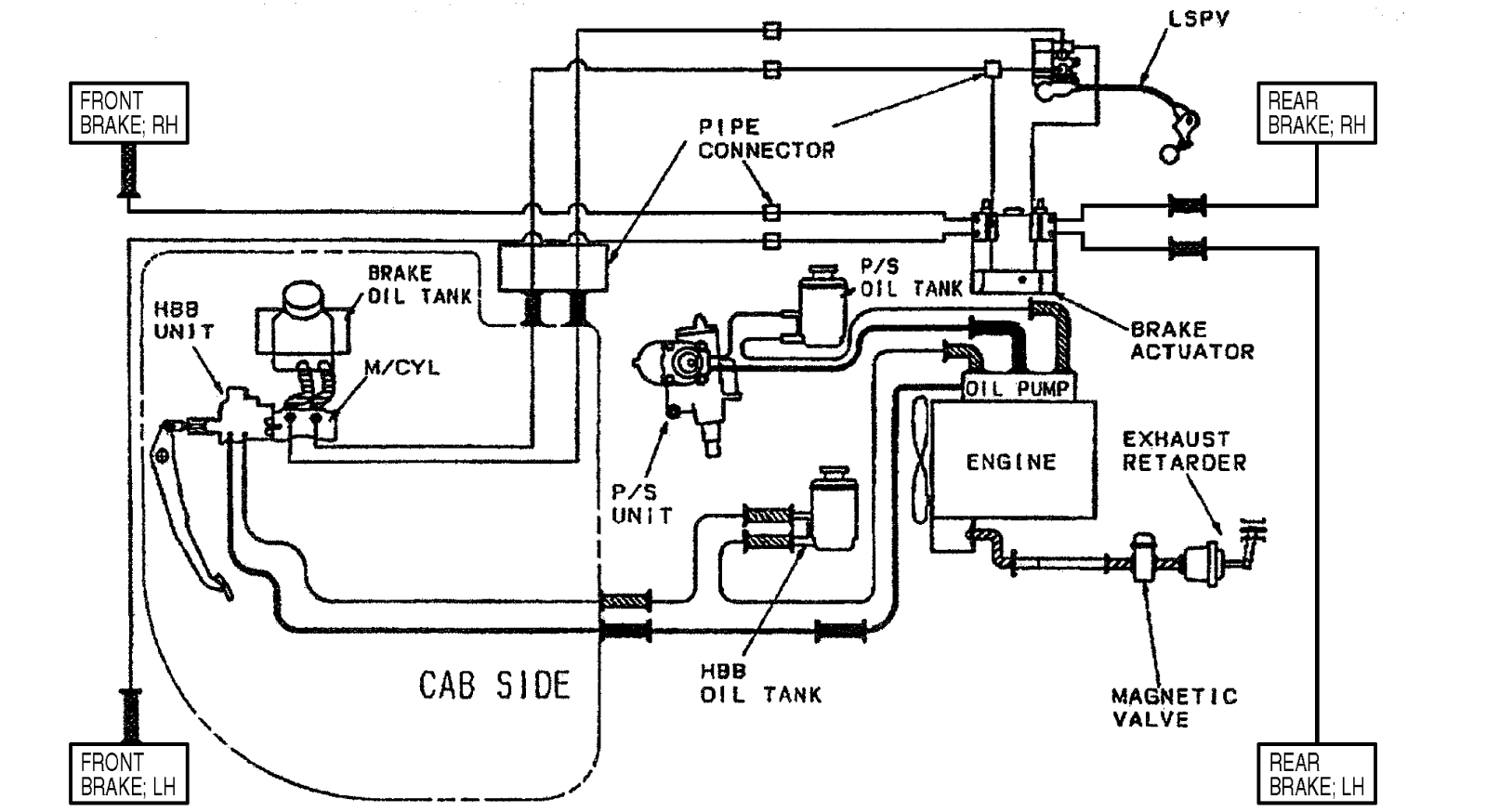
Brake System Diagram

Vacuum Over Hydraulic

Please refer to introduction section of book for antilock system cautions and wheelbase modification requirements.



INDICATION									
NAME	BRAKE HOSE (LOW PRESSURE)	VACUUM HOSE	BRAKE HOSE (HIGH PRESSURE)	VACUUM PIPE	BRAKE PIPE	HYDRAULIC HOSE (HIGH PRESSURE)	HYDRAULIC HOSE (LOW PRESSURE)	HYDRAULIC PIPE (HIGH PRESSURE)	HYDRAULIC PIPE (LOW PRESSURE)

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Diesel Fuel Fill

Installation Instructions

1. Disconnect battery.
2. Loosen hose from the tie downs. Remove caps from plate on rail.
3. Install hoses onto the plate.
4. Extend hose out from the driver's side of the rail to body rail.
5. The filler neck must be mounted to allow the fill plate bracket to be parallel to the frame horizontal (see figure 4).
6. Cover with protector wrap and secure with tie wraps.
7. Filler hose is set for 96 inches outside width body.
8. Filler neck (dimension A) must be between 6.85 inches and 8.5 inches above frame.
9. Secure the filler plate to the bottom of the body and check for leaks.
10. Ensure that fill hose does not sag, creating an area where the fuel could pool in the fill hose.
11. Reconnect battery.

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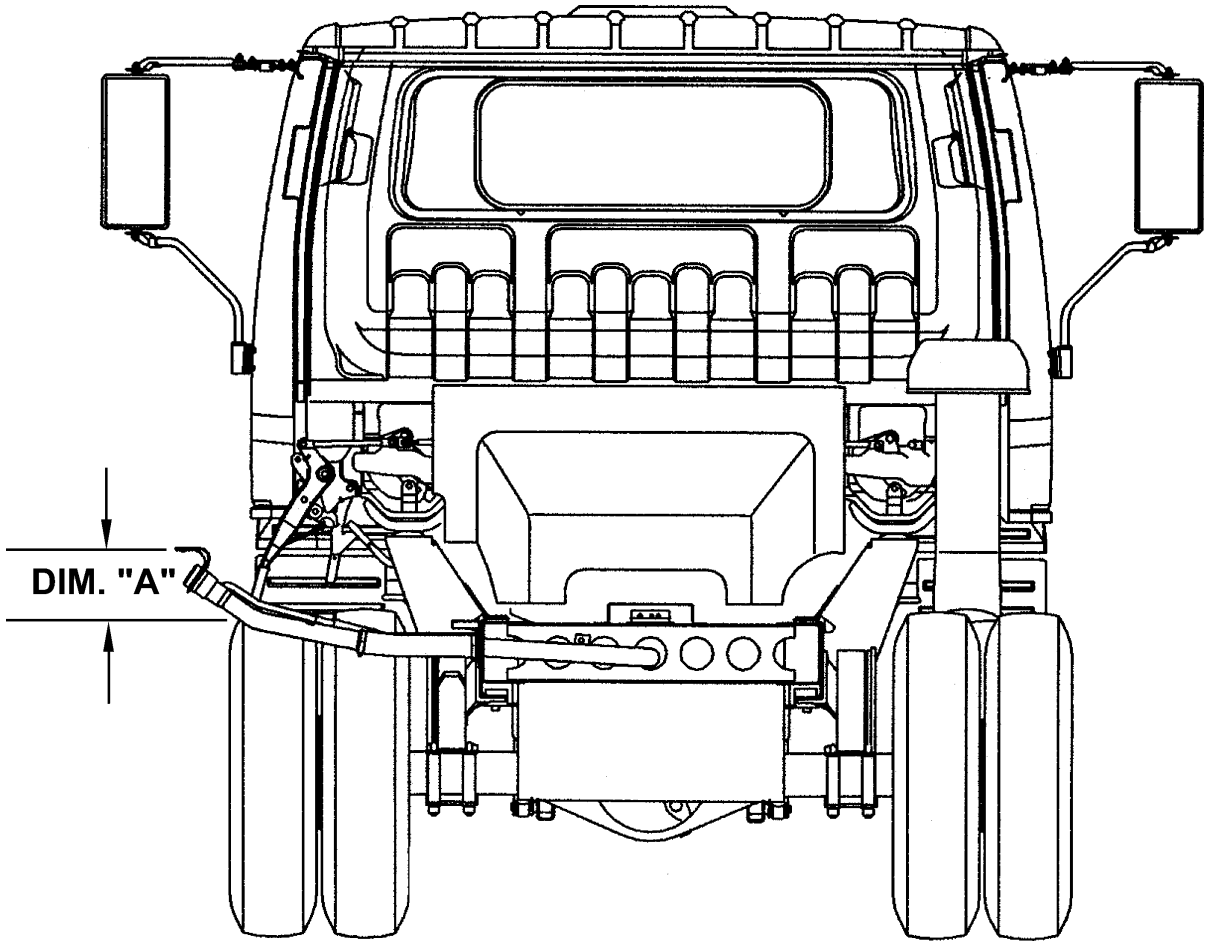
(Vehicle Specifications Index Section – NQR/W5500 Diesel – continued from previous page)

Rear View Fuel Fill

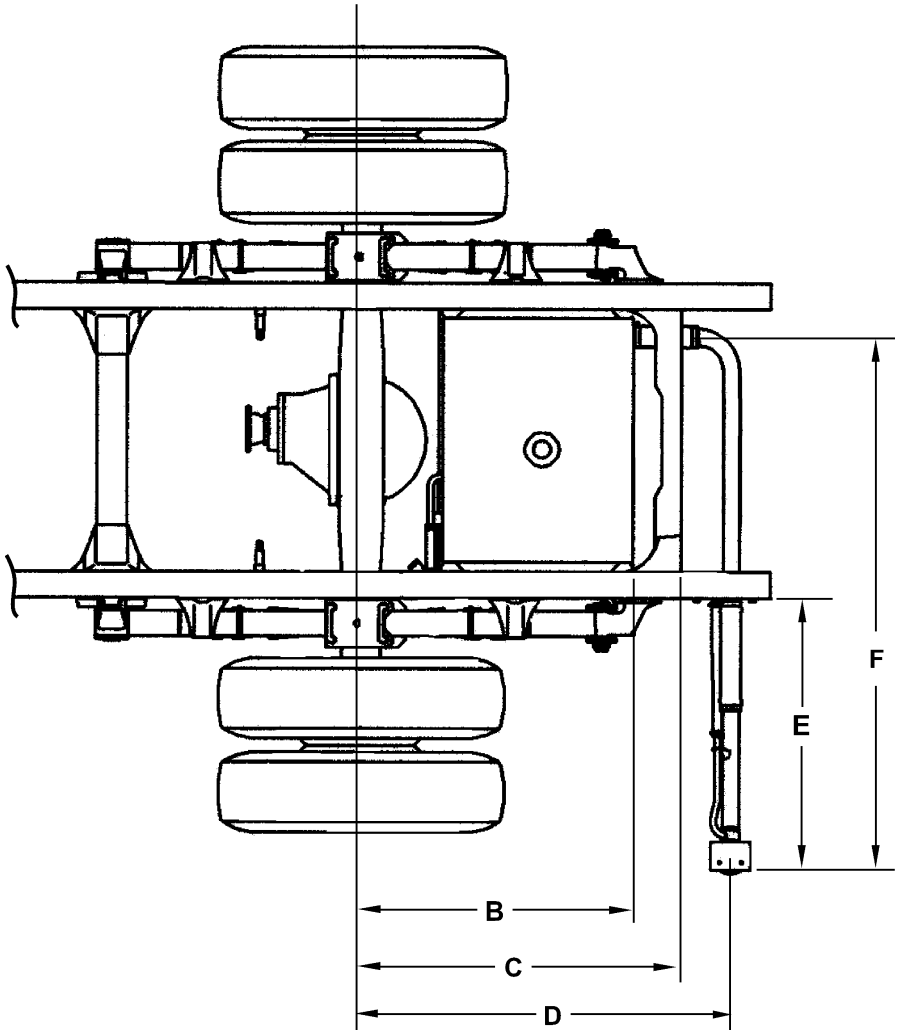


Dimension A = 6.85-8.5 inches (174-216 mm)

(Vehicle Specifications Index Section – NQR/W5500 Diesel – continued on next page)

(Vehicle Specifications Index Section – NQR/W5500 Diesel – continued from previous page)

Top View Fuel Fill



Dimensions:
B = 29.75 inches (756 mm)
C = 34.00 inches (863 mm)
D = 39.29 inches (998 mm)
E = 30.86 inches (784 mm)
F = 56.60 inches (1438 mm)

(Vehicle Specifications Index Section – NQR/W5500 Diesel – continued on next page)

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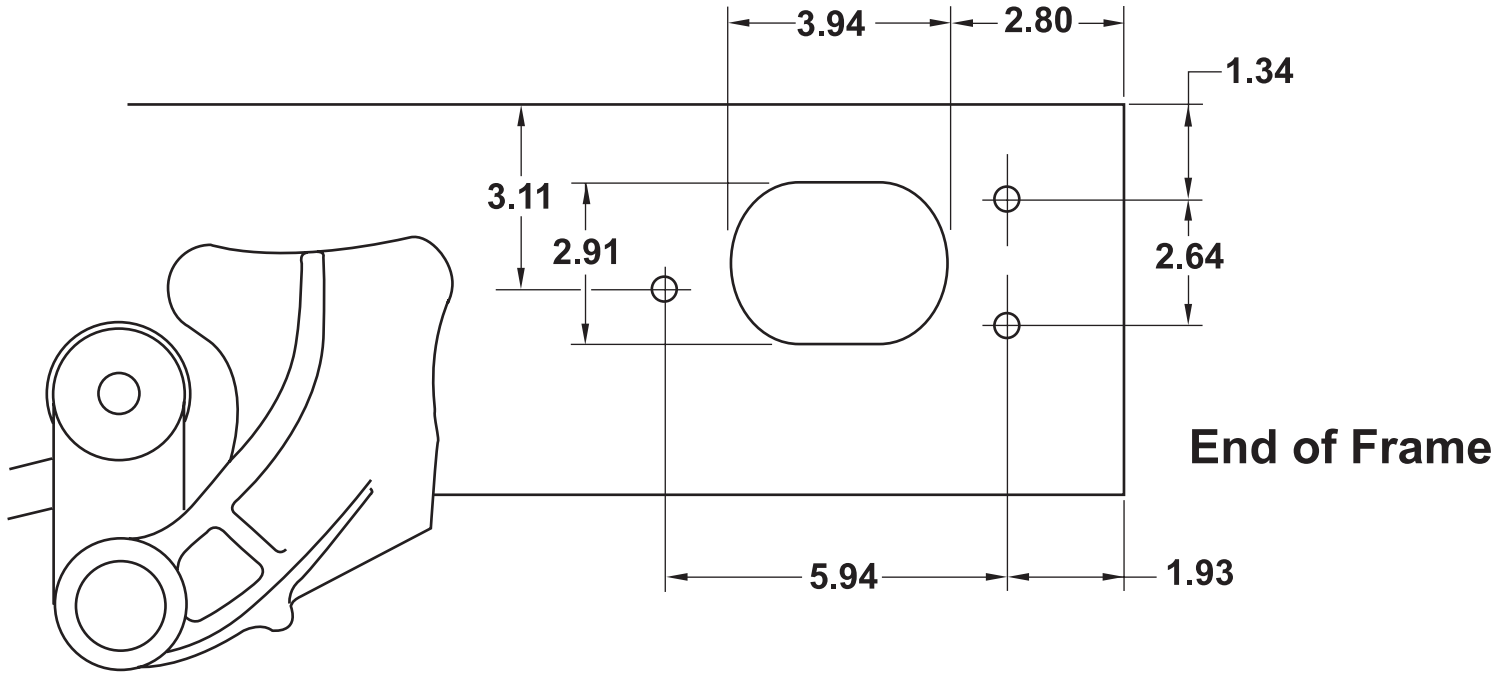
Through the Rail Fuel Fill Frame Hole



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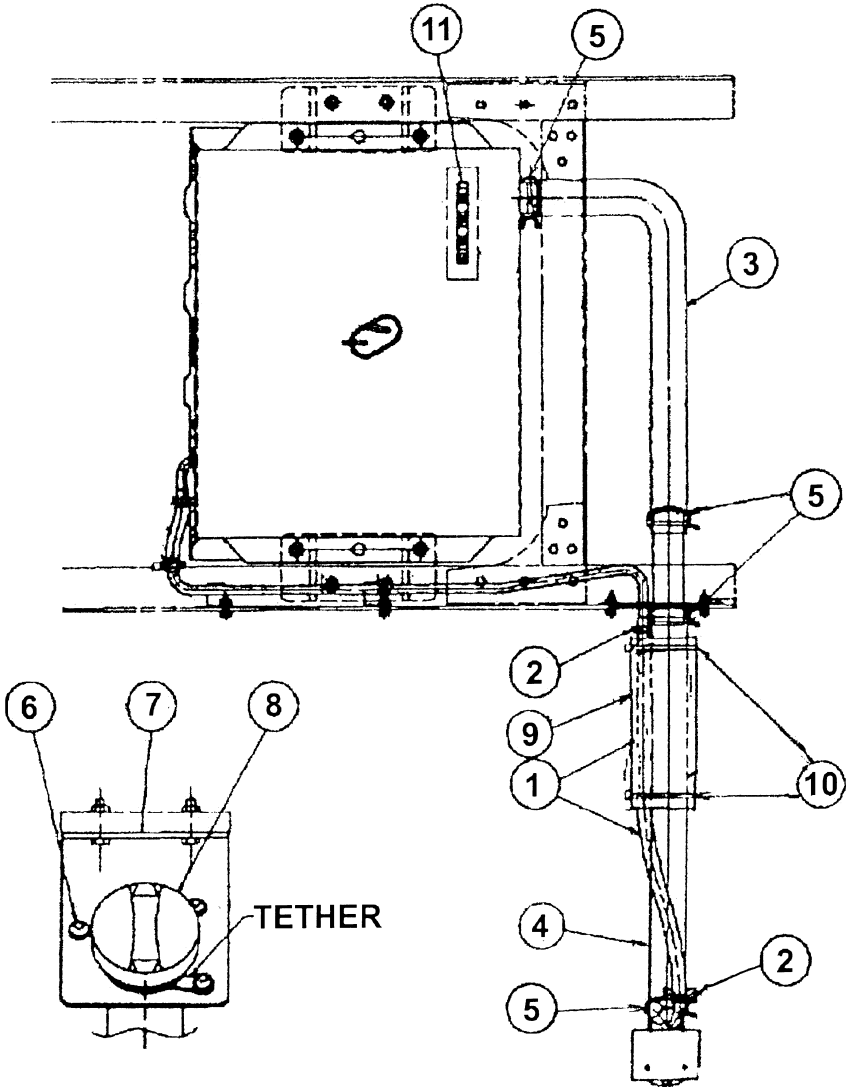
NQR/W5500 Diesel Fuel Fill Parts Illustration



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NQR/W5500 Diesel Fuel Fill Parts List

Number	Part Name	Isuzu Part Number	GM Part Number	Quantity
1	Breather Hose	897206-0420	N/A	1
2	Clip, Rubber Hose	894242-0340	94242034	2
3	Hose, Fuel Filler	897187-8750	97187875	1
4	Hose, Fuel Filler	897253-1400	97253140	1
5	Clip, Filler Hose	894435-8760	97724373	4
6	Screw, Filler Hose	894384-6460	N/A	3
7	Bracket, Filler Neck	897116-621Y	97116621	1
8	Cap, Filler	897118-7020	N/A	1
9	Protector	897114-0630	97114063	1
10	Clip	109707-1070	94062296	2
11	Caution Plate	894414-3530	94414353	1

NPR HD, NQR/W4500, W5500 Crew Cab Diesel

Specifications

Model	NPR HD/W4500 Crew Cab Diesel	NQR/W5500 Crew Cab Diesel
GVWR	14,500 lbs.	17,950 lbs.
WB	150 in., 176 in.	
Engine	Isuzu 4-cylinder, in-line 4-cycle, turbocharged, intercooled, direct injection diesel.	
Model/Displacement	4HE1-TC/290 CID (4.75 liters)	
HP (Gross)	175 HP @ 2,700 RPM	
Torque (Gross)	347 lbs.-ft. torque @ 2,000 RPM	
Equipment	Dry element air cleaner with vertical intake; 2 rows 511.2 in.^{2} radiator; 6-blade 18.7 in. diameter fan with viscous drive. Cold weather starting device and an oil cooler. Engine warning alarm for high water temperature, low water level and low oil pressure.	
Transmission	Aisin 450-43 LE 4-speed overdrive automatic transmission with lock-up capability in 2nd, 3rd and 4th. PTO capability.	
Steering	Integral power steering 20.9:1 ratio. Tilt and telescoping steering column.	
Front Axle	Reverse Elliot "I" Beam rated at 6,830 lbs.	
Suspension	Semi-elliptical steel alloy leaf springs with stabilizer bar and shock absorbers.	
GAWR	5,360 lbs.	6,830 lbs.
Rear Axle	Full-floating single-speed with hypoid gearing rated at 11,020 lbs.	Full-floating single-speed with hypoid gearing rated at 14,550 lbs.
Suspension	Semi-elliptical steel alloy leaf springs and shock absorbers.	
GAWR	9,880 lbs.	12,980 lbs.
Wheels	16 x 6.0 6-hole disc wheels, painted white.	19.5 x 6.0 6-hole disc wheels, painted white.
Tires	215/85R 16E (10 ply) tubeless steel-belted radials, all-season front/rear.	225/70R 19.5F (12 ply) tubeless steel-belted radials, all-season front/rear.
Brakes	Dual-circuit, vacuum-assisted hydraulic service brakes with load-sensing proportioning valve in rear brake circuit and a metering valve between the master cylinder and 6-way joint on the front brake lines.	Dual-circuit, power-assisted hydraulic service brakes with load sensing proportioning valve in rear brake circuit.
	Disc front and self-adjusting outboard mounted read drum. The parking brake is a mechanical, cable-actuated, internal expanding drum type, transmission mounted. The exhaust brake is standard and is vacuum-operated. Four channel antilock brake system.	
Fuel Tank	30-gallon rectangular steel fuel tank mounted in frame rail behind rear axle. Fuel/water separator mounted on rail.	

NOTE: These selected specifications are subject to change without notice.

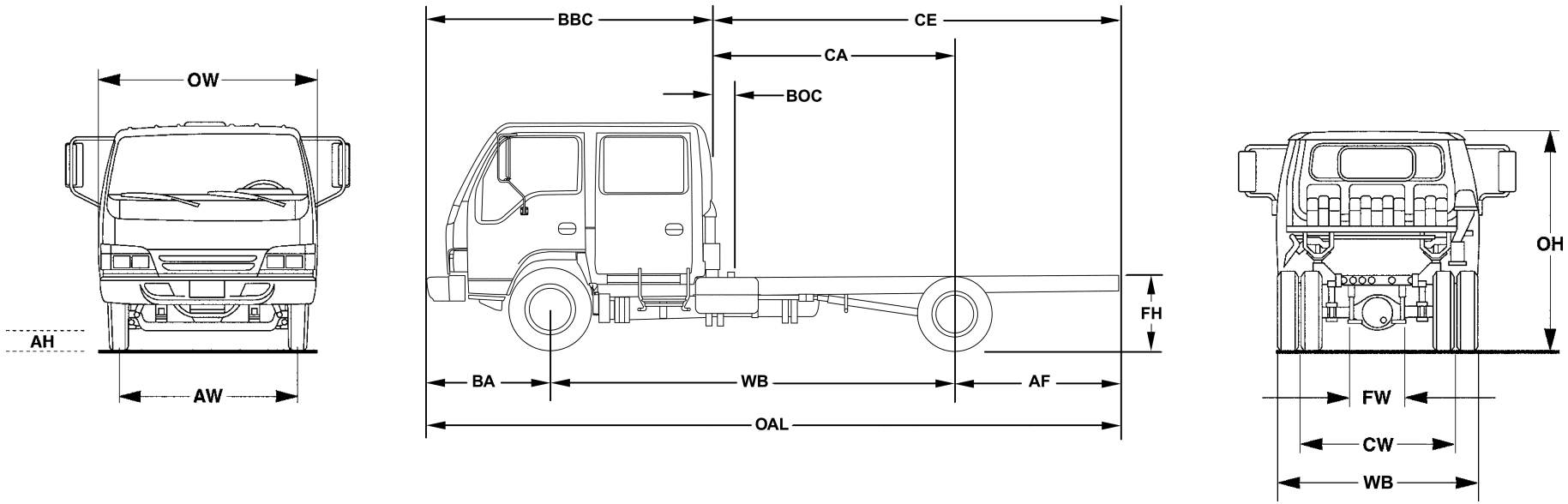
(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued on next page)

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Model	NPR HD/W4500 Crew Cab Diesel	NQR/W5500 Crew Cab Diesel
Frame	Ladder type channel section straight frame rail 33.5 in. wide through the total length of the frame. Yield strength 44,000 psi section modulus 11.89 in.^{3}, RBM 523,160 lbs.-ft./in. per rail.	
Cab	All-steel, 7-passenger, low cab forward, BBC 108.6 in.	
Equipment	Jersey knit covered high back driver's seat with two-occupant passenger seat. Four passenger rear bench seat. Two-way roof ventilator, dual cab mounted exterior mirrors. Tilt and telescoping steering column. Tinted glass.	
Electrical	12-volt, negative ground, dual Delco maintenance-free batteries, 750 CCA each, 80-amp alternator with integral regulator.	
Options	Air Conditioning; AM/FM cassette stereo radio; PTO; engine block heater; engine oil pan heater; 6" stainless steel convex mirrors. Front power window and front/rear power door locks. 33-gallon fuel tank mounted on right-hand rail, spare wheel. Engine shutdown and alarm for high water temperature, low water level and low oil pressure. Rear cab heater, cruise control and engine hour meter.	

NOTE: These selected specifications are subject to change without notice.

Vehicle Weights, Dimensions and Ratings



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NPR HD/W4500 Variable Chassis Dimensions					
Unit	**WB**	**CA***	**CE***	**OAL**	**AF**
Inch	150.0	88.9	132.0	240.5	43.1
Inch	176.0	114.9	158.0	266.5	43.1

* Effective CA & CE are CA or CE less BOC.

NPR HD/W4500 Dimension Constants					
Code	**Inches**	**Code**	**Inches**	**Code**	**Inches**
AH	7.9	BW	83.3	FH	32.0
AW	65.6	CW	65.0		
BA	47.4	FW	33.5		
BBC	108.6	OH	87.4		
BOC	4.2	OW	78.5		

NPR HD/W4500 In-Frame Tank 14,500-lb. GVWR Automatic Transmission Model Chassis Cab and Maximum Payload Weights						
Model	**WB**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
NQ3	150.0 in.	lb.	3,979	2,161	6,140	8,360
NQ4	176.0 in.	lb.	4,056	2,149	6,205	8,295

NPR HD/W4500 Side-Mounted Tank 14,500-lb. GVWR Automatic Transmission Model Chassis Cab and Maximum Payload Weights						
Model	**WB**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
NG3	150.0 in.	lb.	4,167	1,896	6,063	8,437
NG4	176.0 in.	lb.	4,244	1,885	6,129	8,371

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued on next page)

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

NQR/W5500 Variable Chassis Dimensions					
Unit	**WB**	**CA***	**CE***	**OAL**	**AF**
Inch	150.0	129.4	172.5	240.5	43.1
Inch	176.0	155.4	198.5	266.3	43.1

* Effective CA & CE are CA or CE less BOC.

NQR/W5500 Dimension Constants					
Code	**Inches**	**Code**	**Inches**	**Code**	**Inches**
AH	8.6	BW	83.3	FH	32.8
AW	65.6	CW	65.0		
BA	47.4	FW	33.5		
BBC	108.6	OH	88.1		
BOC	4.2	OW	78.5		

NQR/W5500 In-Frame Tank 17,950-lb. GVWR Automatic Transmission Model Chassis Cab and Maximum Payload Weights						
Model	**WB**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
NS3	150.0 in.	lb.	4,167	2,257	6,724	11,226
NS4	176.0 in.	lb.	4,244	2,546	6,790	11,160

NQR/W5500 Side-Mounted Tank 17,950-lb. GVWR Manual Transmission Model Chassis Cab and Maximum Payload Weights						
Model	**WB**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
NS3	150.0 in.	lb.	4,354	2,293	6,647	11,303

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued on next page)

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Vehicle Weight Limits:

	NPR HD/W4500	NQR/W5500
GVWR Designed Maximum	14,500 lbs.	17,950 lbs.
GAWR, Front	5,360 lbs.	6,830 lbs.
GAWR, Rear	9,880 lbs.	12,980 lbs.

Technical Notes:

Chassis Curb Weight reflects standard equipment and fuel. Does not include driver, passenger, payload, body or special equipment.

Maximum Payload Weight is the allowed maximum for equipment, body, payload, driver and passengers and is calculated by subtracting chassis curb weight from the GVWR.

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued on next page)

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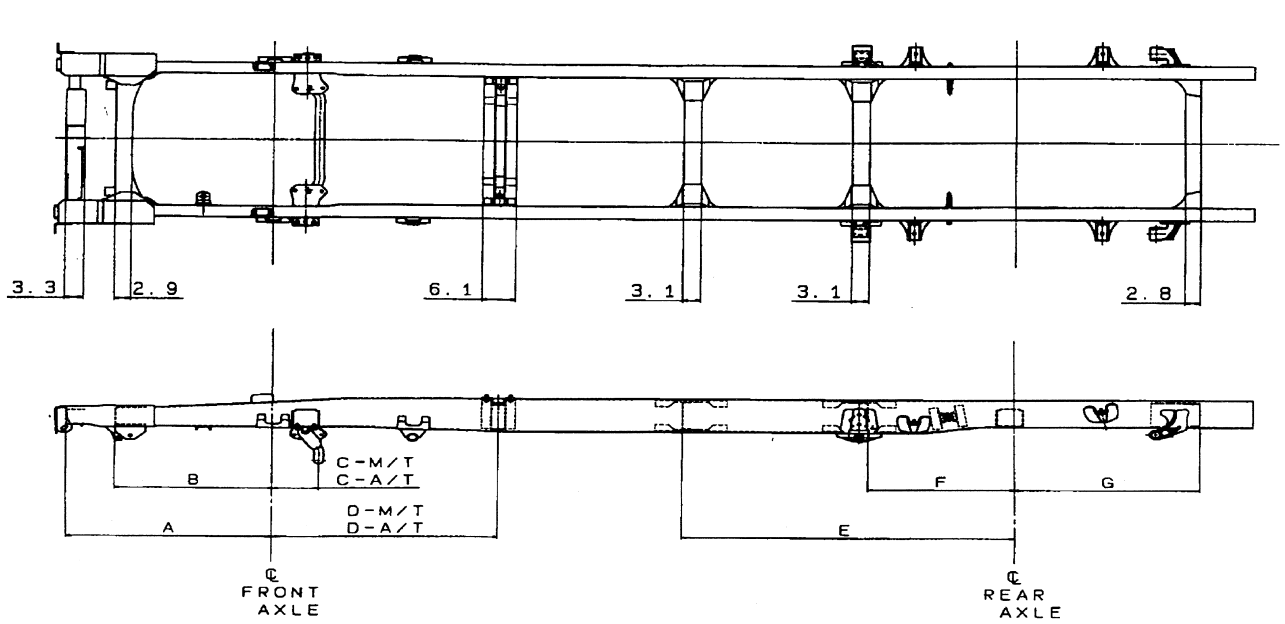
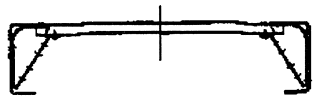
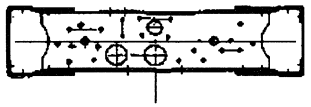
Frame and Crossmember Specifications

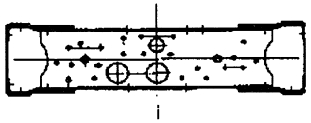




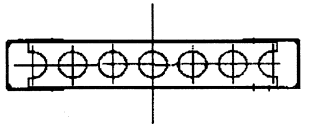
Type AA



Type BB



Type CC



Type DD

Wheelbase	Frame Thick	Crossmember Type/Location								
		A	B	C-M/T	C-A/T	D-M/T	D-A/T	E	F	G
150.0	0.24	37.0 +0.18	28.3	8.1	8.1	AA 40.5	AA 44.7	BB 59.4	CC 26.0	DD 33.0
176.0	0.24	37.0 +0.18	28.3	8.1	8.1	AA 40.5	AA 44.7	BB 59.4	CC 26.0	DD 33.0

M/T = Manual Transmission A/T = Automatic Transmission

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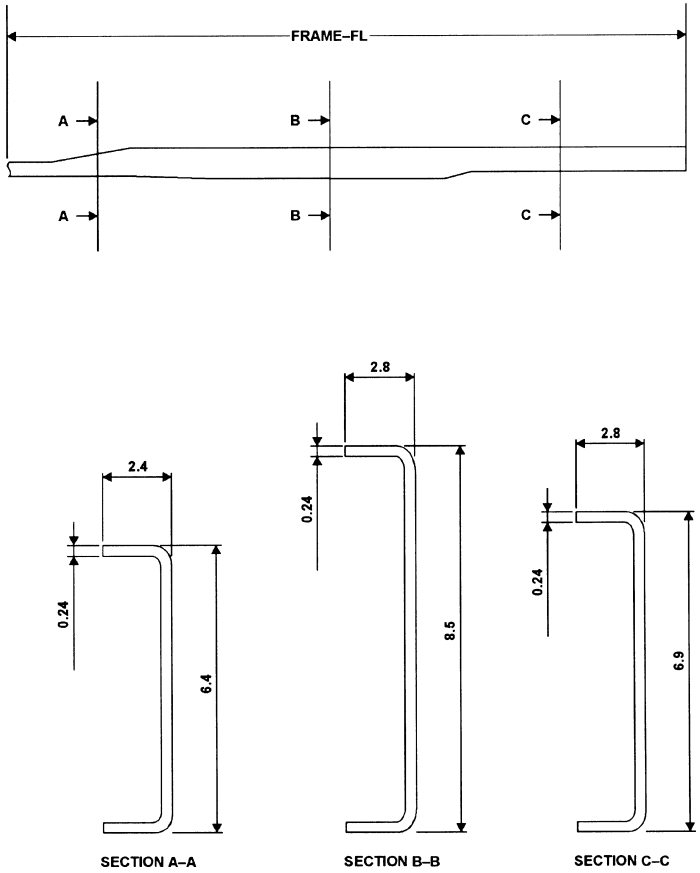
Frame Chart



Wheelbase	Frame FL	Frame Thickness
150.0	227.4	0.24 + 0.18
176.0	253.4	0.24 + 0.18

Note: On this model chassis, GMICT will require that the body installed on the chassis have an understructure manufactured with any of the following structural steel “C” channels: 4" x 1-5/8", 7.5 lb./ft.; 5" x 1-3/4", 6, 7 or 9.0 lb./ft.; 6" x 2", 8.2, 10.5 or 13 lb./ft.

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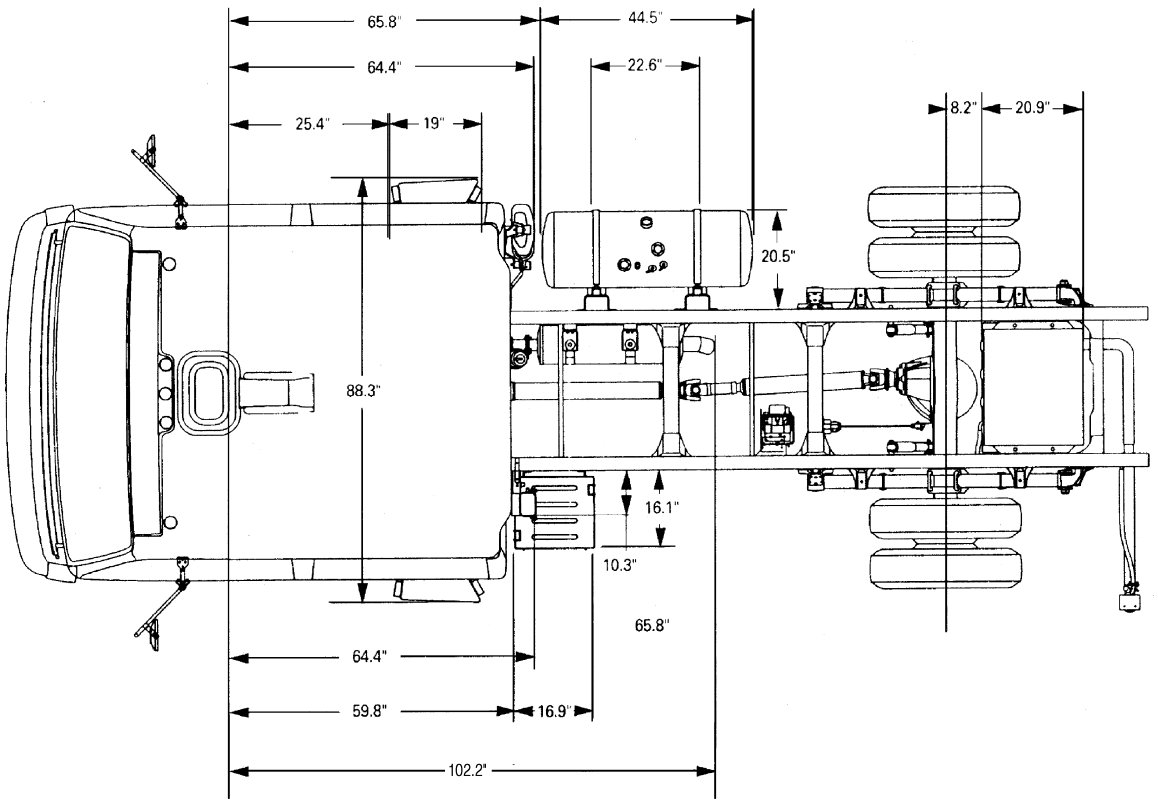
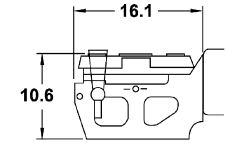
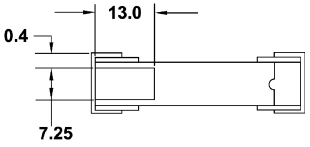
Auxiliary Views

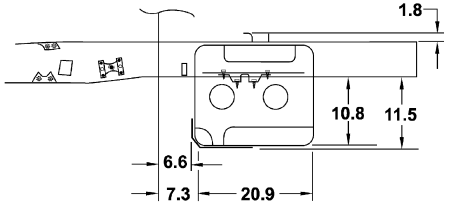




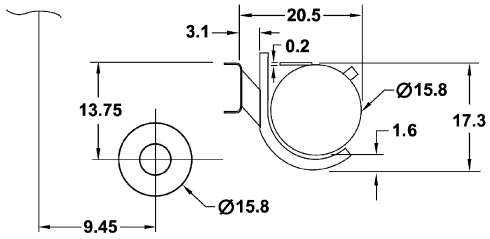
Rear View Battery Box



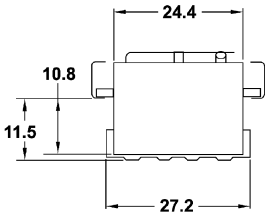
Rear View ABS Controller



Side View In Frame Tank



Rear View Fuel Tank



Rear View In Frame Tank

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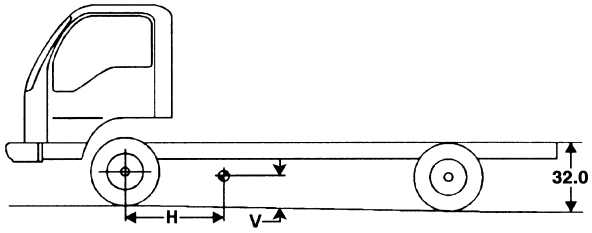
Body Builder Weight Information Chart

NPR Series/W4500

GVWR	Axle	Wheelbase		Unsprung Weight
		150 in. – Automatic Trans.	176 in. – Automatic Trans.	
14,500	Front	3,979	4,056	573
	Rear	2,161	2,149	904
	Total	6,140	6,205	1,477

Center of Gravity

GVWR	WB	V	H
			Automatic Transmission
14,500	150	21.4	52.8
	176	20.0	60.9



V = Vertical Center of Gravity
H = Horizontal Center of Gravity

The center of gravity of the completed vehicle with a full load should not exceed **58** inches above ground level for the **14,500** lb. GVWR, and must be located horizontally between the centerlines of the front and rear axles.

NOTE: The maximum dimensions for a body installed on the NQR/W5500 are 96 inches wide (outside) by 90 inches high (inside). Any larger body applications must be approved by GMICT Application Engineering. In the West Coast, call 1-562-229-5314 and, in the East Coast, call 1-404-257-3013.

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued on next page)

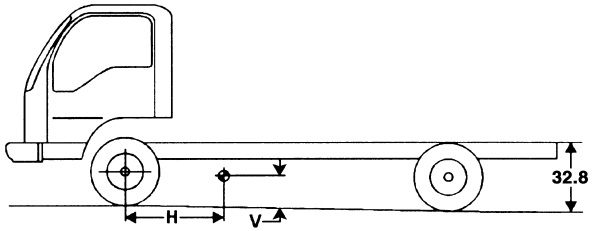
(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

NPR Series/W5500

GVWR	Axle	Wheelbase		Unsprung Weight
		150 in. – Automatic Trans.	176 in. – Automatic Trans.	
17,950	Front	4,167	4,244	705
	Rear	2,257	2,546	1,366
	Total	6,724	6,790	2,071

Center of Gravity

GVWR	WB	V	H
			Automatic Transmission
17,950	150	21.3	57.0
	176	19.9	66.0



V = Vertical Center of Gravity
H = Horizontal Center of Gravity

The center of gravity of the completed vehicle with a full load should not exceed 63 inches above ground level for the **17,950** lb. GVWR, and must be located horizontally between the centerlines of the front and rear axles.

NOTE: The maximum dimensions for a body installed on the NQR/W5500 are 96 inches wide (outside) by 90 inches high (inside). Any larger body applications must be approved by GMICT Application Engineering. In the West Coast, call 1-562-229-5314 and, in the East Coast, call 1-404-257-3013.

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued on next page)

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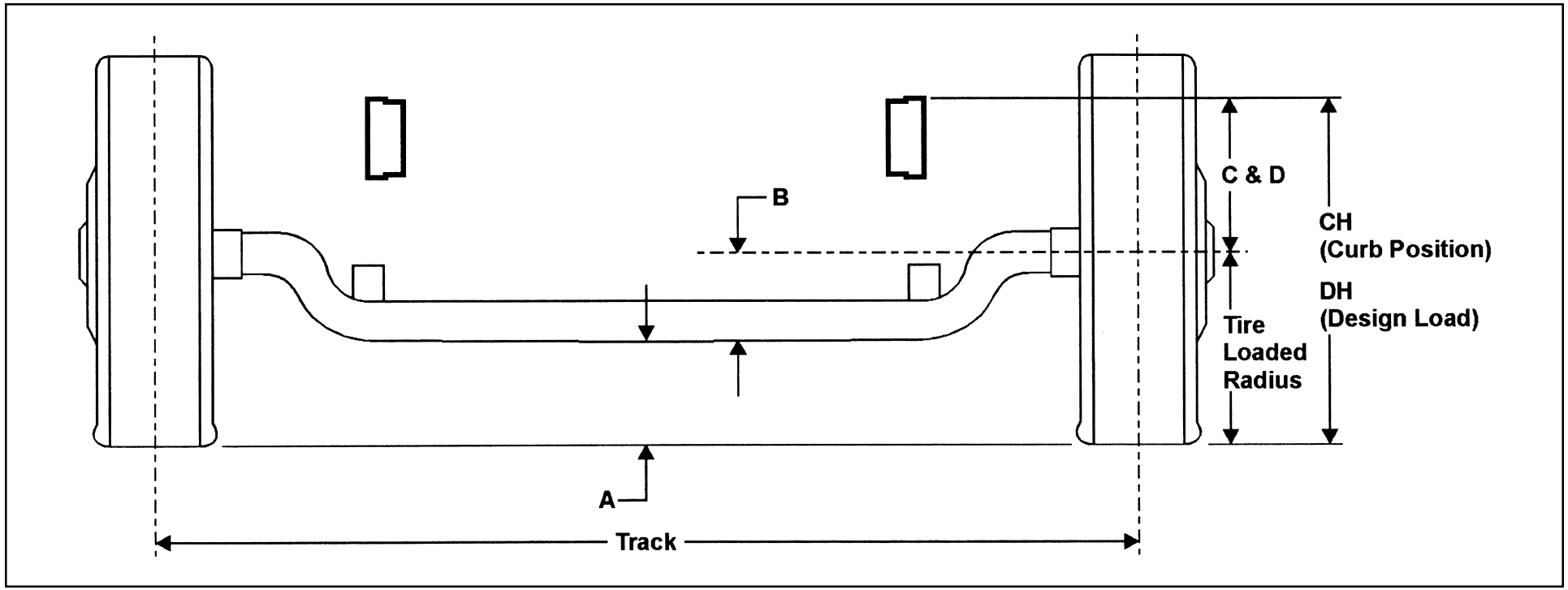
Front Axle Chart NPR HD/W4500



Formulas for calculating height dimensions:

A = Tire Loaded Radius – B
C = Centerline of Axle to Top of Frame Rail at Curb Position
D = Centerline of Axle to Top of Frame Rail at Design Load
CH = C + Tire Unloaded Radius
DH = D + Tire Loaded Radius

Tire	GVWR	GAWR	A	B	C	D	CH	DH	Track	Tire Radius	
										Unload	Load
215/85R 16E	14,500 lbs.	5,360 lbs.	7.7	6.4	13.0	12.5	27.3	26.6	65.6	14.3	14.1

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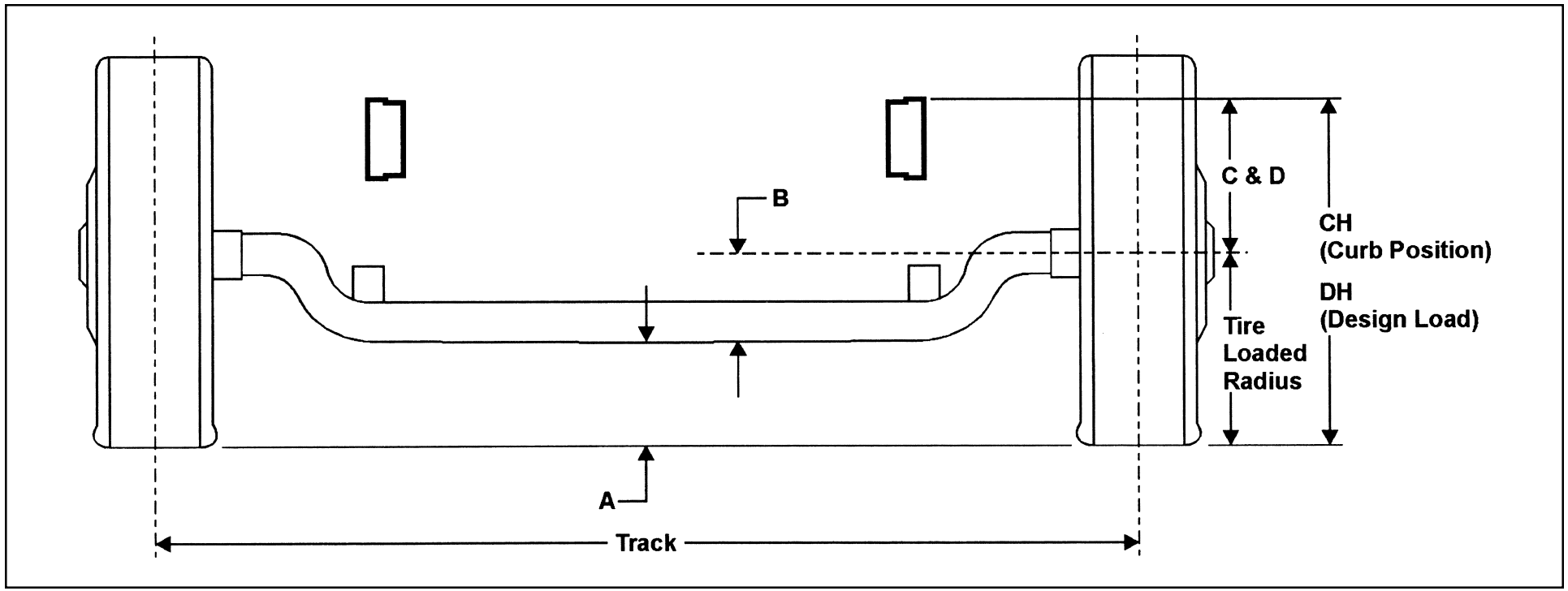
Front Axle Chart NQR/W5500



Formulas for calculating height dimensions:

A = Tire Loaded Radius – B
C = Centerline of Axle to Top of Frame Rail at Curb Position
D = Centerline of Axle to Top of Frame Rail at Design Load
CH = C + Tire Unloaded Radius
DH = D + Tire Loaded Radius

Tire	GVWR	GAWR	A	B	C	D	CH	DH	Track	Tire Radius	
										Unload	Load
225/70R 19.5	17,950 lbs.	6,830 lbs.	8.4	7.0	13.6	13.1	29	28.1	66.1	15.4	15.0

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued on next page)

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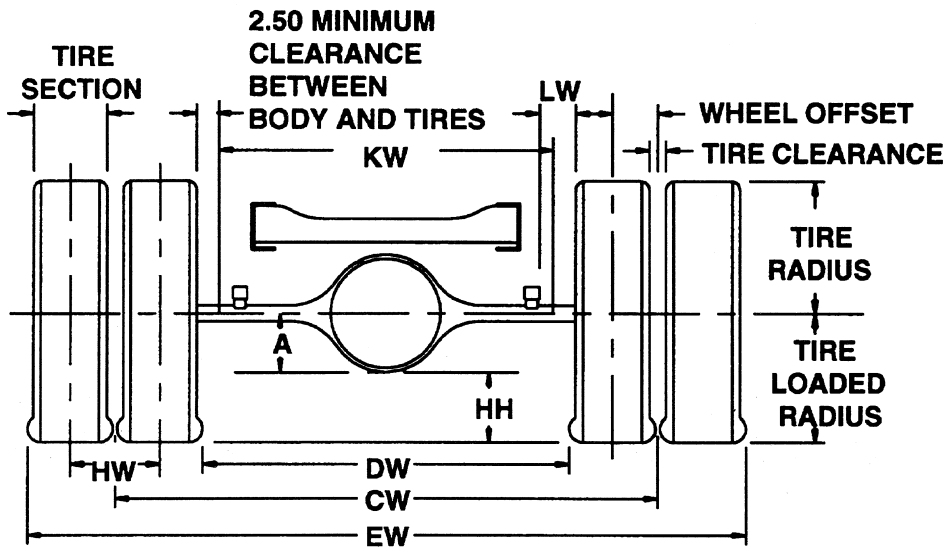
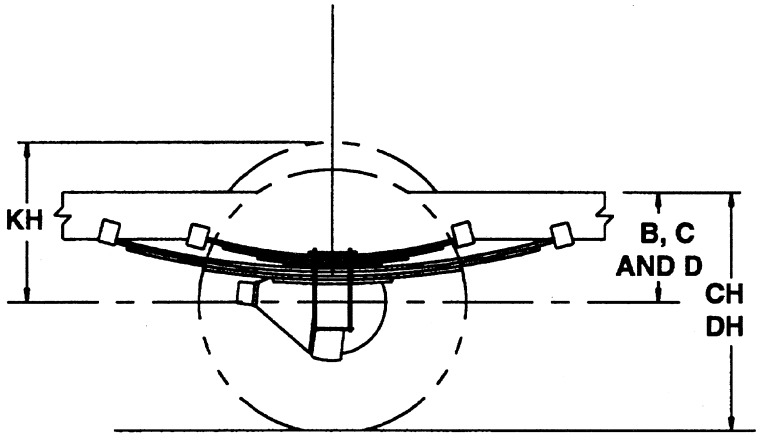
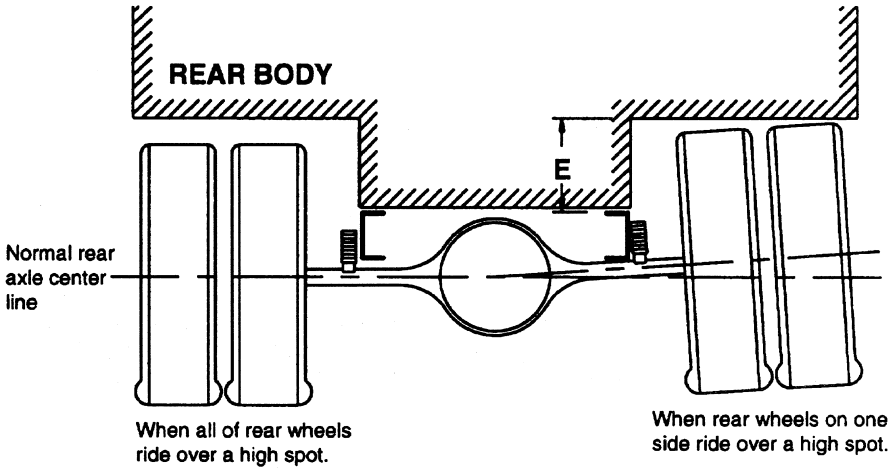
Rear Axle Chart NPR HD/W4500







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(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Definitions			
A	Centerline of axle to bottom of axle bowl.	DH	Rear Frame Height: Vertical distance between the normal top of frame rail and the ground-line through the centerline of the rear axle at design load.
B	Centerline of axle to top of frame rail at metal-to-metal position.	DW	Minimum distance between the inner surfaces of the rear tires.
C	Centerline of axle to top of frame rail at curb position.	EW	Maximum Rear Width: Overall width of the vehicle measured at the outermost surface of the rear tires.
D	Centerline of axle to top of frame rail at design load.	HH	Rear Tire Clearance: Minimum clearance between the rear axle and the ground-line.
E	Rear Tire Clearance: Minimum clearance required for tires and chain measured from the top of the frame at the vertical centerline of the rear axle, when rear wheels on one side ride over a high spot.	HW	Dual Tire Spacing: Distance between the centerlines of the minimum distance required for tire bounce as measured from the centerline of the rear axle and the top of the rear tire when one wheel rides over a high spot.
CH	Rear Frame Height: Vertical distance between the normal top of frame rail and the ground-line through the centerline of the rear axle at curb position.	CW	Track Dual Rear Wheel Vehicles: Distance between the centerlines of the dual wheels measured at the ground-line.
Tire Section, Tire Radius, Tire Loaded Radius, Tire Clearance		See Tire Chart for Values	

Formulas for Calculating Rear Width and Height Dimensions			
CW	= Track	HH	= Tire loaded radius – A
CH	= Tire loaded radius + C	JH	= KH – B
DH	= Tire loaded radius + D	KH	= Tire radius + 3.00 inches
DW	= Track + 2 tire sections – tire clearance	KW	= DW – 5.00 inches
EW	= Track + 2 tire sections + tire clearance	LW	= 1.00-inch minimum clearance between tires and springs

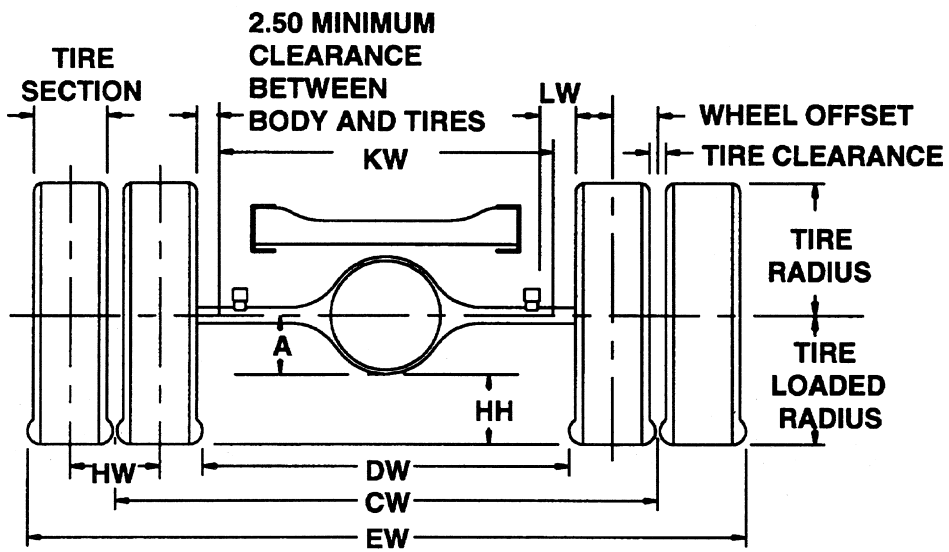
NOTE: Track and overall width may vary with optional equipment.

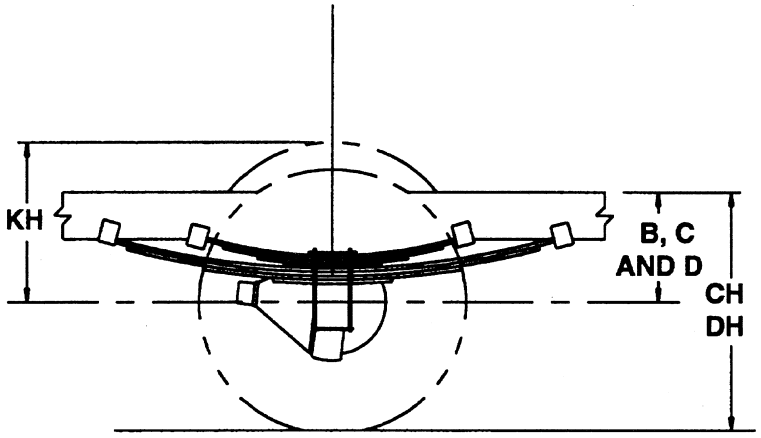
Tire	GAWR	Track CW	A	B	C	D	E
215/85R 16E	9,880 lbs.	65.0	10.6	10.6	14.9	13.3	7.8

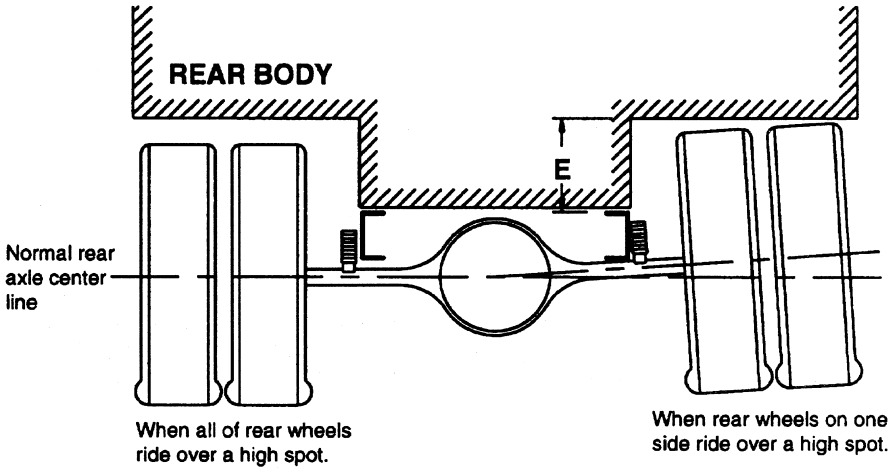
(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued on next page)

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Rear Axle Chart NQR/W5500







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(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Definitions			
A	Centerline of axle to bottom of axle bowl.	DH	Rear Frame Height: Vertical distance between the normal top of frame rail and the ground-line through the centerline of the rear axle at design load.
B	Centerline of axle to top of frame rail at metal-to-metal position.	DW	Minimum distance between the inner surfaces of the rear tires.
C	Centerline of axle to top of frame rail at curb position.	EW	Maximum Rear Width: Overall width of the vehicle measured at the outermost surface of the rear tires.
D	Centerline of axle to top of frame rail at design load.	HH	Rear Tire Clearance: Minimum clearance between the rear axle and the ground-line.
E	Rear Tire Clearance: Minimum clearance required for tires and chain measured from the top of the frame at the vertical centerline of the rear axle, when rear wheels on one side ride over a high spot.	HW	Dual Tire Spacing: Distance between the centerlines of the minimum distance required for tire bounce as measured from the centerline of the rear axle and the top of the rear tire when one wheel rides over a high spot.
CH	Rear Frame Height: Vertical distance between the normal top of frame rail and the ground-line through the centerline of the rear axle at curb position.	CW	Track Dual Rear Wheel Vehicles: Distance between the centerlines of the dual wheels measured at the ground-line.
Tire Section, Tire Radius, Tire Loaded Radius, Tire Clearance		See Tire Chart for Values	

Formulas for Calculating Rear Width and Height Dimensions			
CW	= Track	HH	= Tire loaded radius – A
CH	= Tire loaded radius + C	JH	= KH – B
DH	= Tire loaded radius + D	KH	= Tire radius + 3.00 inches
DW	= Track + 2 tire sections – tire clearance	KW	= DW – 5.00 inches
EW	= Track + 2 tire sections + tire clearance	LW	= 1.00-inch minimum clearance between tires and springs

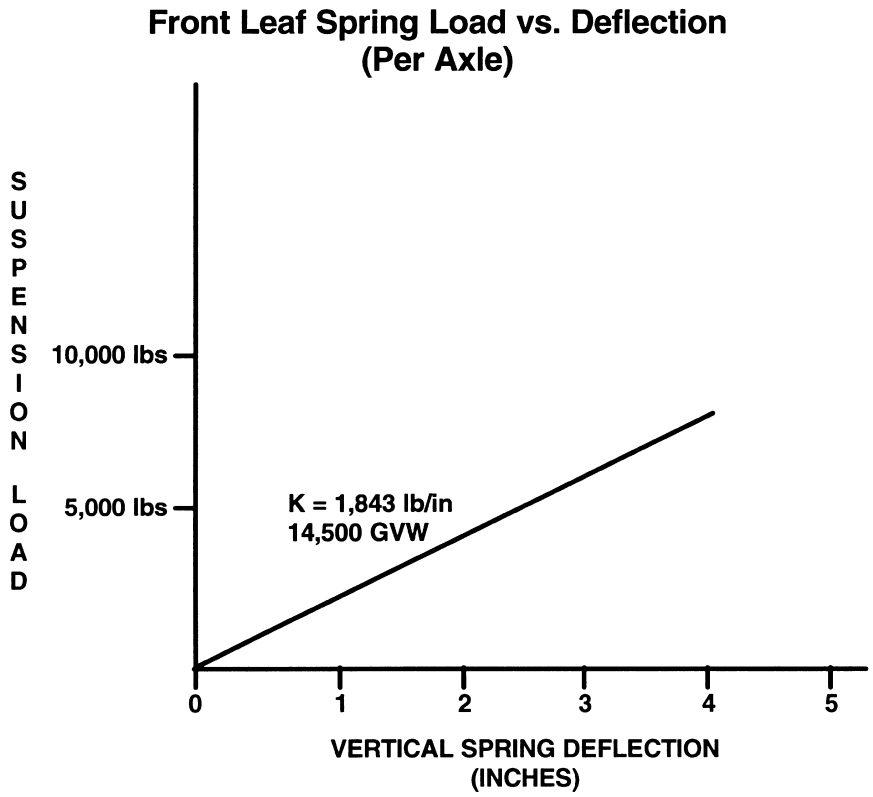
NOTE: Track and overall width may vary with optional equipment.

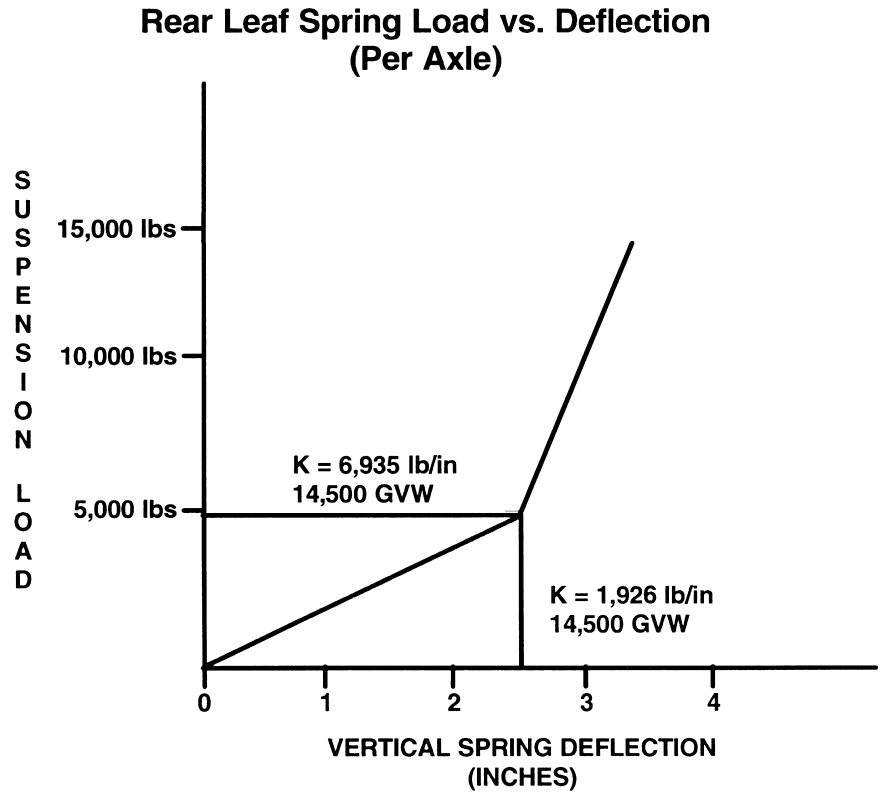
Tire	GAWR	Track CW	A	B	C	D	E
225/70R 19.5	12,980 lbs.	65.0	11.6	10.6	14.9	13.0	8.4

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued on next page)

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Suspension Deflection Charts NPR HD/W4500





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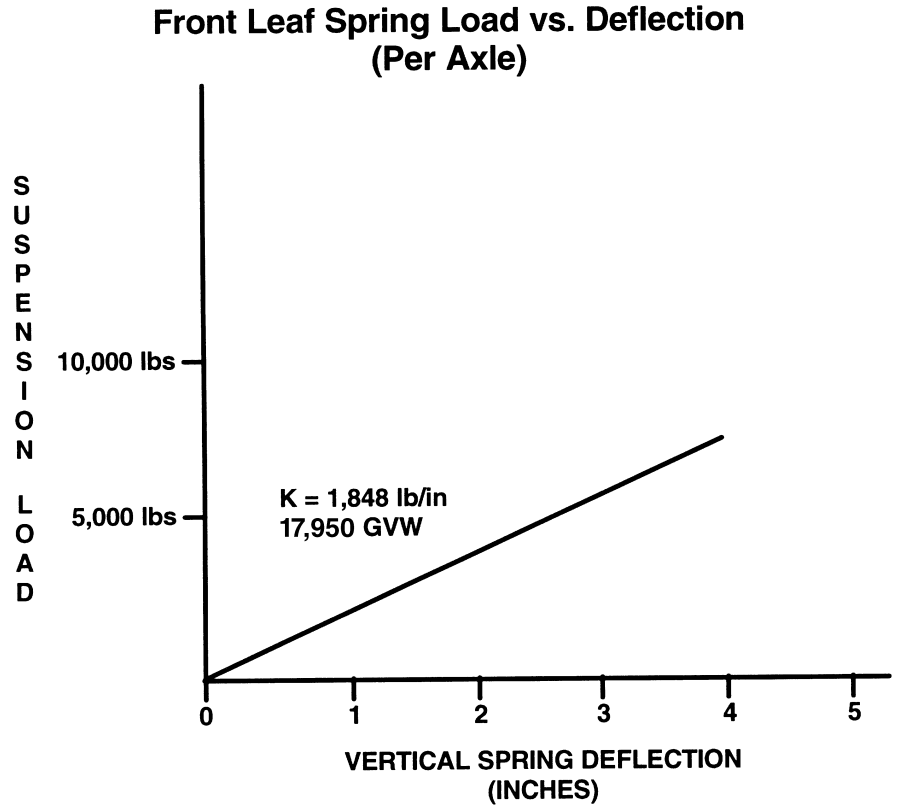
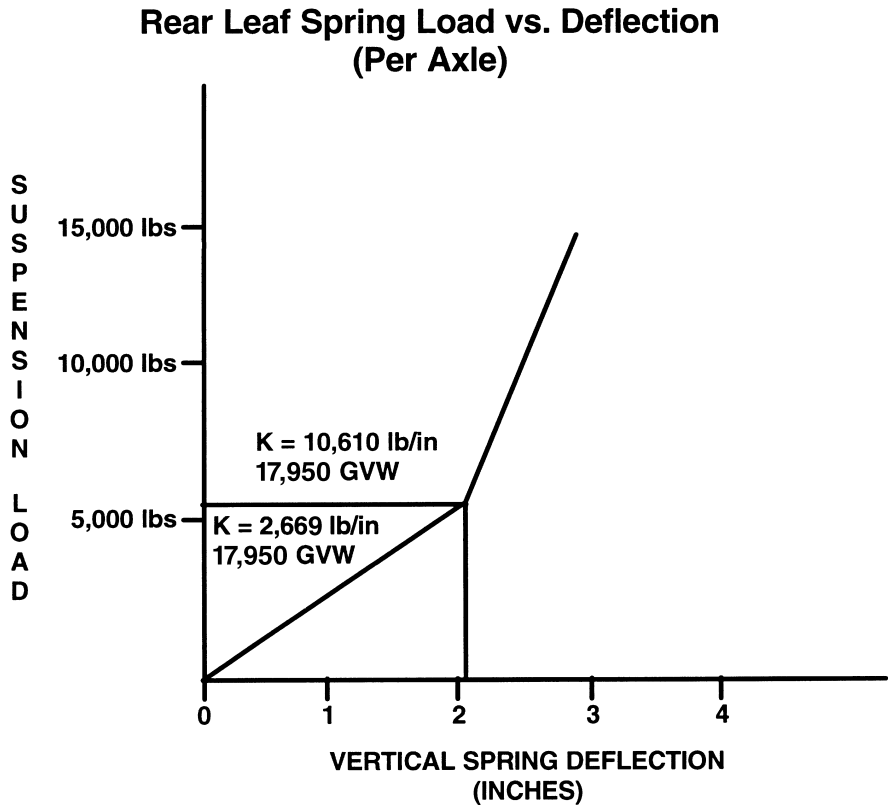
(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Suspension Deflection Charts NQR/W5500





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(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Tire and Disc Wheel Chart NPR HD/W4500

Tire

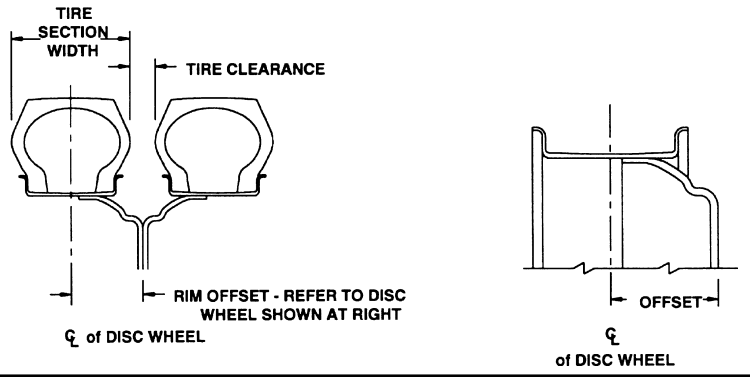
Tire Size	Tire Load Limit and Cold Inflation Pressures				Maximum Tire Load Limits		GVWR (Lb.)
	Single		Dual		Front	Rear	
	Lb.	PSI	Lb.	PSI	2 Single	4 Dual	
215/85R 16E	2,680	80	2,470	80	5,360	9,880	14,500

Tire Size	GVWR (Lb.)	Tire Radius				Tire Section Width	Tire Clearance	Design Rim Width
		Loaded		Unloaded				
		Front	Rear	Front	Rear			
215/85R 16E	14,500	14.1	14.1	14.3	14.3	8.2	18	6.0

Disc Wheel

Wheel Size	Bolt Holes	Bolt Circle Dia.	Ft./Rr. Nut Size*	Rear Stud Size*	Nut/Stud Torque Specs.	Inner Circle	Outside Offset	Disc Thickness	Rim Type	Material Mfg.
16.6 x 6.00K	6 JIS	8.75	1.6142 (41 mm) BUD HEX	0.8268 (21 mm) SQUARE	289 ft.-lb. (392 N•m)	6.46	5.0	0.39	15° DC	Steel TOPY

* O.D. Wrench Sizes



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Tire and Disc Wheel Chart NQR/W5500

Tire

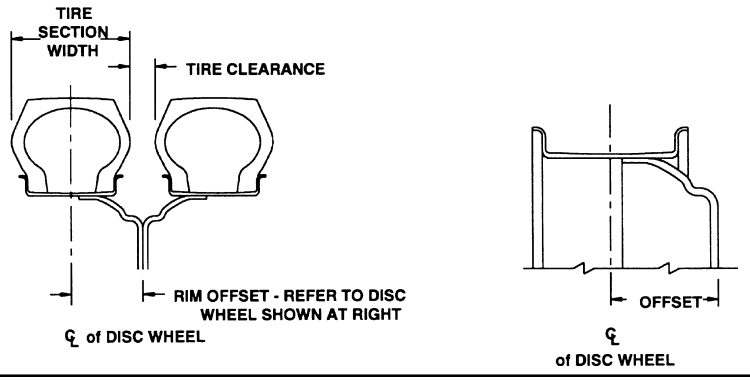
Tire Size	Tire Load Limit and Cold Inflation Pressures				Maximum Tire Load Limits		GVWR (Lb.)
	Single		Dual		Front	Rear	
	Lb.	PSI	Lb.	PSI	2 Single	4 Dual	
225/70R 19.5F	3,450	90	3,245	90	6,900	12,980	17,950

Tire Size	GVWR (Lb.)	Tire Radius				Tire Section Width	Tire Clearance	Design Rim Width
		Loaded		Unloaded				
		Front	Rear	Front	Rear			
225/70R 19.5F	17,950	15.0	15.2	15.4	15.8	8.8	1.2	6.0

Disc Wheel

Wheel Size	Bolt Holes	Bolt Circle Dia.	Ft./Rr. Nut Size*	Rear Stud Size*	Nut/Stud Torque Specs.	Inner Circle	Outside Offset	Disc Thickness	Rim Type	Material Mfg.
19.5 x 6.00K	6 JIS	8.75	1.6142 (41 mm) BUD HEX	0.8268 (21 mm) SQUARE	325 ft.-lb. (440 N•m)	6.46	5.0	0.39	15° DC	Steel TOPY

* O.D. Wrench Sizes



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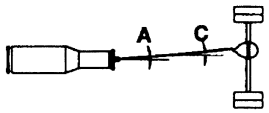
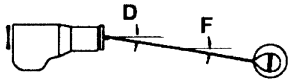
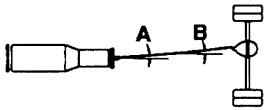
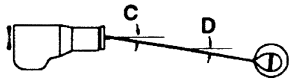
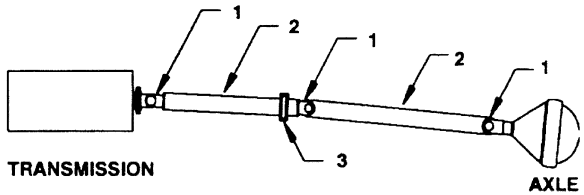
(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Propeller Shaft NPR HD/W4500

WB	PLANE VIEW	SIDE VIEW
150 in.		
176 in.		

TYPICAL INSTALLATIONS SHOWING YOKES "IN PHASE." "IN PHASE" MEANS THAT THE YOKES AT EITHER END OF A GIVEN PROPELLER SHAFT ASSEMBLY ARE IN THE SAME PLANE.

(150 and 176 in. WB)



1. UNIVERSAL JOINT
2. PROPELLER SHAFT
3. CENTER CARRIER BEARING

Wheelbase	Plane View		Side View	
	A Automatic Transmission	B Automatic Transmission	C Automatic Transmission	D Automatic Transmission
150 in.	0°	2.4°	2.6°	6.4°
176 in.	0°	1.7°	2.8°	4.5°

NOTE: All driveline angles are at unloaded condition (curb position with typical cargo body).

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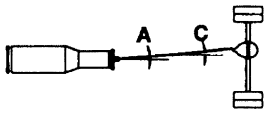
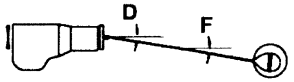
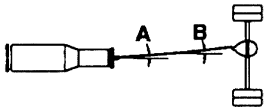
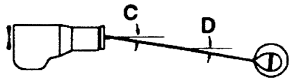
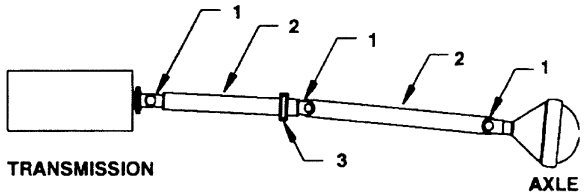
(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Propeller Shaft NQR/W5500

WB	PLANE VIEW	SIDE VIEW
150 in.		
176 in.		

TYPICAL INSTALLATIONS SHOWING YOKES "IN PHASE." "IN PHASE" MEANS THAT THE YOKES AT EITHER END OF A GIVEN PROPELLER SHAFT ASSEMBLY ARE IN THE SAME PLANE.

(150 and 176 in. WB)



1. UNIVERSAL JOINT
2. PROPELLER SHAFT
3. CENTER CARRIER BEARING

Wheelbase	Plane View		Side View	
	A Automatic Transmission	B Automatic Transmission	C Automatic Transmission	D Automatic Transmission
150 in.	0°	3.1°	2.6°	7.7°
176 in.	0°	2.3°	2.8°	4.8°

NOTE: All driveline angles are at unloaded condition (curb position with typical cargo body).

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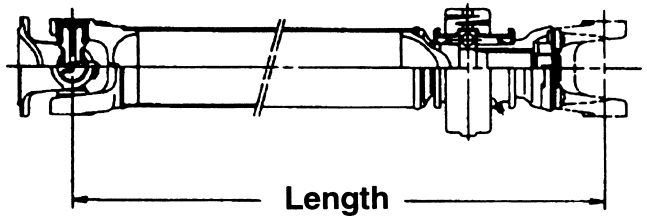
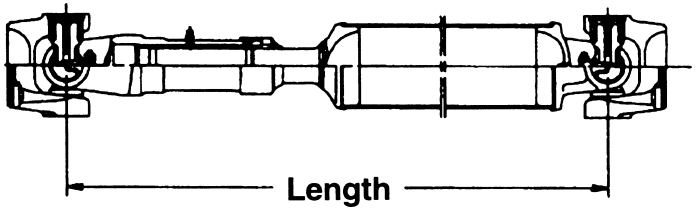
(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Wheelbase	150	176
Number of Shafts	1	2
Transmission Type	6 Manual Trans.	4 Auto. Trans.
Shaft #1 O.D.	3.25	3.25
Thickness	0.091	0.091
Length	41.9	53.7
Type	A	A
Shaft #2 O.D.	3.25	3.25
Thickness	0.091	0.091
Length	38.3	52.6
Type	C	C

Type	Description	Model	Illustration
Type **A**	1st shaft in 2-piece driveline	P20	
Type **C**	2nd shaft in 2-piece driveline	P20	

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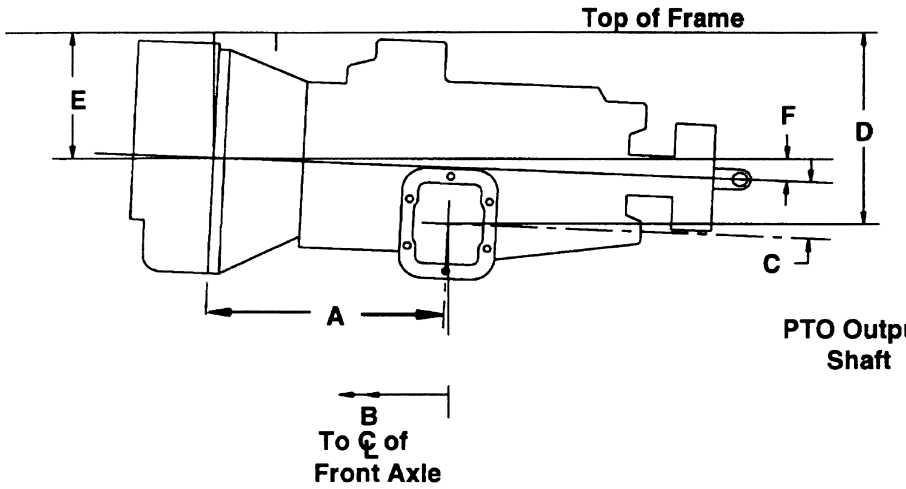
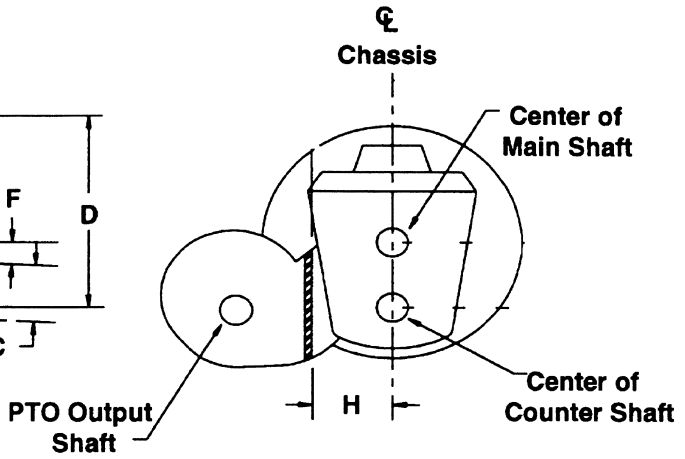
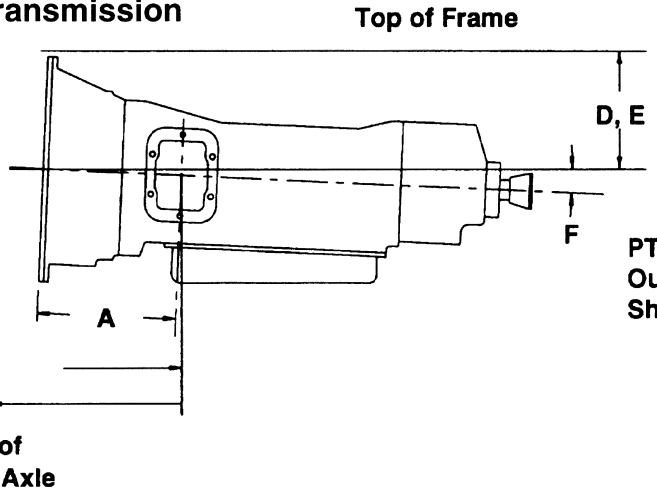
PTO Location, Drive Gear and Opening Information

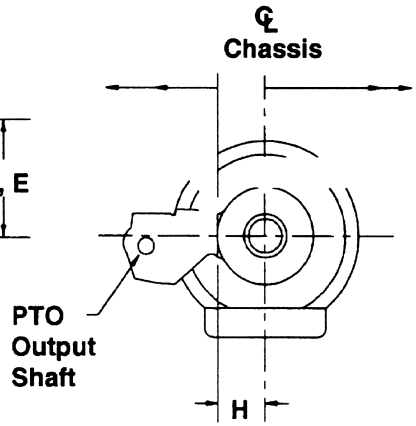
Manual Transmission





Automatic Transmission





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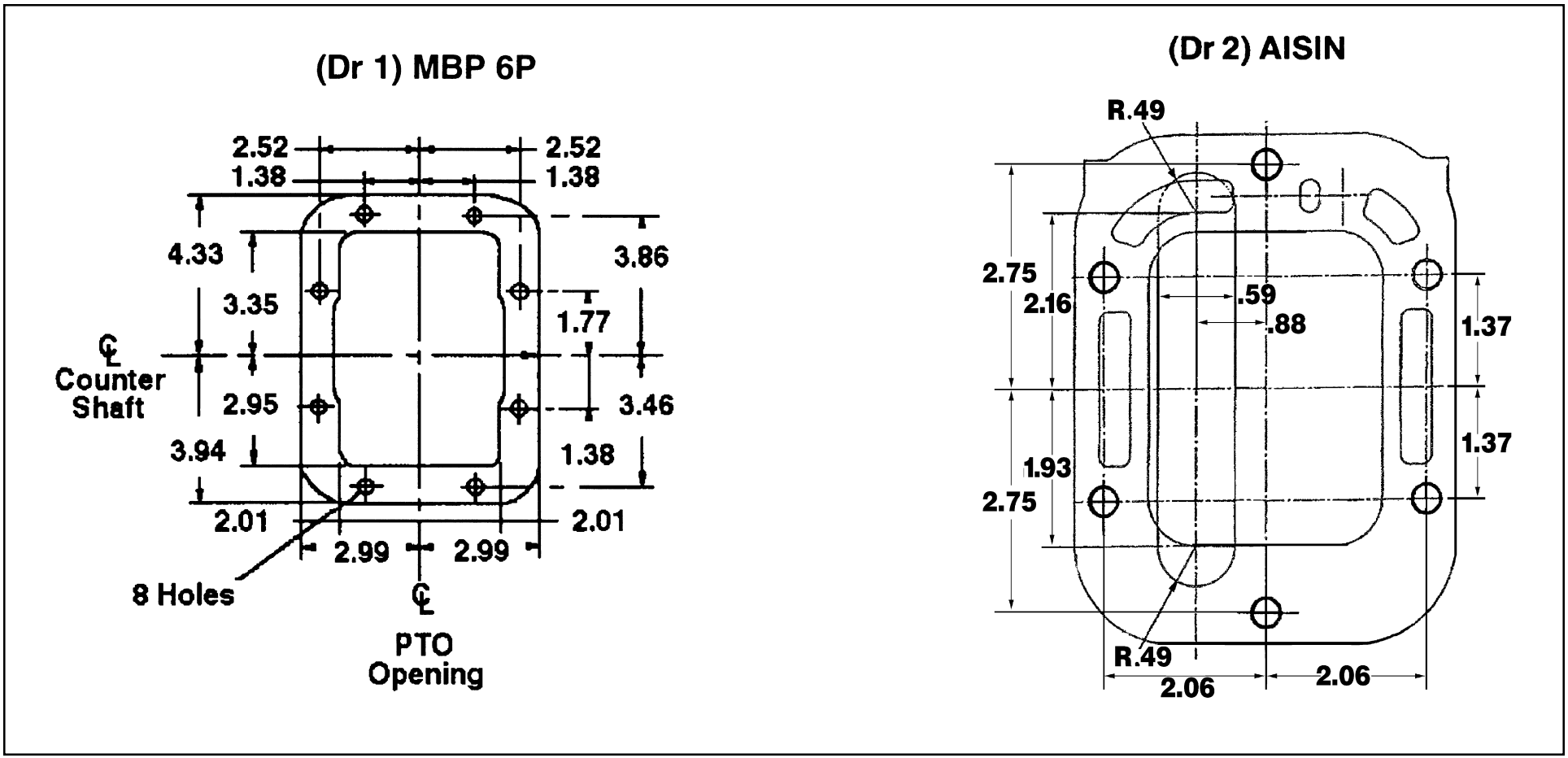
(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Trans.	Opening Location	Bolt Pattern	A	B	C	D	E	F	H	PTO Drive Gear Location	Ratio of PTO Drv. Gear Spd. to Eng. Spd.	No. of Teeth	Pitch	Helix Angle	Max. Output Torque
MBP 6P	Left	(Dr 1)	10.9	36.9	5.2	13.1	7.7	2.5°	3.9	3rd Gear Trans. Countershaft	20/38 = .526	28	3.5	22° RH	180 lbs.-ft. @ 1,500 RPM
Aisin[1)]	Left	(Dr 2)	12.6	38.59	0	8	7.5	2.5°	4.48	PTO Gear	1:1 with turbine	58	N/A	0°	134 lbs.-ft. @ 1,000 RPM

1) No PTO gear in the 150" WB models

Opening Diagram



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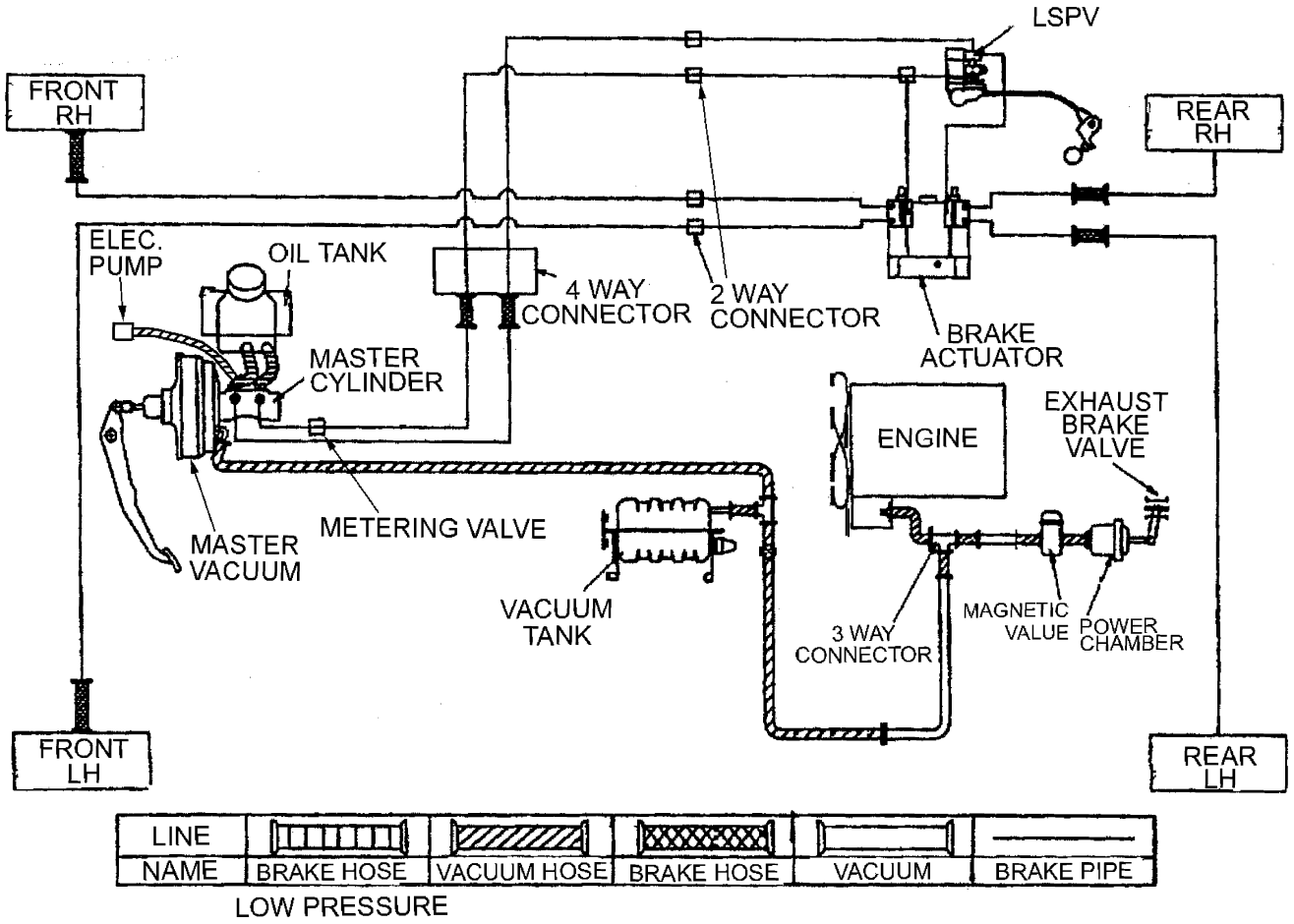
(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Brake System Diagram 14,500 GVW

Vacuum Over Hydraulic

Please refer to introduction section of book for antilock system cautions and wheelbase modification requirements.



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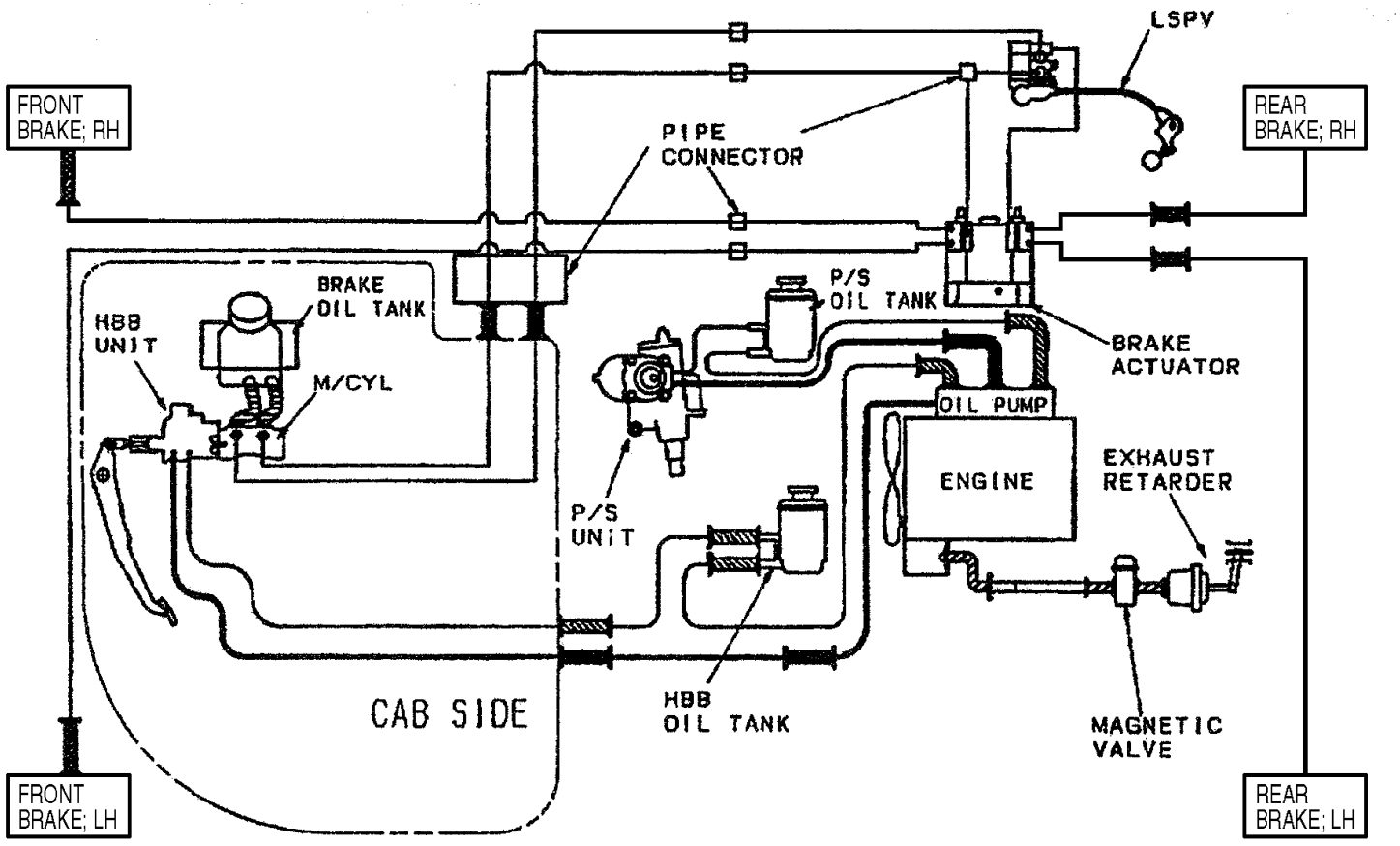
(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Brake System Diagram 17,950 GVW

Vacuum Over Hydraulic

Please refer to introduction section of book for antilock system cautions and wheelbase modification requirements.



INDICATION									
NAME	BRAKE HOSE (LOW PRESSURE)	VACUUM HOSE	BRAKE HOSE (HIGH PRESSURE)	VACUUM PIPE	BRAKE PIPE	HYDRAULIC HOSE (HIGH PRESSURE)	HYDRAULIC HOSE (LOW PRESSURE)	HYDRAULIC PIPE (HIGH PRESSURE)	HYDRAULIC PIPE (LOW PRESSURE)

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(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Diesel Fuel Fill

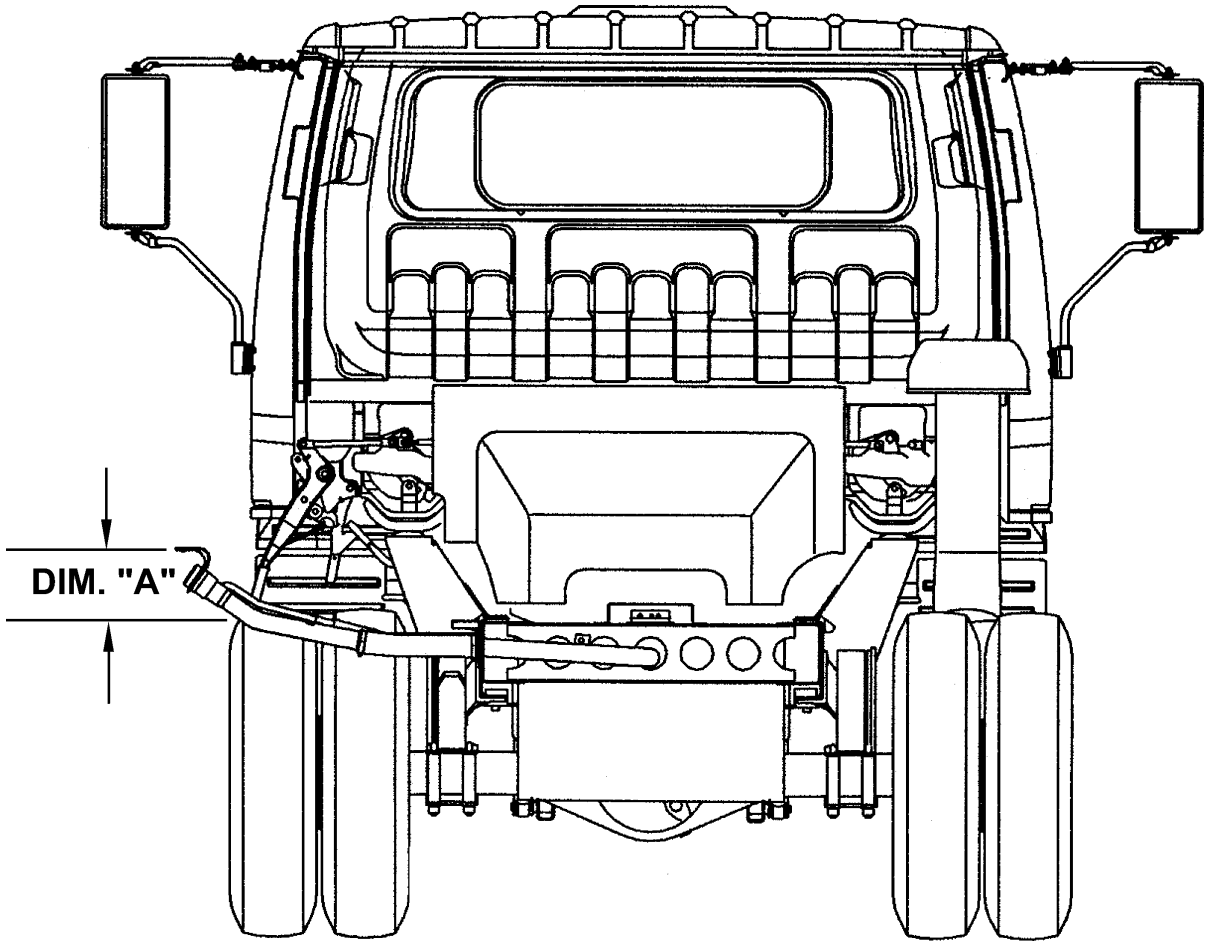
Installation Instructions

1. Disconnect battery.
2. Loosen hose from the tie downs. Remove caps from plate on rail.
3. Install hoses onto the plate.
4. Extend hose out from the driver's side of the rail to body rail.
5. The filler neck must be mounted to allow the fill plate bracket to be parallel to the frame horizontal (see figure 4).
6. Cover with protector wrap and secure with tie wraps.
7. Filler hose is set for 96 inches outside width body.
8. Filler neck (dimension A) must be between 6.85 inches and 8.5 inches above frame.
9. Secure the filler plate to the bottom of the body and check for leaks.
10. Ensure that fill hose does not sag, creating an area where the fuel could pool in the fill hose.
11. Reconnect battery.

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued on next page)

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Rear View Fuel Fill



Dimension A = 6.85-8.5 inches (174-216 mm)

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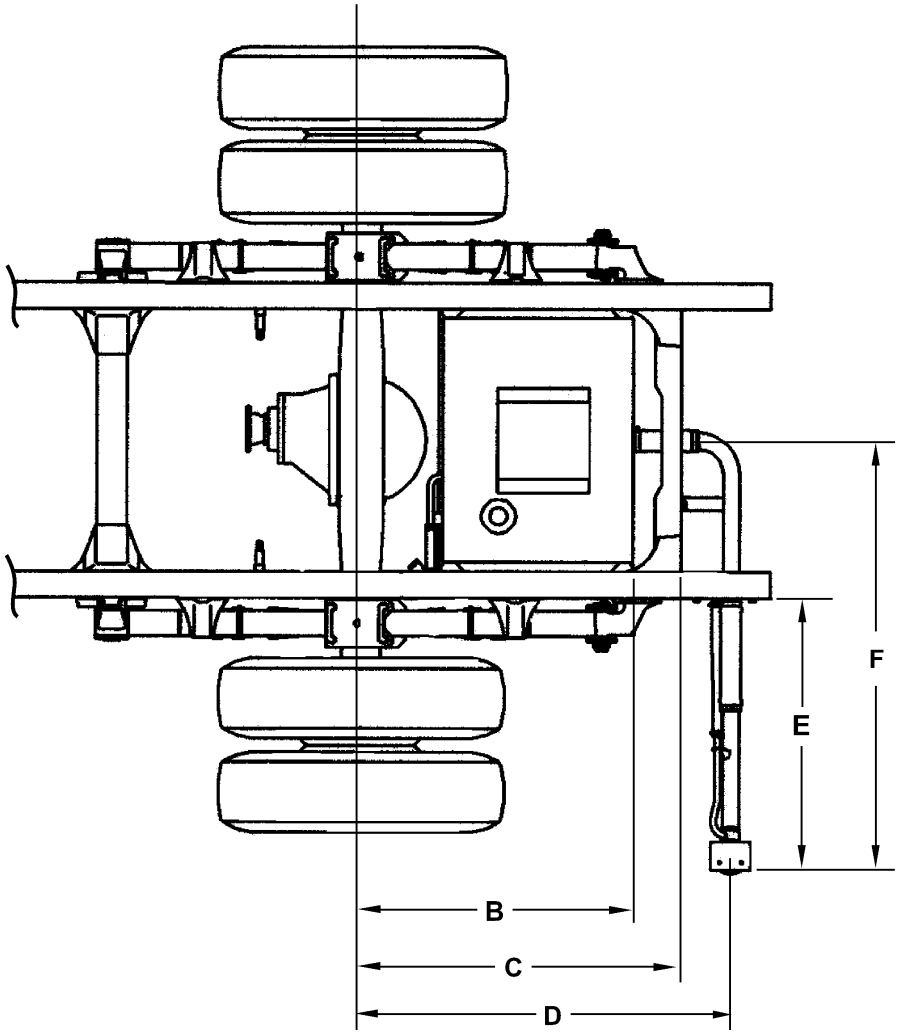
(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Top View Fuel Fill

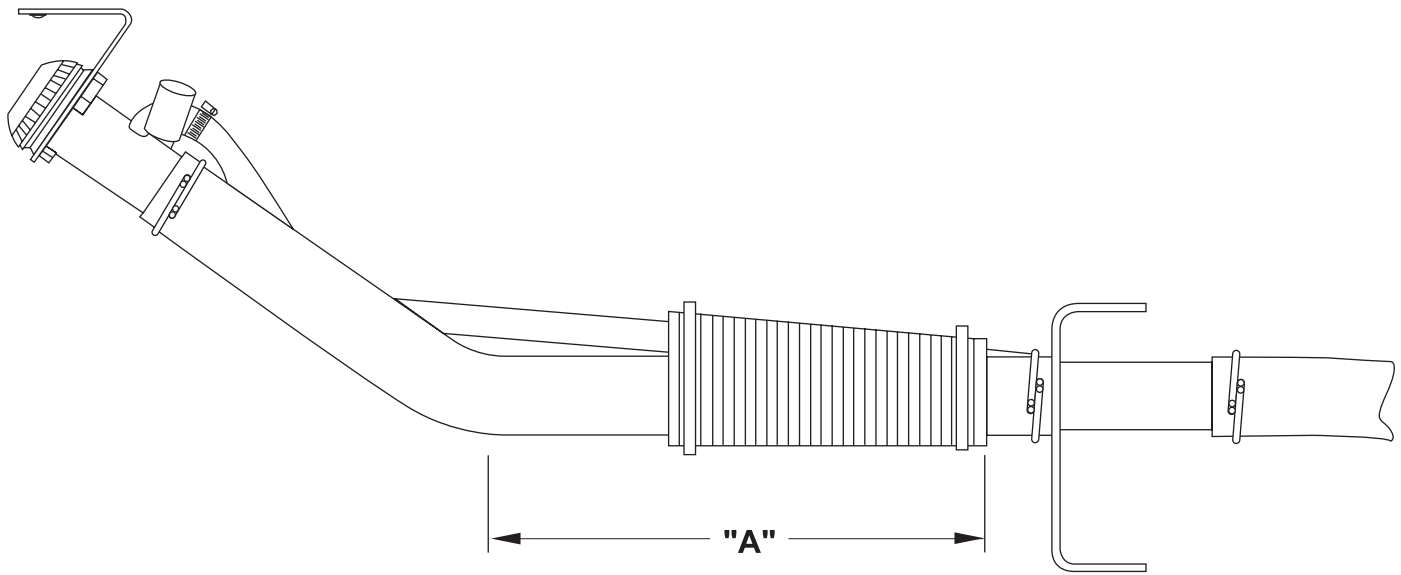


Dimensions:
B = 29.75 inches (756 mm)
C = 34.00 inches (863 mm)
D = 39.29 inches (998 mm)
E = 30.86 inches (784 mm)
F = 56.60 inches (1,438 mm)

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued on next page)

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued from previous page)

Hose Modification for Various Width Bodies



NOTE: Shorten Hose at "A" Area only.

96 remove 0 inches
90 remove 3 inches
86 remove 5 inches

(Vehicle Specifications Index Section – NPR HD, NQR/W4500, W5500 Crew Cab Diesel – continued on next page)

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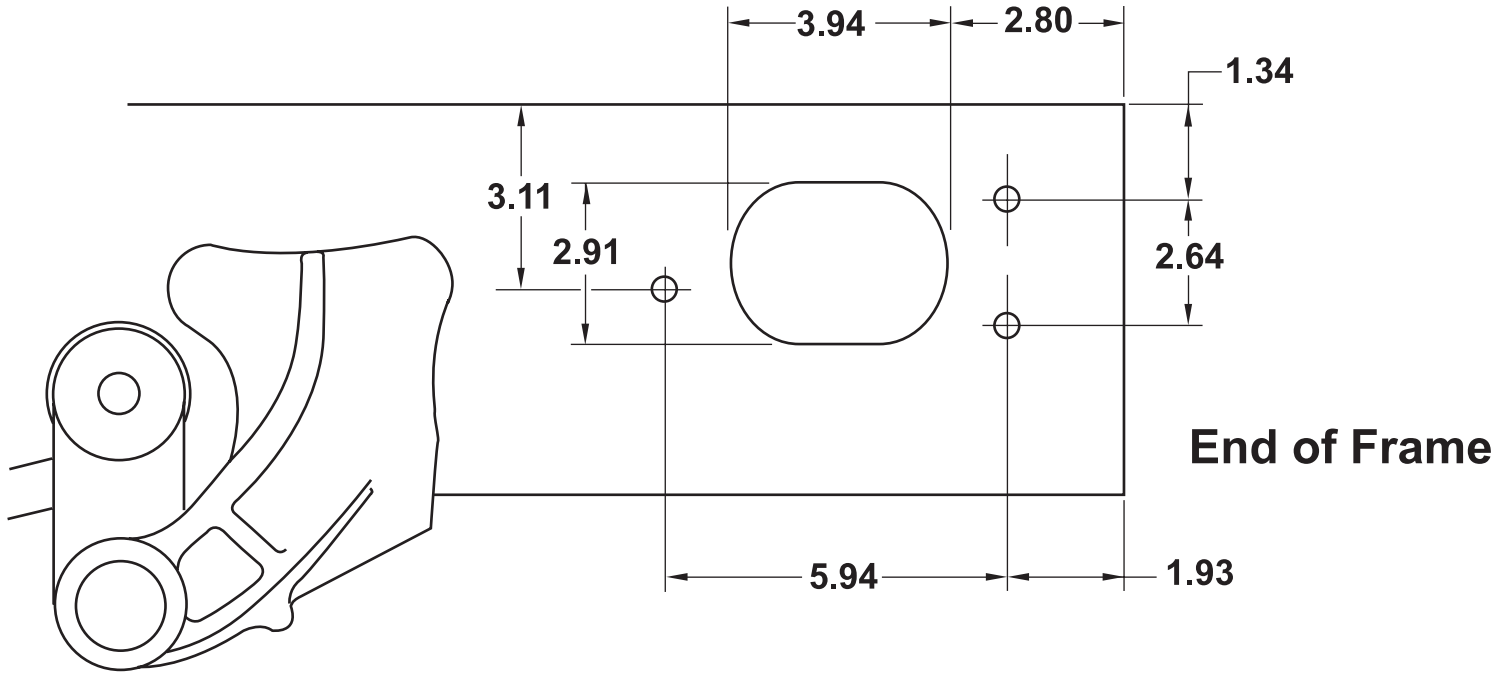
Through the Rail Fuel Fill Frame Hole



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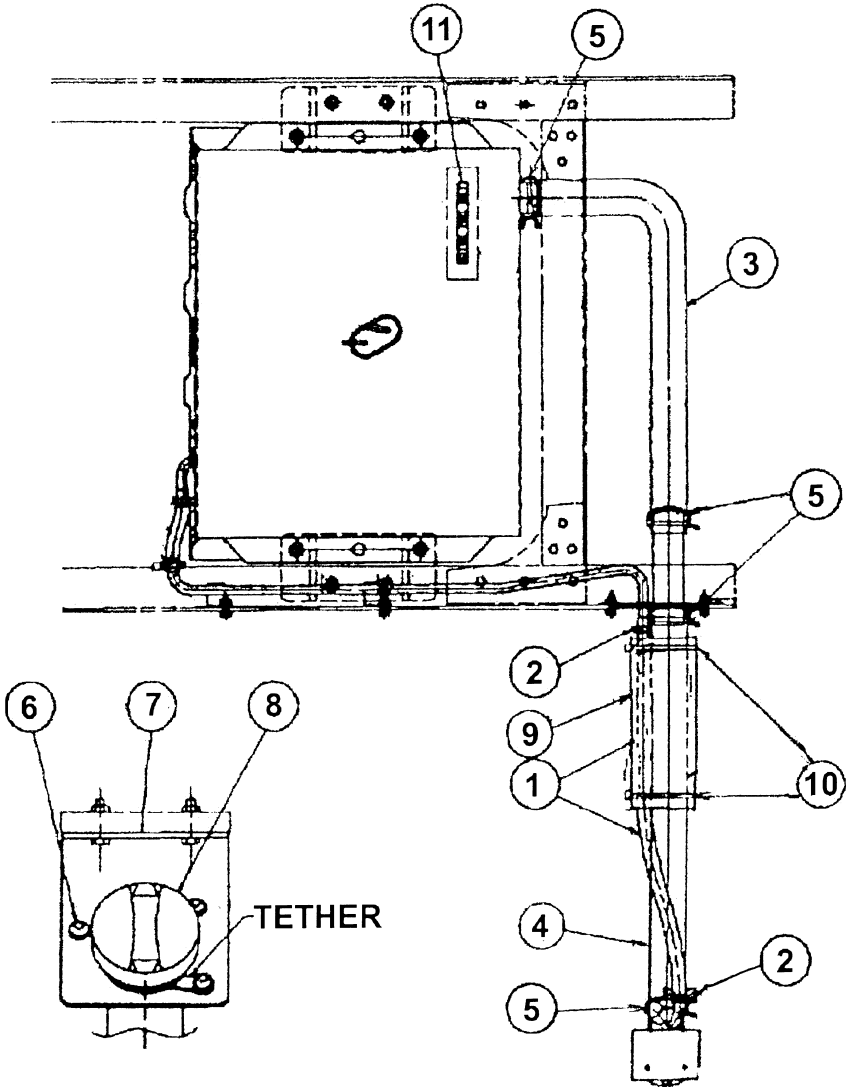
Fuel Fill Parts Illustration



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Fuel Fill Parts List

Number	Part Name	Isuzu Part Number	GM Part Number	Quantity
1	Breather Hose	897206-0420	N/A	1
2	Clip, Rubber Hose	894242-0340	94242034	2
3	Hose, Fuel Filler	897187-8750	97187875	1
4	Hose, Fuel Filler	897253-1400	97253140	1
5	Clip, Filler Hose	894435-8760	97724373	4
6	Screw, Filler Hose	894384-6460	N/A	3
7	Bracket, Filler Neck	897116-621Y	97116621	1
8	Cap, Filler	897118-7020	N/A	1
9	Protector	897114-0630	97114063	1
10	Clip	109707-1070	94062296	2
11	Caution Plate	894414-3530	94414353	1

FRR/WT5500

Specifications

Model	FRR/WT5500	
GVWR/GCWR	18,000/30,000 lbs. (26,000 lbs. with automatic)	19,500/30,000 lbs. (26,000 lbs. with automatic)
WB	148 in., 167 in., 176 in., 191 in., 218 in.	
Engine	GM/Isuzu 6-cylinder, in-line 4-cycle, OHC, turbocharged, intercooled, direct injection diesel.	
Model/Displacement	6HK1-TC/475 CID (7.8 liters)	
HP (Gross)	200 HP @ 2,400 RPM	
Torque (Gross)	441 lbs.-ft. torque @ 1,500 RPM	
Equipment	Dry element air cleaner with vertical inlet. Spin-on paper element type fuel and oil filters. Cold weather starting device. Fuel/water separator, common rail type electronic fuel injection system and an oil cooler.	
Clutch	Single dry disc, hydraulic actuation, 14-inch diameter, cerametallic Spicer.	
Transmission	MLD 6Q Manual 6-Speed synchronized second through sixth, sixth gear is overdrive.	
Optional	Allison S1000, 5-speed, automatic transmission.	
Steering	Integral power steering with variable ratio (18.8-16.1:1).	
Front Axle	Reverse Elliot "I" Beam rated at 8,800 lbs.	
Suspension	Semi-elliptical alloy steel leaf springs with stabilizer bar and shock absorbers.	
GAWR	6,800 lbs.	7,060 lbs.
Rear Axle	Full-floating single speed with hypoid gearing rated at 14,330 lbs.	
Ratio	3.900:1	
Suspension	Semi-elliptical alloy steel leaf springs.	
GAWR	13,000 lbs.	13,680 lbs.
Wheels	19.5 x 6.00 on 6-hole disc wheels, painted white.	
Tires	225/70R 19.5F low profile tubeless radial.	
Fuel Tank	42-gallon rectangular steel, mounted on left hand frame rail, fuel/water separator frame mounted. Fuel filter.	
Brakes	Antilock brake system with dual circuit air over hydraulic self-adjusting service brakes. Mechanical cable-actuated internal expanding drum parking brake, transmission mounted. An exhaust brake is standard.	

NOTE: These selected specifications are subject to change without notice.

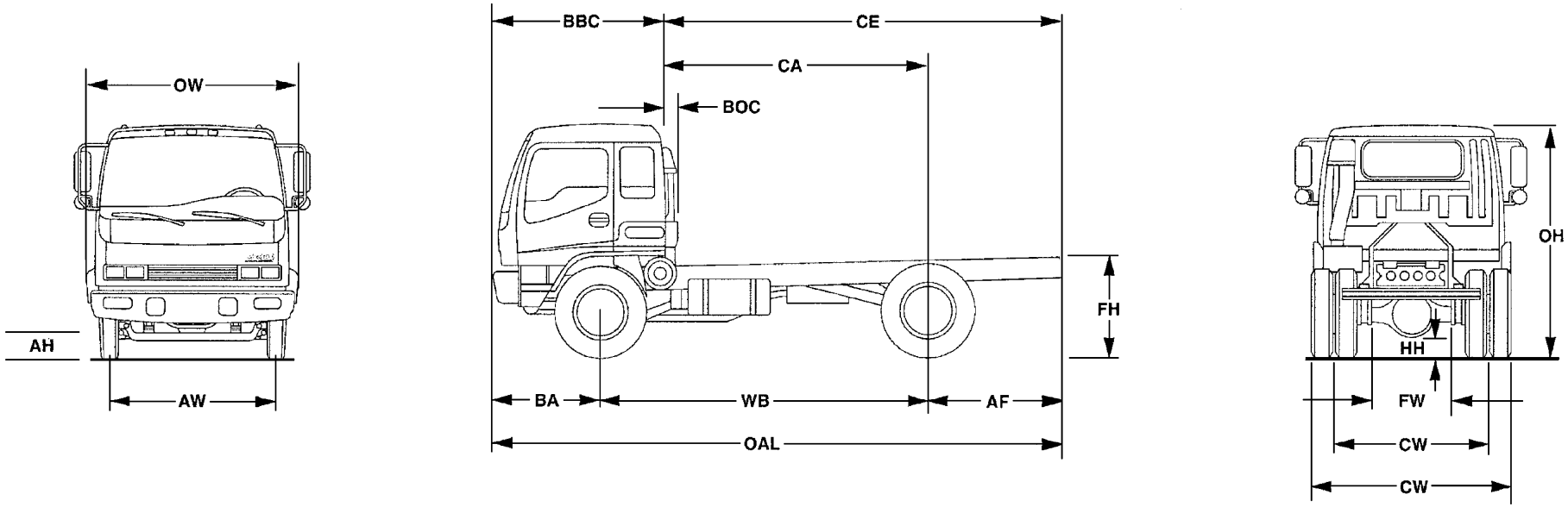
(Vehicle Specifications Index Section – FRR/WT5500 – continued on next page)

(Vehicle Specifications Index Section – FRR/WT5500 – continued from previous page)

Model	FRR/WT5500
Frame	Ladder type channel section, 33-inch width at load platform area, section modulus 7.63 in.^{3}, and RBM 412,200 lbs.-ft./in. per rail.
Cab	All-steel, low cab forward, BBC 78.2 in., 45° mechanical tilt with torsion assist.
Equipment	Dual exterior rearview mirrors, electrically operated wipers and window washer. Steering column tilts and telescopes. Includes two 3-point seat belts and retractors, and a 2-point seat belt.
Electrical	12-volt, dual Delco maintenance-free batteries, 750 CCA each. 110-amp alternator with integral regulator.
Options	Second fuel tank on 167 in., 179 in., 191 in., and 218 in. wheelbase; transmission mounted PTO; air conditioning; block heater; oil pan heater; AM/FM cassette stereo radio; rear traction tread tires; spare wheel; spare tire carrier; spare tire.

NOTE: These selected specifications are subject to change without notice.

Vehicle Weights, Dimensions and Ratings



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Variable Chassis Dimensions					
Unit	**WB+**	**CA***	**CE***	**OAL**	**AF**
Inch	148.8	117.4	180.6	259.3	63.2
Inch	167.3	135.9	206.2	284.9	70.3
Inch	179.1	147.7	225.9	304.9	78.1
Inch	190.9	159.5	243.6	322.3	84.1
Inch	218.5	187.1	283.0	361.7	95.9

* Effective CA & CE are 7.5 inches less for MT. Effective CA & CE are 10 inches less for AT.

Dimension Constants					
Code	**Inches**	**Code**	**Inches**	**Code**	**Inches**
AH	8.2	BW	85.3	HH	6.7
AW	70.5	CW	65.4	OH	100.9
BA	47.3	FH	33.2	OW	86.3
BBC	78.7	FH**	35.2		
BOC	7.5 MT / 10 AT	FW	33.0		

** 191" and 218" WB.

19,500-lb. GVW With 6-Speed Manual Transmission Chassis Curb and Maximum Payload Weights						
Model	**WB+**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
SA1	148 in.	lb.	5,027	2,448	7,475	12,025
SA2	167 in.	lb.	5,116	2,414	7,530	11,970
SA3	179 in.	lb.	5,182	2,403	7,585	11,915
SA4	191 in.	lb.	5,171	2,503	7,674	11,826
SA5	218 in.	lb.	5,270	2,547	7,817	11,683

+ Frame is tapered at the rear of the 148", 167" and 179" WB.

(Vehicle Specifications Index Section – FRR/WT5500 – continued on next page)

(Vehicle Specifications Index Section – FRR/WT5500 – continued from previous page)

18,000-lb. GVW With 6-Speed Manual Transmission Chassis Curb and Maximum Payload Weights						
Model	**WB+**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
SE1	148 in.	lb.	5,027	2,448	7,475	10,525
SE2	167 in.	lb.	5,116	2,414	7,530	10,470
SE3	179 in.	lb.	5,182	2,403	7,585	10,415
SE4	191 in.	lb.	5,171	2,503	7,674	10,326
SE5	218 in.	lb.	5,270	2,547	7,817	10,183

19,500-lb. GVW With Automatic Transmission Chassis Curb and Maximum Payload Weights						
Model	**WB+**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
SB1	148 in.	lb.	5,045	2,426	7,471	12,029
SB2	167 in.	lb.	5,134	2,392	7,526	11,974
SB3	179 in.	lb.	5,189	2,381	7,570	11,930
SB4	191 in.	lb.	5,178	2,481	7,659	11,841
SB5	218 in.	lb.	5,277	2,525	7,802	11,698

18,000-lb. GVW With Automatic Transmission Chassis Curb and Maximum Payload Weights						
Model	**WB+**	**Unit**	**Front**	**Rear**	**Total**	**Payload**
SF1	148 in.	lb.	5,045	2,426	7,471	10,529
SF2	167 in.	lb.	5,134	2,392	7,526	10,474
SF3	179 in.	lb.	5,189	2,381	7,570	10,430
SF4	191 in.	lb.	5,178	2,481	7,659	10,341
SF5	218 in.	lb.	5,277	2,525	7,802	10,198

+ Frame is tapered at the rear of the 148", 167" and 179" WB.

(Vehicle Specifications Index Section – FRR/WT5500 – continued on next page)

(Vehicle Specifications Index Section – FRR/WT5500 – continued from previous page)

Truck Weight Limits:

GVWR Designed Maximum	18,000 lbs.	19,500 lbs.
GAWR, Front	6,800 lbs.	7,060 lbs.
GAWR, Rear	13,000 lbs.	13,680 lbs.

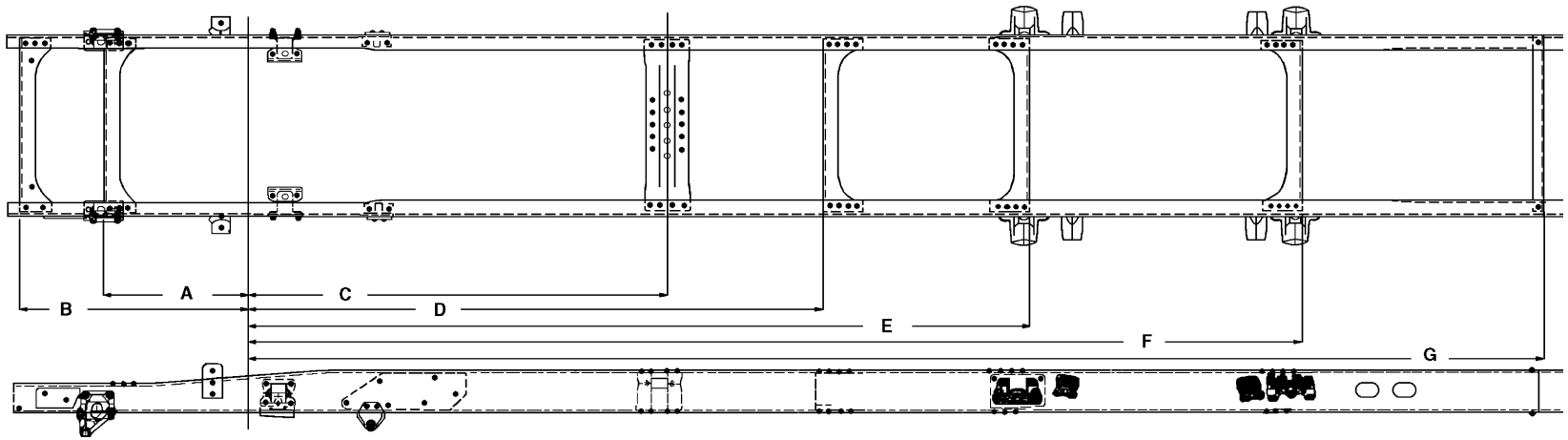
Technical Notes:

Chassis Curb Weight reflects standard equipment and fuel, but no driver or payload.

Maximum Payload Weight is the allowed maximum for equipment, body, payload and driver and is calculated by subtracting chassis curb weight from the GVWR.

Frame and Crossmember Specifications

191 & 218 in. Wheelbase



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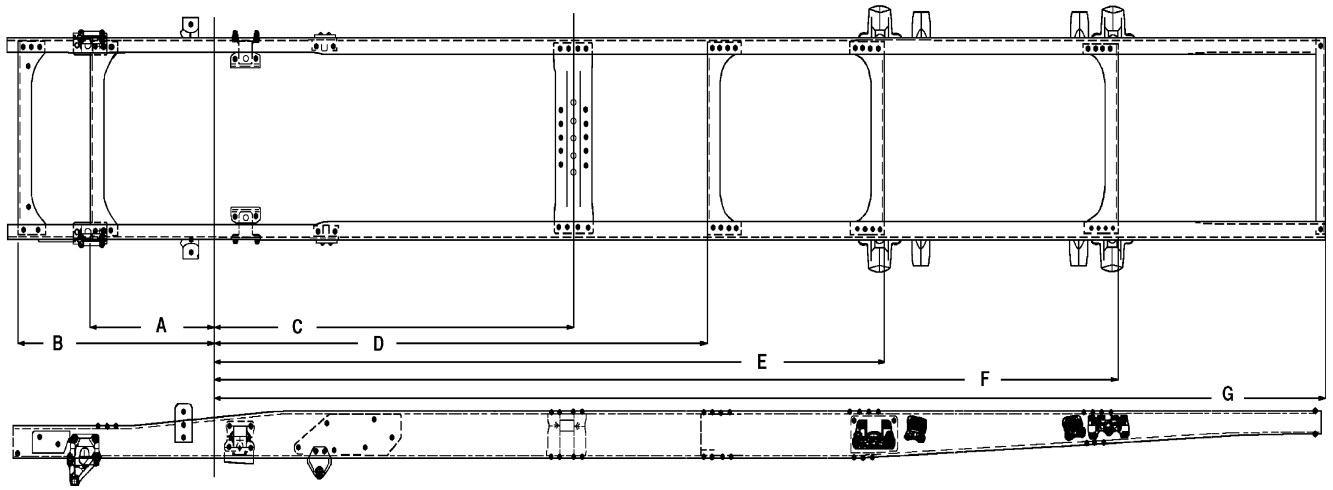
148, 167 & 179 in. Wheelbase



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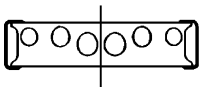

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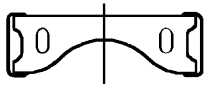
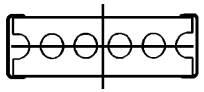
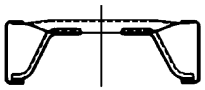


TYPE DD

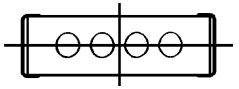


TYPE BB



TYPE C2

TYPE EE



Wheelbase	Frame FL	Frame Thick	Crossmember Type/Location							
			A	B	C	D	DD	E	F	G
148	253.9	0.24	AA 24.3	AA 39.6	BB 77.9	—	C2 96.1	DD 125.4	DD 175.0	EE 212.0
167	279.5	0.24	AA 24.3	AA 39.6	BB 77.9	—	C1 106.3	DD 143.9	DD 193.5	EE 237.6
179	299.2	0.24	AA 24.3	AA 39.6	BB 77.9	—	C1 106.3	DD 155.7	DD 205.3	EE 257.3
191	316.9	0.24	AA 24.3	AA 39.6	BB 77.9	—	C1 117.7	DD 167.5	DD 217.1	EE 267.1
218	356.3	0.24	AA 24.3	AA 39.6	BB 77.9	C2 106.28	C1 145.27	DD 195.0	DD 244.6	EE 314.3

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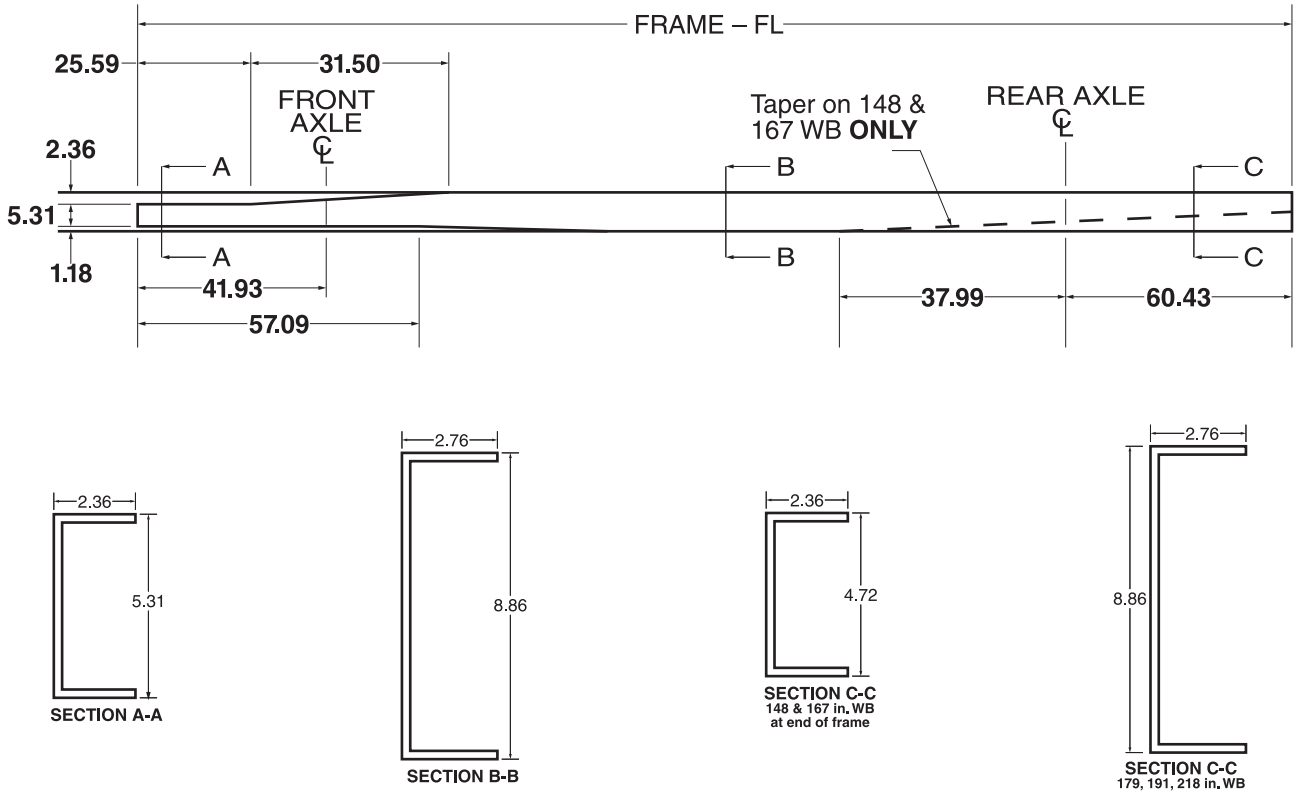
Frame Chart



Wheelbase	Frame FL	CA	CE	Frame Thickness
148	253.9	117.7	180.6	0.24
167	279.5	132.2	206.5	0.24
179	299.2	148.0	226.2	0.24
191	316.9	159.8	243.9	0.24
218	356.3	187.4	283.3	0.24

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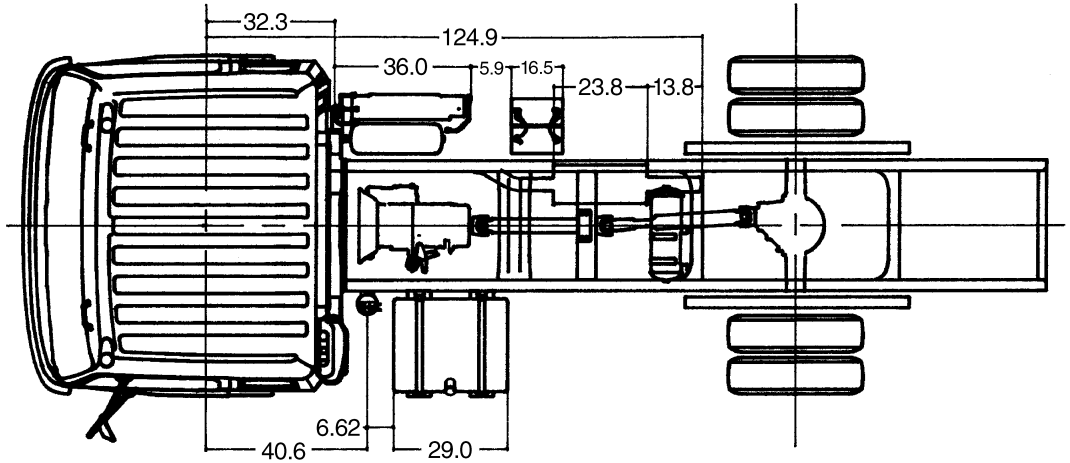
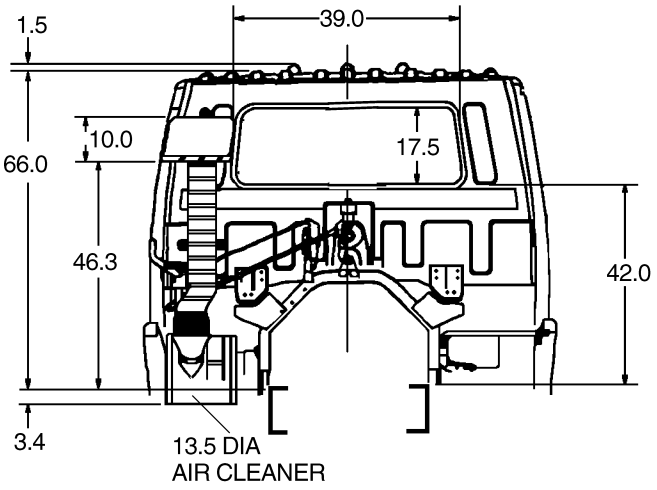
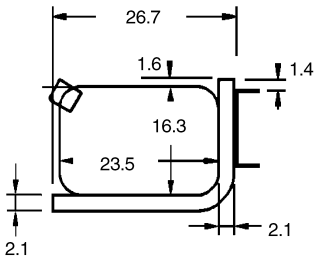
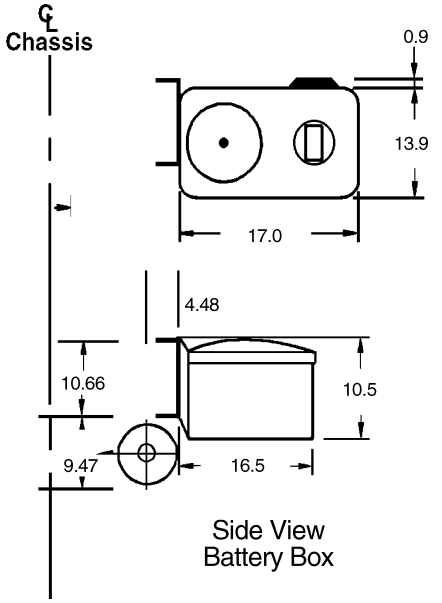
Auxiliary Views







Side View
Fuel Tank



Side View
Battery Box

Unit: Inch

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(Vehicle Specifications Index Section – FRR/WT5500 – continued from previous page)

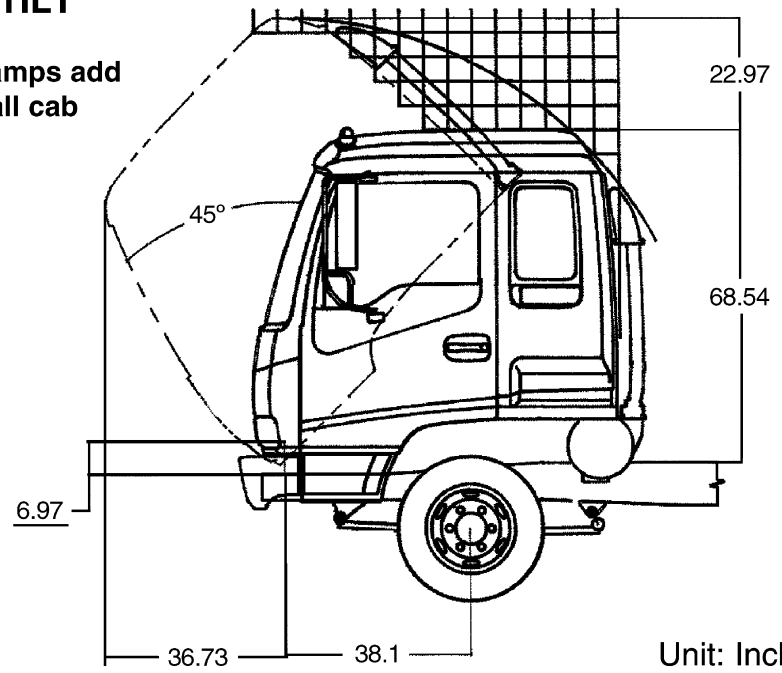
Body Builder Weight Information Chart

GVWR	Axle	Wheelbase										Unsprung Weight
		148 in.		167 in.		179 in.		191 in.		218 in.		
		Man. Trans.	Auto. Trans.	Man. Trans.	Auto. Trans.	Man. Trans.	Auto. Trans.	Man. Trans.	Auto. Trans.	Man. Trans.	Auto. Trans.	
19,500	Front	5,027	4,994	5,116	5,083	5,182	5,138	5,171	5,127	5,270	5,226	770
	Rear	2,448	2,426	2,414	2,392	2,403	2,381	2,503	2,481	2,547	2,525	1,335
	Total	7,475	7,420	7,530	7,475	7,585	7,519	7,674	7,608	7,817	7,751	2,105

Cab Tilt

CAB TILT

NOTE: Roof marker lamps add 1.575" to overall cab height.



(Pivot point to top of frame)

GRID SCALE:
One square is 5 in. x 5 in.

Unit: Inch

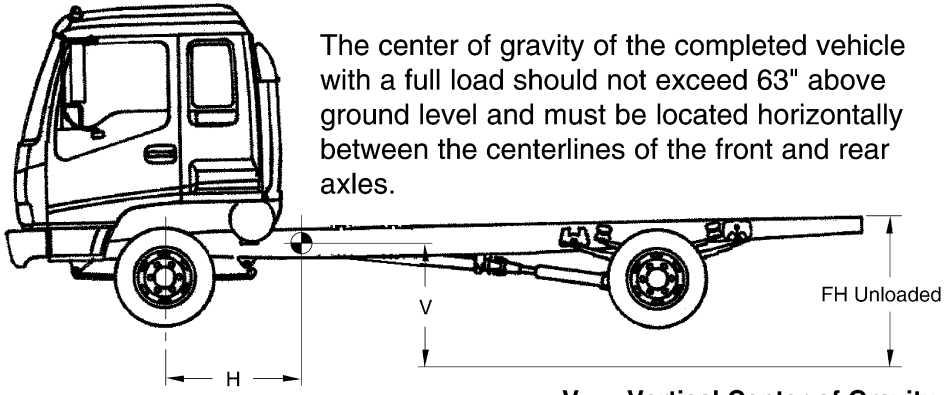
(Vehicle Specifications Index Section – FRR/WT5500 – continued on next page)

(Vehicle Specifications Index Section – FRR/WT5500 – continued from previous page)

Center of Gravity

The center of gravity of the chassis cab.

GVWR	WB	V	H	
			Manual Transmission	Automatic Transmission
19,500	148	27.5	48.7	48.6
	167	27.5	53.7	53.6
	179	27.5	56.8	56.7
	191	28.3	62.3	62.3
	218	28.3	71.2	71.2



The center of gravity of the completed vehicle with a full load should not exceed 63" above ground level and must be located horizontally between the centerlines of the front and rear axles.

V = Vertical Center of Gravity
H = Horizontal Center of Gravity

NOTE: The maximum dimensions for a body installed on the FRR/WT5500 are 96 inches wide (outside) by 90 inches high (inside). Any larger body applications must be approved by GMICT Application Engineering. In the West Coast, call 1-562-229-5314 and, in the East Coast, call 1-404-257-3013.

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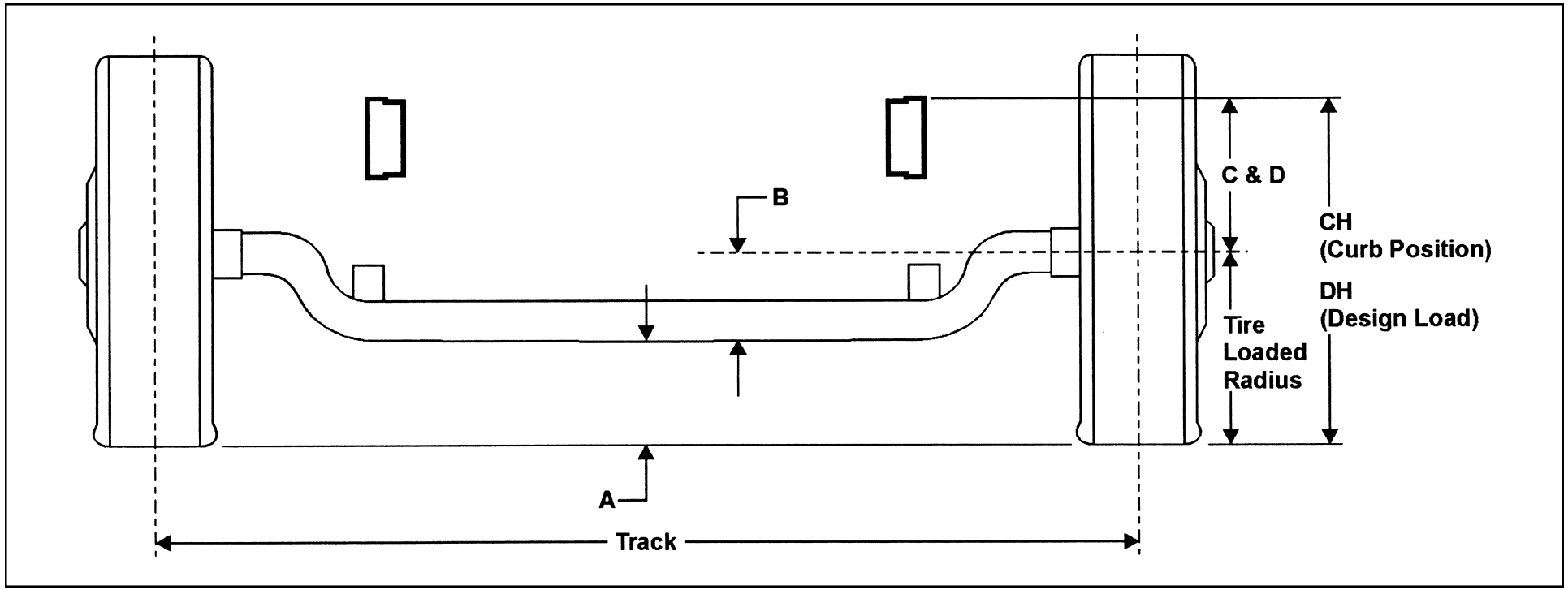
Front Axle Chart



Formulas for calculating height dimensions:

A = Tire Loaded Radius – B
C = Centerline of Axle to Top of Frame Rail at Curb Position
D = Centerline of Axle to Top of Frame Rail at Design Load
CH = C + Tire Unloaded Radius
DH = D + Tire Loaded Radius

Tire	GVWR	AXLE CAPACITY	SUSP. CAPACITY	A	B	C	D	CH	DH	Track	Tire Radius	
											Unload	Load
225/70R 19.5	19,500 lbs.	8,800 lbs.	7,060 lbs.	8.2	6.9	12.3	11.39	27.52	26.41	70.5	15.4	15.0

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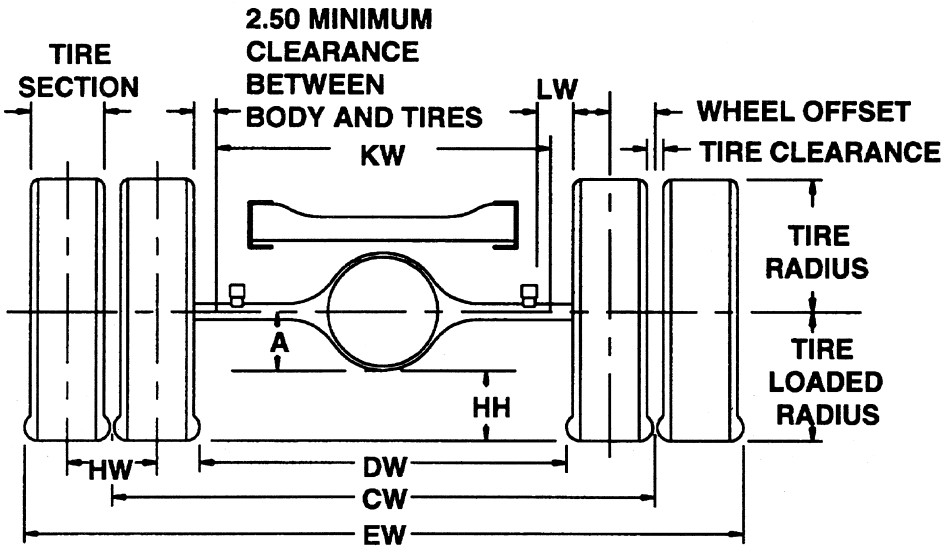
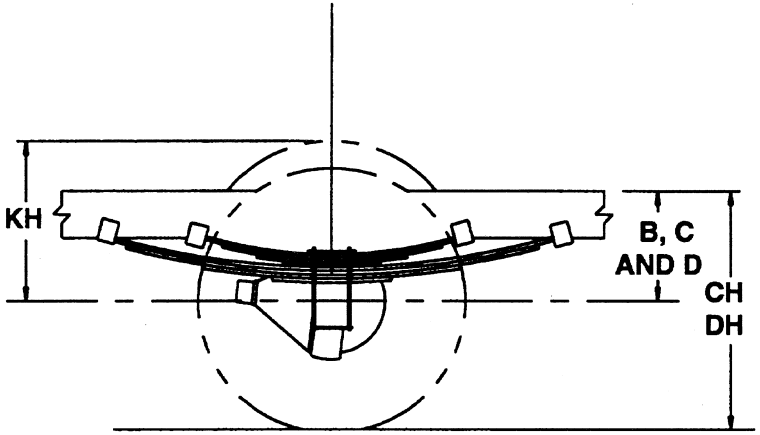
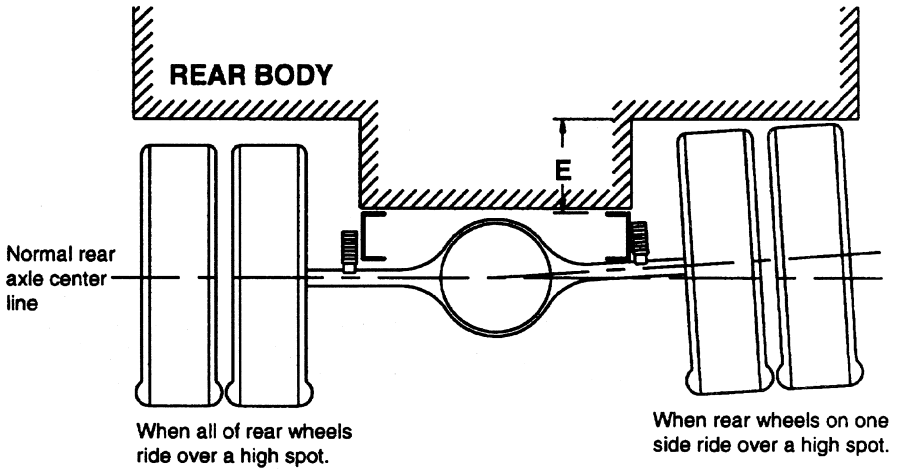
Rear Axle Chart







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Definitions			
A	Centerline of axle to bottom of axle bowl.	DH	Rear Frame Height: Vertical distance between the normal top of frame rail and the ground-line through the centerline of the rear axle at design load.
B	Centerline of axle to top of frame rail at metal-to-metal position.	DW	Minimum distance between the inner surfaces of the rear tires.
C	Centerline of axle to top of frame rail at curb position.	EW	Maximum Rear Width: Overall width of the vehicle measured at the outermost surface of the rear tires.
D	Centerline of axle to top of frame rail at design load.	HH	Rear Tire Clearance: Minimum clearance between the rear axle and the ground-line.
E	Rear Tire Clearance: Minimum clearance required for tires and chain measured from the top of the frame at the vertical centerline of the rear axle, when rear wheels on one side ride over a high spot.	HW	Dual Tire Spacing: Distance between the centerlines of the tires in a set of dual tires.
		KH	Tire Bounce Clearance: Minimum distance required for tire bounce as measured from the centerline of the rear axle and the top of the rear tire when one wheel rides over a high spot.
CH	Rear Frame Height: Vertical distance between the normal top of frame rail and the ground-line through the centerline of the rear axle at curb position.	CW	Track Dual Rear Wheel Vehicles: Distance between the centerlines of the dual wheels measured at the ground-line.
Tire Section, Tire Radius, Tire Loaded Radius, Tire Clearance		See Tire Chart for Values	

Formulas for Calculating Rear Width and Height Dimensions			
CW	= Track	HH	= Tire loaded radius – A
CH	= Tire loaded radius + C	JH	= KH – B
DH	= Tire loaded radius + D	KH	= Tire radius + 3.00 inches
DW	= Track + 2 tire sections – tire clearance	KW	= DW – 5.00 inches
EW	= Track + 2 tire sections + tire clearance	LW	= 1.00-inch minimum clearance between tires and springs

NOTE: Track and overall width may vary with optional equipment.

Tire	GVWR	Axle Capacity	Susp. Capacity	A	B	C	D	E	Track CW
225/70R 19.5 (12 ply)	19,500 lbs.	14,330 lbs.	13,680 lbs.	8.1	11.2	17.4	15.1	9.8	65.3

(Vehicle Specifications Index Section – FRR/WT5500 – continued on next page)

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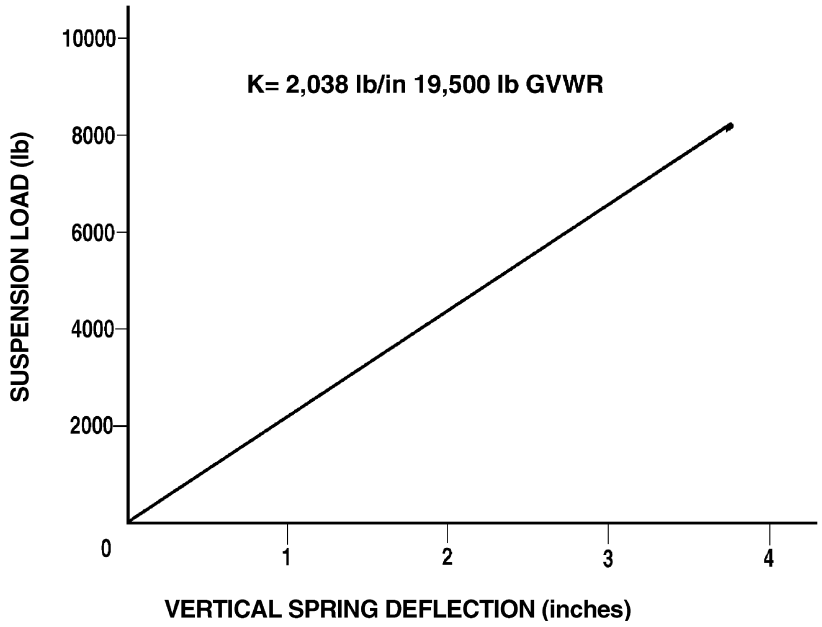
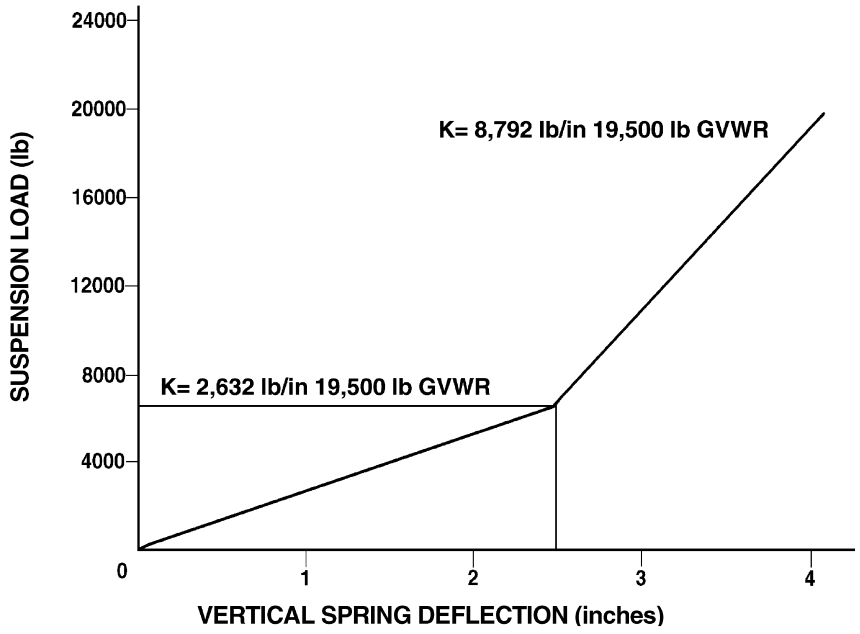
Suspension Deflection Charts

FRONT LEAF SPRING LOAD VS. DEFLECTION (PER AXLE)



REAR LEAF SPRING LOAD VS. DEFLECTION (PER AXLE)



(Vehicle Specifications Index Section – FRR/WT5500 – continued on next page)

(Vehicle Specifications Index Section – FRR/WT5500 – continued from previous page)

Tire and Disc Wheel Chart

Tire

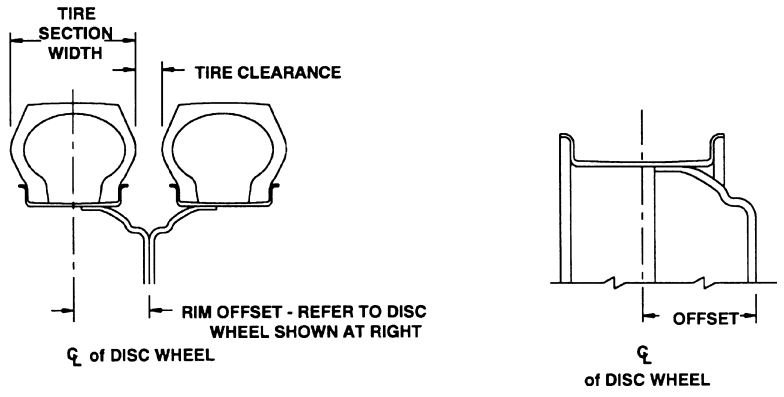
Tire Size	Tire Load Limit and Cold Inflation Pressures				Maximum Tire Load Limits		GVWR (Lb.)
	Single		Dual		Front	Rear	
	Lb.	PSI	Lb.	PSI	2 Single	4 Dual	
225/70R 19.5F (12 ply)	13,640	95	3,420	95	7,280	13,680	19,500

Tire Size	GVWR (Lb.)	Tire Radius		Tire Section Width	Tire Clearance	Design Rim Width
		Loaded	Unloaded			
225/70R 19.5F	19,500	15.0 in.	15.4 in.	8.8 in.	1.20 in.	6.0 in.

Disc Wheel

Wheel Size	Bolt Holes	Bolt Circle Dia.	Ft./Rr. Nut Size*	Rear Stud Size*	Nut/Stud Torque Specs.	Inner Circle	Outside Offset	Disc Thickness	Rim Type	Material Mfg.
19.5 x 6.00	6 JIS	8.75	1.6142 in. (41 mm) BUD HEX	0.8268 in. (21 mm) SQUARE	400 ft.-lb. (550 N•m)	6.46 in.	5.3 in.	0.35 in.	15° DC	Steel TOPY

* O.D. Wrench Sizes



(Vehicle Specifications Index Section – FRR/WT5500 – continued on next page)

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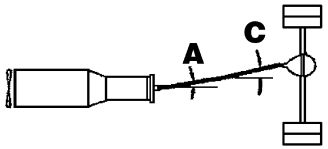
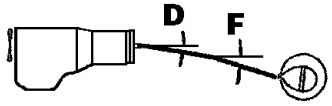
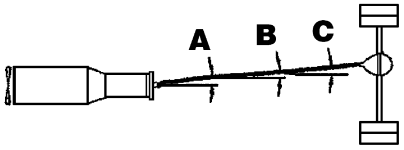
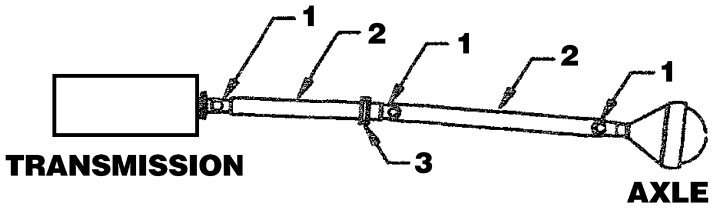
Propeller Shaft

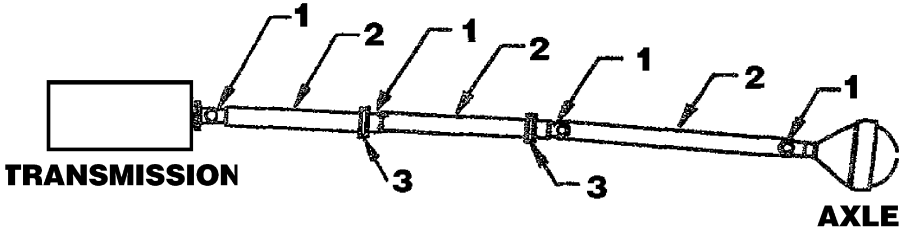
WB	PLANE VIEW	SIDE VIEW
148 in. 167 in. 179 in. 191 in.		
218 in.		

TYPICAL INSTALLATIONS SHOWING YOKES "IN PHASE." "IN PHASE" MEANS THAT THE YOKES AT EITHER END OF A GIVEN PROPELLER SHAFT ASSEMBLY ARE IN THE SAME PLANE.

(148 in., 167 in., 179 in. & 191 in. WB)



(218 in. WB)



1. UNIVERSAL JOINT
2. PROPELLER SHAFT
3. CENTER CARRIER BEARING

(Vehicle Specifications Index Section – FRR/WT5500 – continued on next page)

(Vehicle Specifications Index Section – FRR/WT5500 – continued from previous page)

Wheelbase	Plane View								Side View							
	A		B		C				D		E		F			
					Unloaded		Loaded						Unloaded		Loaded	
	M/T	A/T	M/T	A/T	M/T	A/T	M/T	A/T	M/T	A/T	M/T	A/T	M/T	A/T	M/T	A/T
148 in.	0.0º	4.4º	—	—	4.8º	9.6º	4.8º	4.9º	1.7º	1.9º	—	—	7.1º	7.1º	2.4º	2.4º
167 in.	0.0º	3.8º	—	—	3.5º	6.6º	3.5º	3.2º	1.2º	1.3º	—	—	4.2º	4.1º	0.7º	0.7º
179 in.	0.0º	3.8º	—	—	2.6º	5.0º	2.6º	2.4º	1.2º	1.3º	—	—	2.5º	2.5º	-0.1º	-0.1º
191 in.	0.0º	4.6º	—	—	2.6º	4.8º	2.6º	2.2º	2.0º	2.1º	—	—	2.2º	2.3º	-0.2º	-0.3º
218 in.	0.0º	3.7º	0.0º	4.2º	2.6º	3.2º	2.6º	0.7º	1.2º	1.2º	1.6º	1.7º	0.7º	0.7º	-1.8º	-1.8º

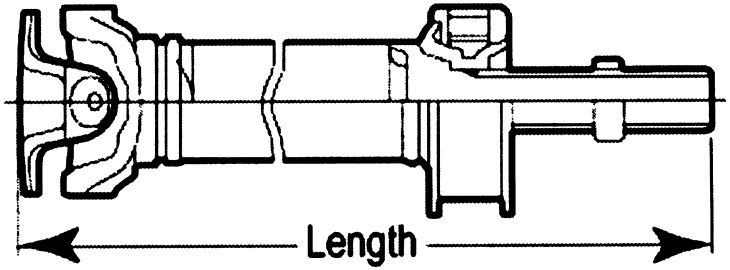
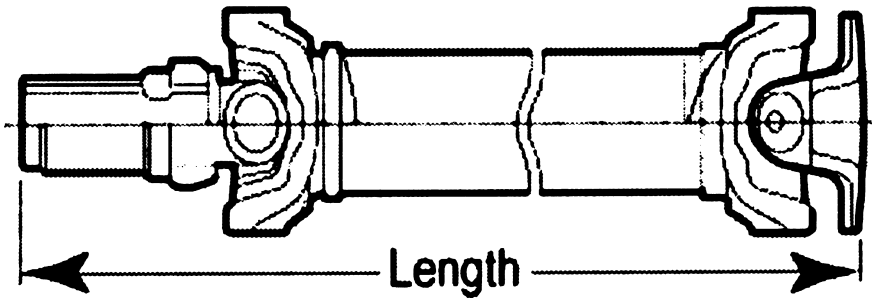
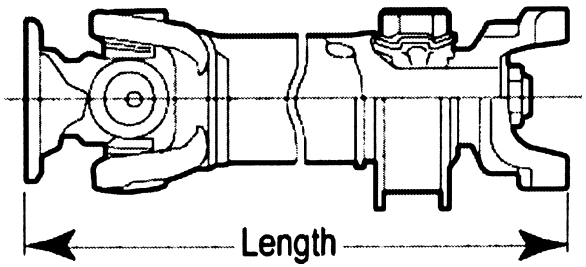
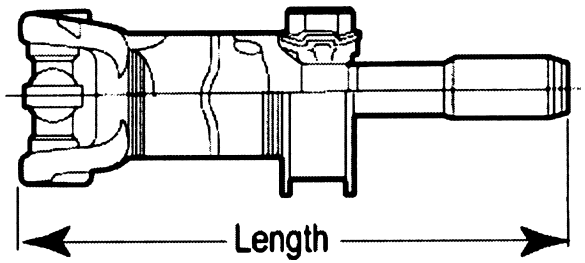
Engine install at 2.5º angle from horizontal frame. Side view angles are measured from 2.5º angle. Positive angles are in addition to 2.5º angle. Negative angles are in subtraction from 2.5º angle.

NOTE: Loaded = at Design Load. Unloaded = at Curb Position (with typical cargo body).

Wheelbase	148 in.		167 in.		179 in.		191 in.		218 in.	
No. of Shafts	2		2		2		2		3	
Trans. Type	M/T	A/T	M/T	A/T	M/T	A/T	M/T	A/T	M/T	A/T
Shaft #1 O.D.	4.0									
Thickness	0.134									
Length	37.89	35.80	46.16	44.07	46.16	44.07	57.57	55.49	42.37	40.28
Type	A	A	A	A	A	A	A	A	C	C
Shaft #2 O.D.	4.0									
Thickness	0.134									
Length	38.20	38.20	48.44	48.44	60.05	60.05	60.65	60.65	42.89	42.89
Type	B	B	B	B	B	B	B	B	D	D
Shaft #3 O.D.	4.0									
Thickness	0.134									
Length	—	—	—	—	—	—	—	—	60.65	60.65
Type	—	—	—	—	—	—	—	—	B	B

(Vehicle Specifications Index Section – FRR/WT5500 – continued on next page)

(Vehicle Specifications Index Section – FRR/WT5500 – continued from previous page)

Type	Description	Illustration
Type **A**	1st shaft in 2-piece driveline 6-speed manual and automatic	
Type **B**	2nd shaft in 2-piece driveline 3rd shaft in 3-piece driveline 6-speed manual and automatic	
Type **C**	1st shaft in 3-piece driveline 6-speed manual and automatic	
Type **D**	2nd shaft in 3-piece driveline 6-speed manual and automatic	

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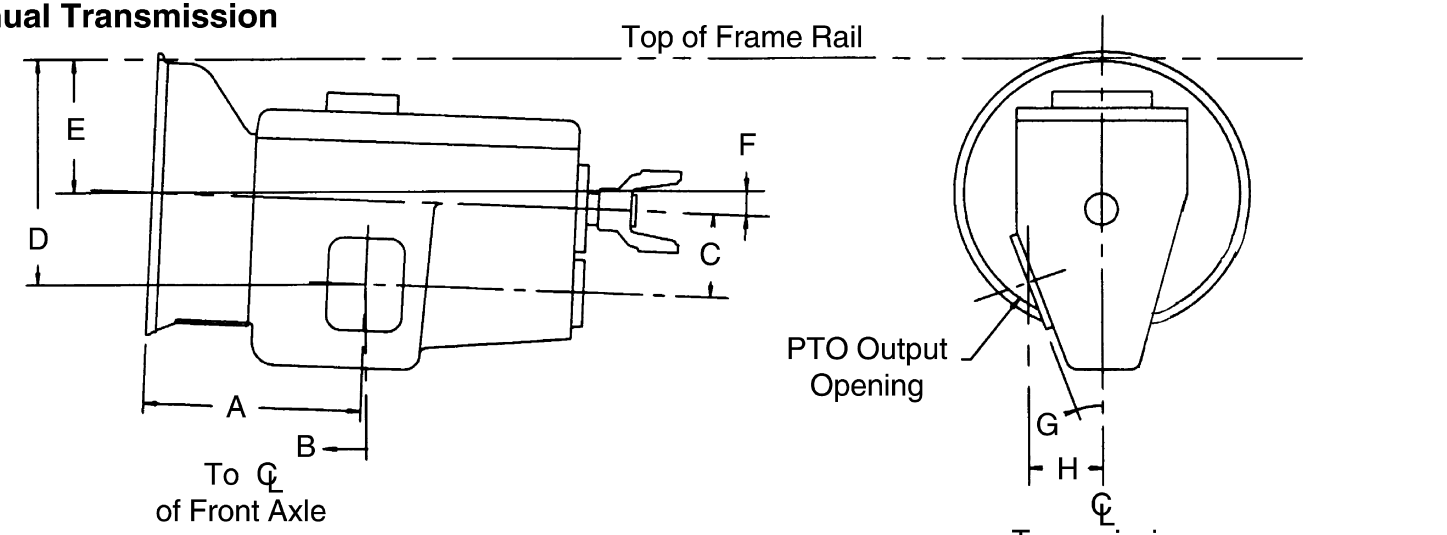
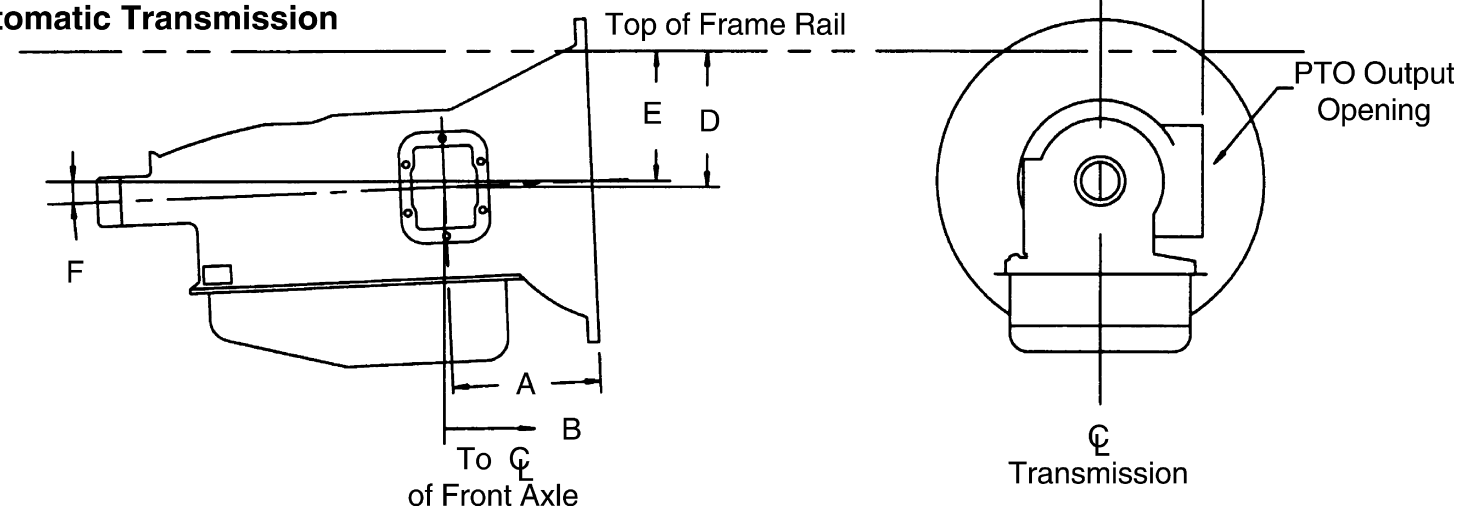
PTO Location, Drive Gear and Opening Information

Manual Transmission



Automatic Transmission



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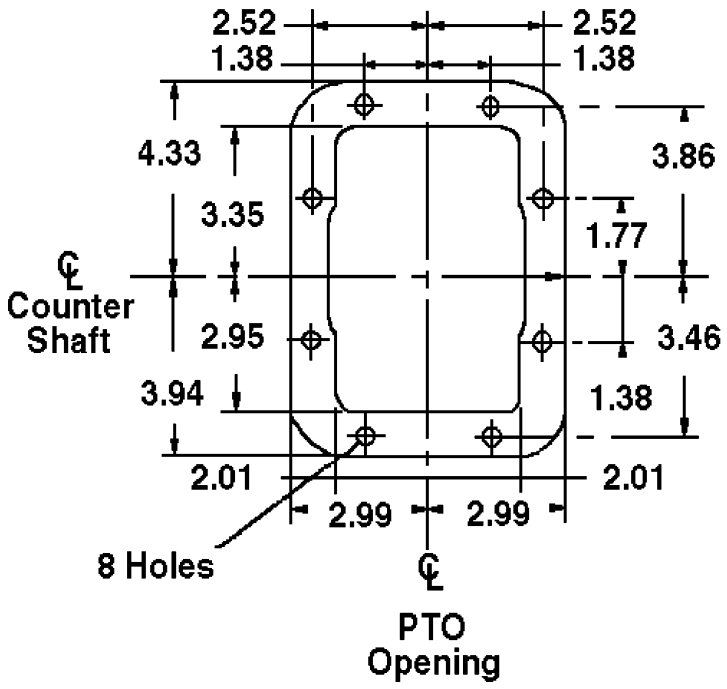
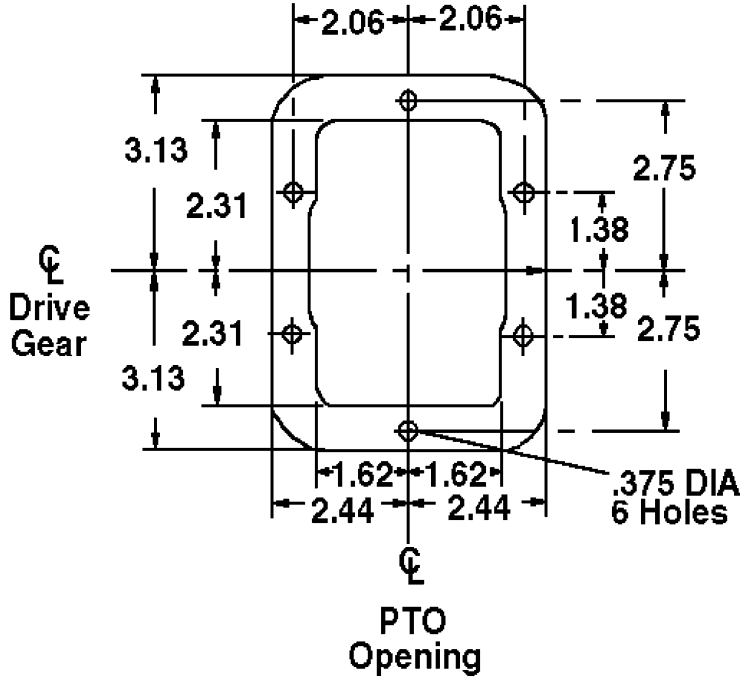
Trans.	Opening Location	Bolt Pattern	A	B	C	D	E	F	G	H	PTO Drive Gear Location	Ratio of PTO Drv. Gear Spd. to Eng. Spd.	No. of Teeth	Pitch	Helix Angle	Max. Output Torque
MLD6Q	Left	(Dr 1)	11.3	43.2	5.1	12.9	7.3	2.5º	0º	5.6	4th Gear Trans. Countershaft	25/42 - 0.595	36	6.6299	24º RH	180 lbs.-ft. @ 1,500 RPM
AT S1000	Right	SAE-6	11.94	43.7	0.0	7.8	7.3	2.5º	0º	5.67	Converter Driven PTO Gear	1:1 with turbine	64	6.865	0º	200 lbs.-ft. @ 1,500 RPM

Opening Diagram

(Dr 1) MLD 6Q



S1000



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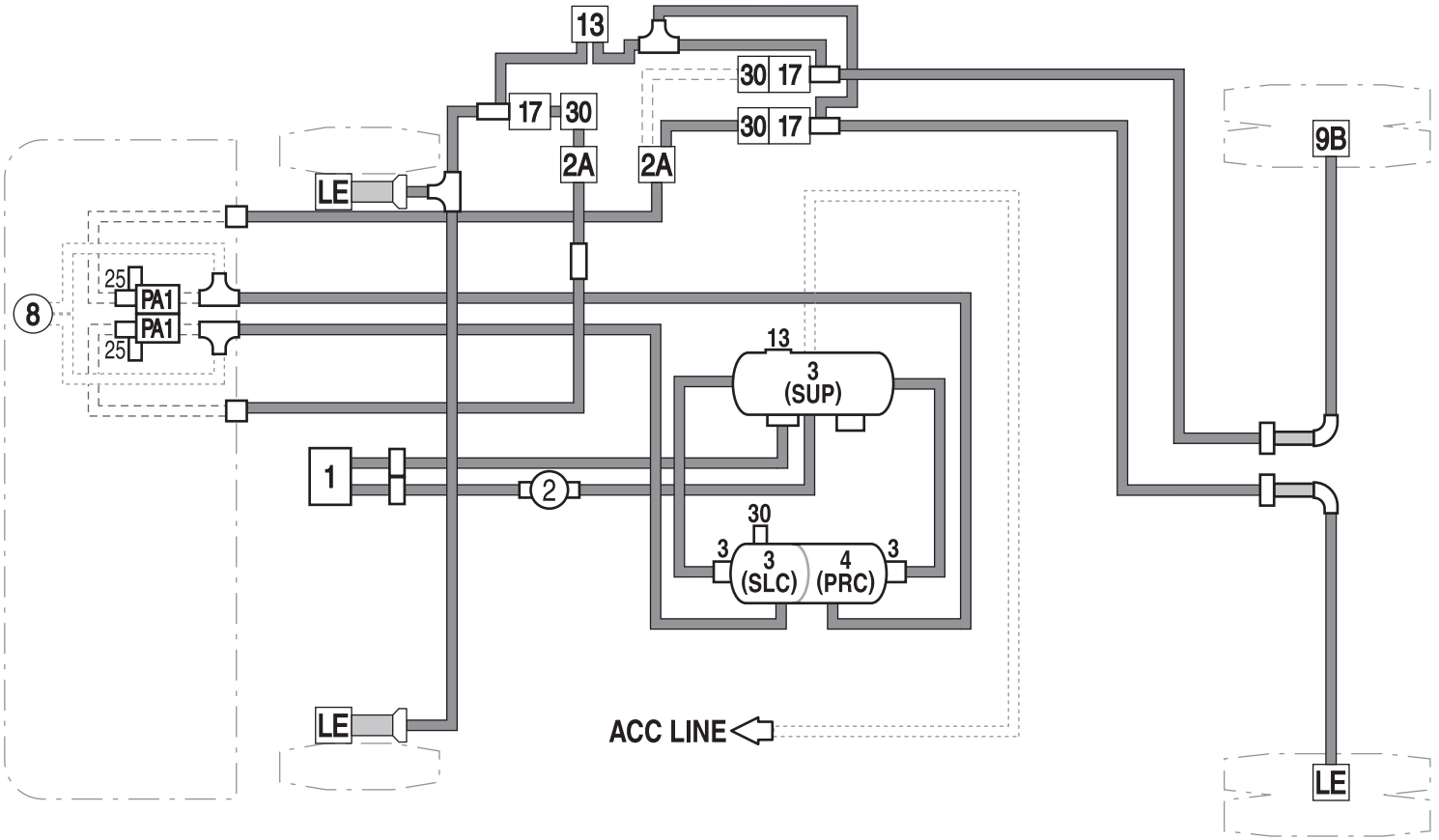
(Vehicle Specifications Index Section – FRR/WT5500 – continued from previous page)

Brake System Diagram

Vacuum Over Hydraulic

Please refer to Introduction Section of book for antilock system cautions and wheelbase modification requirements.



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Allison Transmission Rating Guide

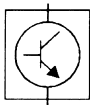
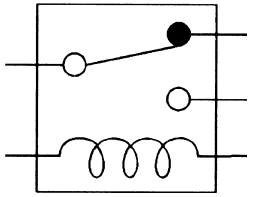
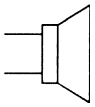
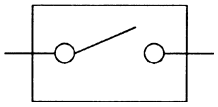
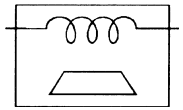
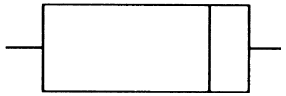
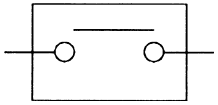
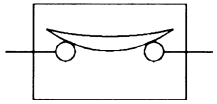
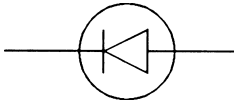
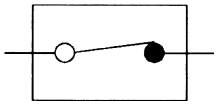
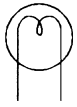
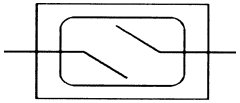
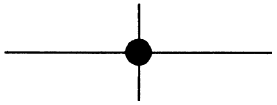
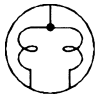
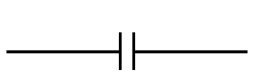
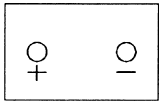
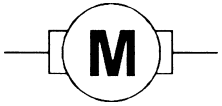
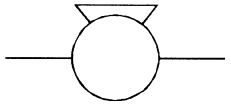
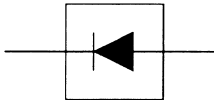
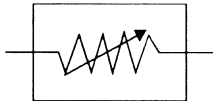
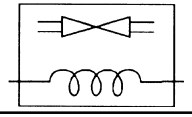
	Input Torque		Input Power		Turbine				
	Gross[1] N•m (lbs./ft.)	Net N•m (lbs./ft.)	Gross[1,2] (kW) (hp)	Net (kW) (hp)	Torque N•m (lbs./ft.)	GVW kg (lbs.)	GCW kg (lbs.)	N/V Ratio[3] rpm/kMph (rpm/mph)	Vocations
General	740 (545)	705 (520)	280 (375)	254 (340)	1,152 (850)	9,000 (19,850)	11,800 (26,000)	24-38 (38-62)	One-Way Rental, School Bus, General Purpose
Severe Duty	740 (545)	705 (520)	280 (375)	254 (340)	1,152 (850)	7,500 (16,540)	N/A	24-38 (38-62)	Refuse Vehicles (On-Highway Only)
Specialty	740 (545)	705 (520)	280 (375)	254 (340)	1,152 (850)	9,980 (22,000)	11,800 (26,000)	24-38 (38-62)	Motorhome
Transit Bus	576 (425)	542 (400)	149 (200)	134 (180)	1,017 (750)	7,500 (16,540)	N/A	24-38 (38-62)	Transit Bus
Transit Bus w/SEM[4]	630 (456)	603 (445)	149 (200)	134 (180)	1,017 (750)	7,500 (16,540)	N/A	24-38 (38-62)	Transit Bus

1. Gross Power and Torque ratings are included for reference only.
2. Gross Power rating as defined by SAE J1995.
3. Ratio of transmission output rpm to vehicle round speed. N/V is only used to limit park pawl applications.
4. SEM = Engine controls with Shift Energy Management.

NOTE: Consult Allison for transmission applications and approvals not listed above.

NPR, NPR HD/W3500, W4500 Gas Electrical

Symbols

Symbol	Meaning	Symbol	Meaning	Symbol	Meaning
	Fuse		Electronic Parts		Coil (Inductor), Solenoid Magnetic Valve
	Fusible Link		Resistor		Relay
	Fusible Link Wire		Speaker		
	Switch		Buzzer		Connector
	Switch		Circuit Breaker		Light-Emitting Diode
	Switch (Normal Close Type)		Bulb		Reed Switch
	Contact Wiring		Double-Filament Bulb		Condenser
	Battery		Motor		Horn
	Diode		Variable Resistor Rheostat		Vacuum Switching Valve

(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas Electrical – continued on next page)

(Vehicle Specifications Index Section – NPR, NPR HD/W3500, W4500 Gas Electrical – continued from previous page)

Abbreviations

Abbreviation	Definition	Abbreviation	Definition
A	Ampere (S)	kW	Kilowatt
ABS	Anti-lock Brake System	LH	Left Hand
ASM	Assembly	LWB	Long Wheelbase
AC	Alternating Current	M/T	Manual Transmission
A/C	Air Conditioner	OD	Overdrive
ACC	Accessories	OPT	Option
A/T	Automatic Transmission	QOS	Quick on Start
C/B	Circuit Breaker	RH	Right Hand
CSD	Cold Start Device	RR	Rear
DIS	Direct Ignition System	RWAL	Rear Wheel Anti-lock Brake System
EBCM	Electronic Brake Control Module	ST	Start
ECGI	Electronic Control Gasoline Injection	STD	Standard
ECM	Electronic Control Module	SW	Switch
ECU	Electronic Control Unit	SWB	Short Wheelbase
EFE	Early Fuel Evaporation	TCM	Transmission Control Module
4 A/T	4-Speed Automatic Transmission	3 A/T	3-Speed Automatic Transmission
4 X 4	Four-Wheel Drive	V	Volt
FL	Fusible Link	VSV	Vacuum Switching Valve
FRT	Front	W	Watt (S)
H/L	Headlight	WOT	Wide Open Throttle
IC	Integrated Circuit	W/	With
IG	Ignition	W/O	Without

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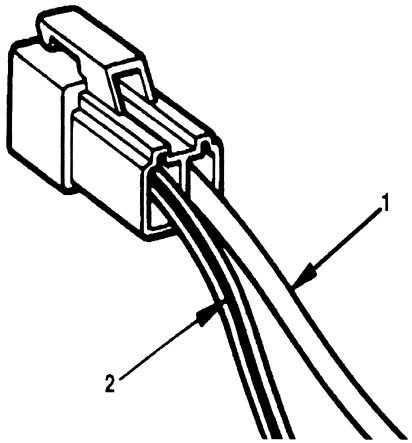
Wiring

Wire Color

All wires have color-coded insulation. Wires belonging to a system's main harness will have a single color. Wires belonging to a system's sub-circuits will have a colored stripe. Striped wires use the following code to show wire size and colors.

Example: 0.5 G / R

- R — Red (Stripe Color)
- G — Green (Base Color)
- 0.5 — Wire Size (0.5 mm^2)



1. Single Color Wire
2. Colored Stripe Wire

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Abbreviations are used to indicate wire color within a circuit diagram. Refer to the following table.

Color-Coding	Meaning	Color-Coding	Meaning
B	Black	BR	Brown
W	White	LG	Light Green
R	Red	GR	Grey
G	Green	P	Pink
Y	Yellow	LB	Light Blue
L	Blue	V	Violet
O	Orange		

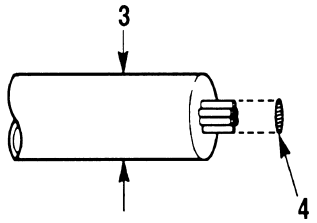
Distinction of Circuit by Wire Base Color

Base Color	Circuits	Base Color	Circuits
B	Starter Circuit	Y	Instrument Circuit
W	Charging Circuit	L, O, BR, LG, GR, P, LB, V	Other Circuits
R	Lighting Circuit		
G	Signal Circuits		

Wire Size

The size of wire used in a circuit is determined by the amount of current (amperage), the length of the circuit, and the voltage drop allowed. The following wire size and load capacity, are specified by AWG (American Wire Gauge). (Nominal size means approximate cross sectional area.)

3. Outside Diameter
4. Cross Sectional Area



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Nominal Size	Cross Sectional Area (mm^2)	Outside Diameter (mm)	Allowable Current (A)	AWG Size (Cross reference)
0.3	0.372	1.8	9	22
0.5	0.563	2.0	12	20
0.85	0.885	2.2	16	18
1.25	1.287	2.5	21	16
2	2.091	2.9	28	14
3	3.296	3.6	37.5	12
5	5.227	4.4	53	10
8	7.952	5.5	67	8
15	13.36	7.0	75	6
20	20.61	8.2	97	4

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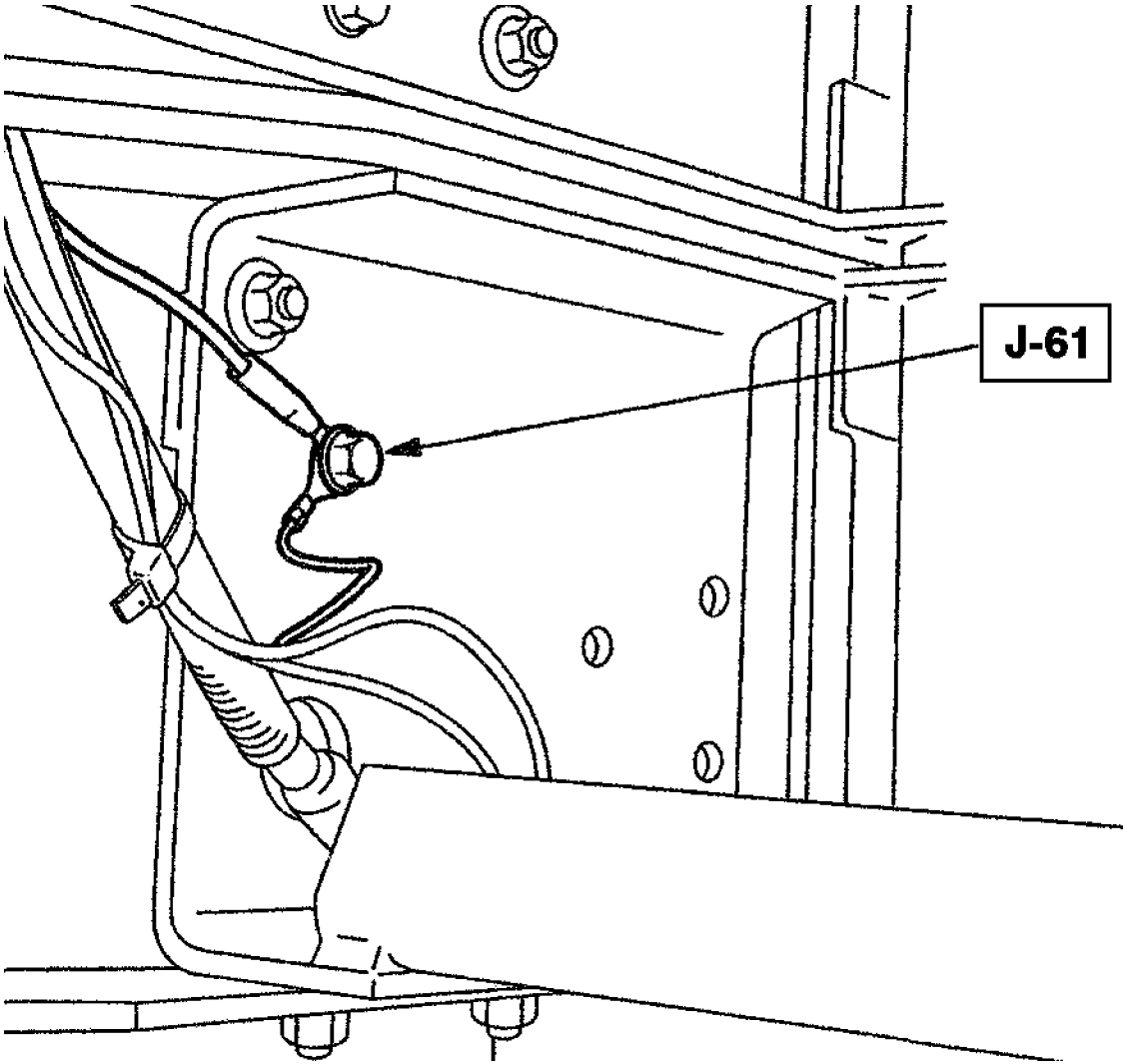
Grounding Point Location (J-61)



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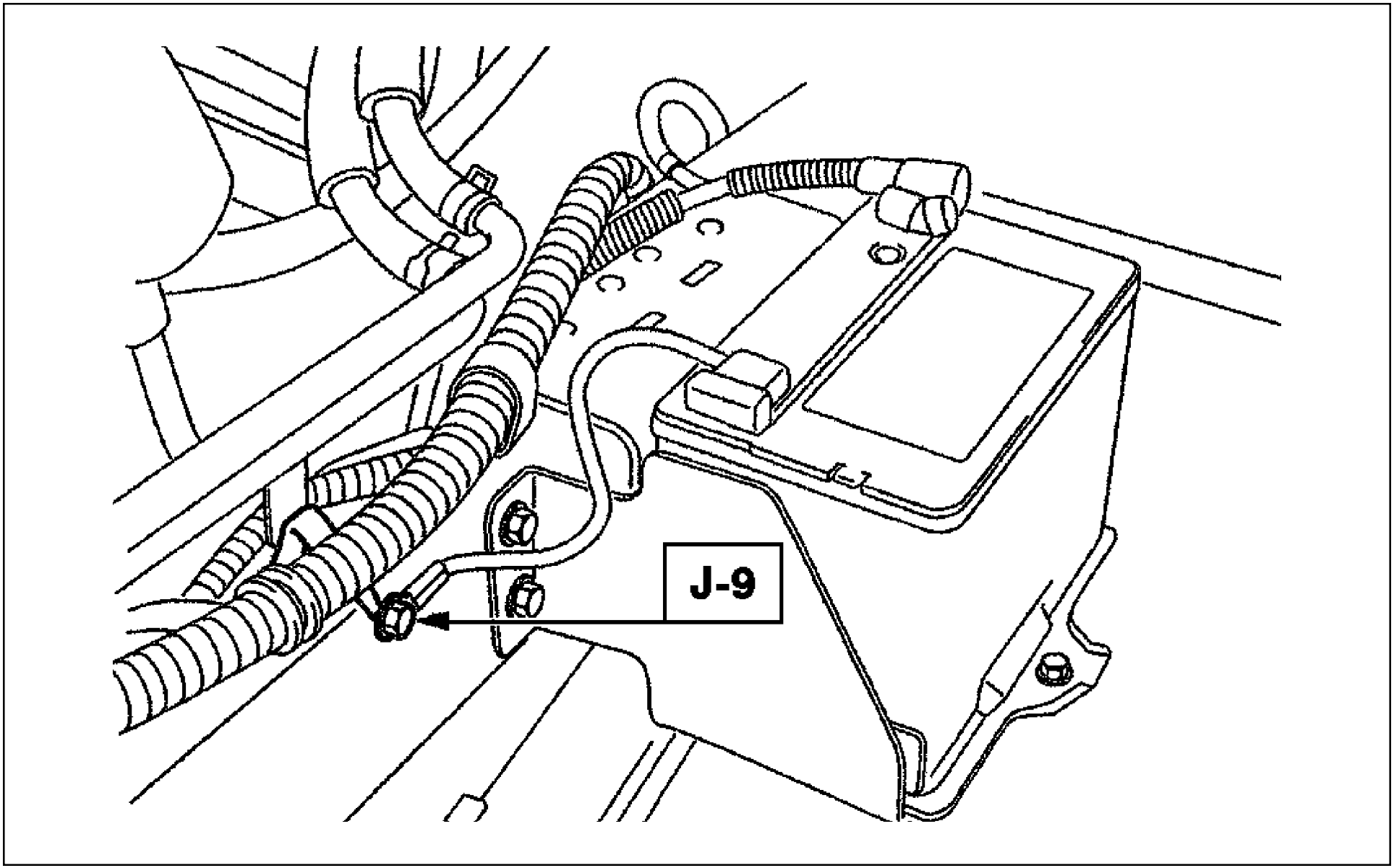
Grounding Point Location (J-9)



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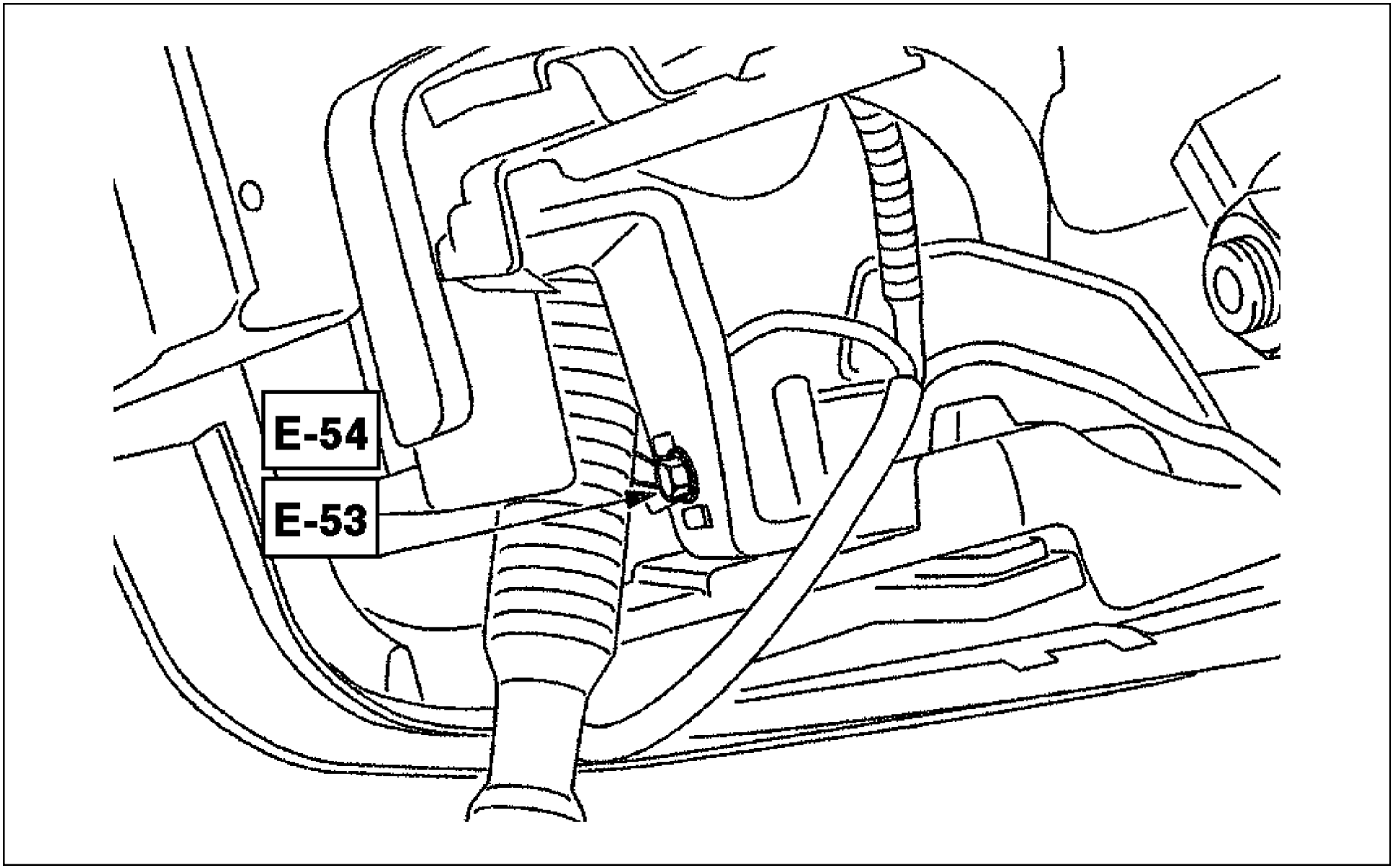
Grounding Point Location (E-54, E-53)



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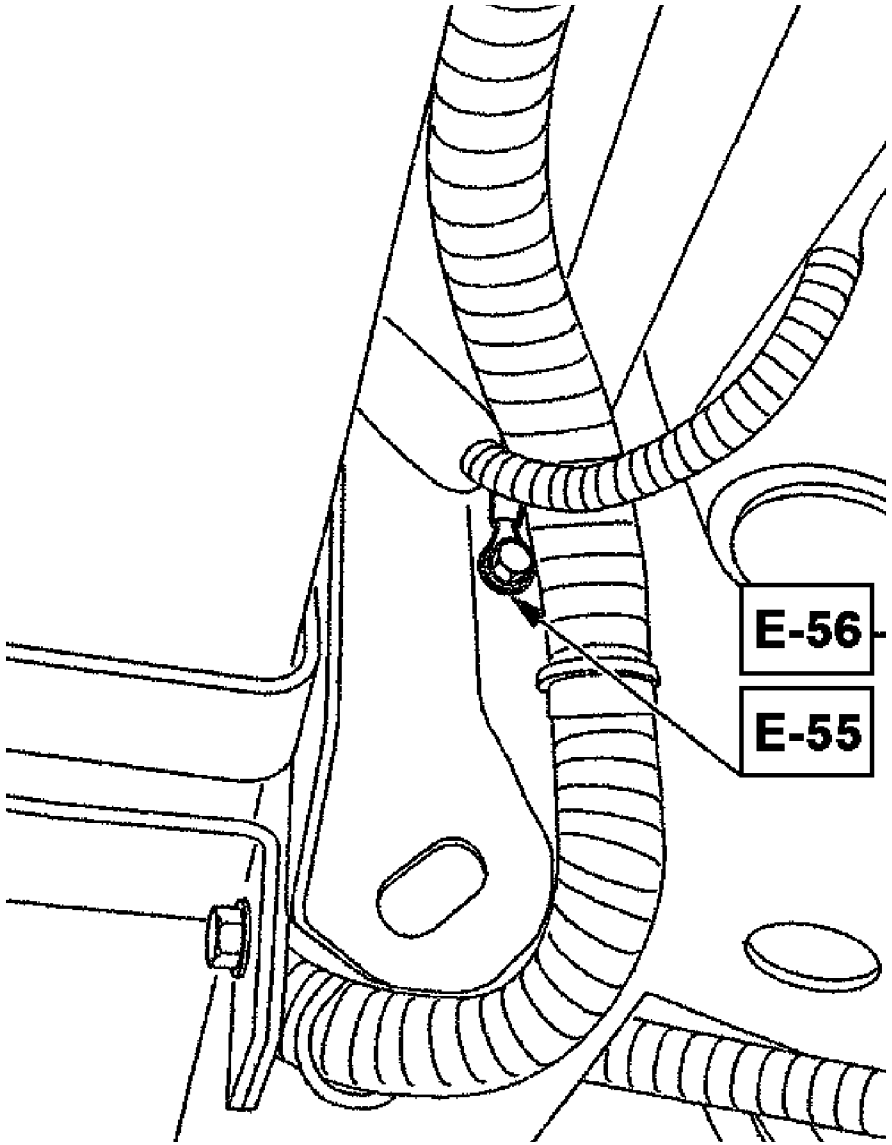
Grounding Point Location (E-56, E-55)



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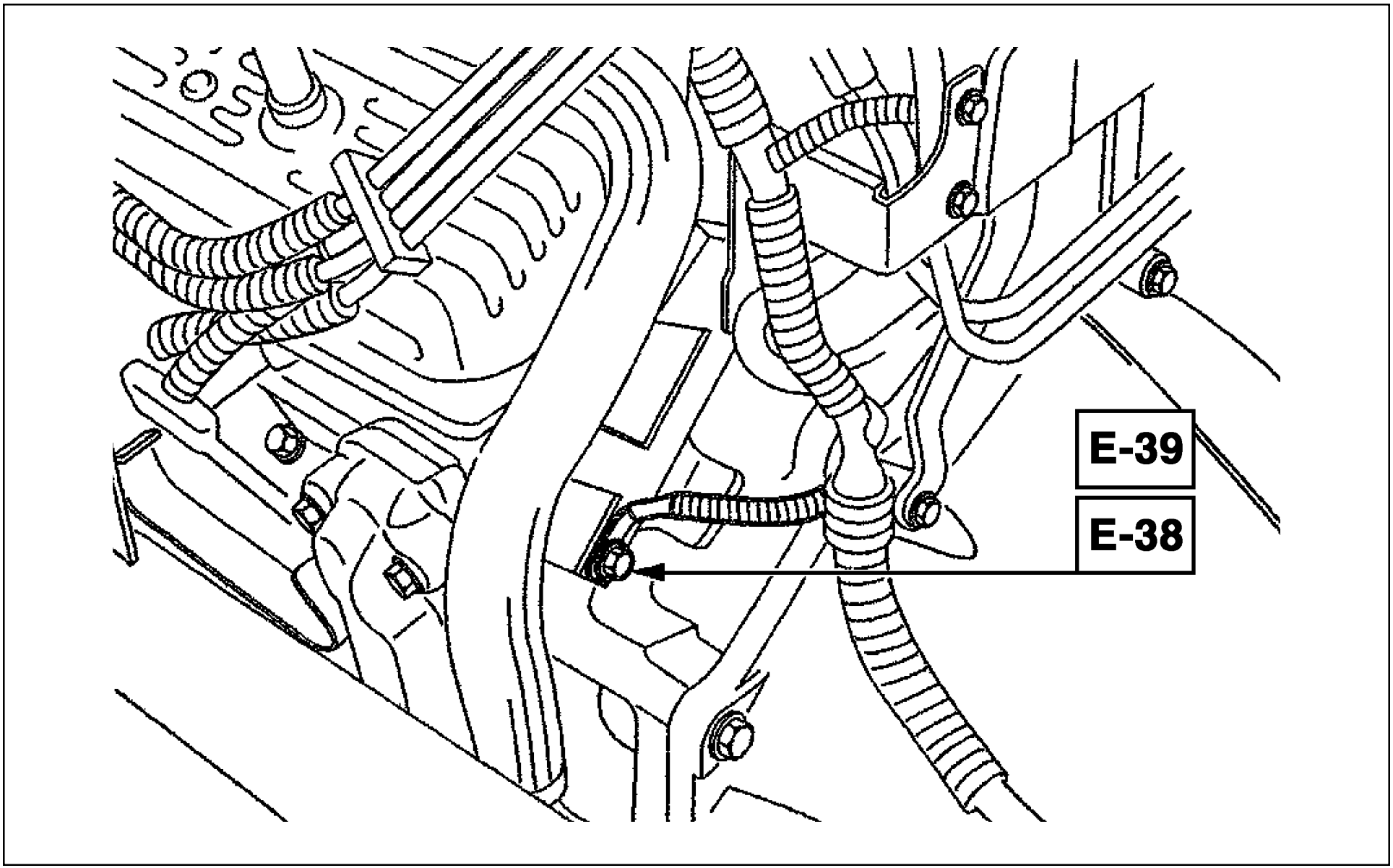
Grounding Point Location (E-39, E-38)



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Reference Table of Grounding Point

NOTICE: Abnormal phenomena of electrical components are considered resulted from defective grounding. In repair, be sure to inspect grounding points and to tighten all fastening parts surrounding the grounding points.

Connector No.	Cable Harness Name	Location	Main Parts (Load)
E-55 E-55	Engine harness	Frame-LH (FRT)	Turn signal indicator light, Meter, High beam indicator light, Diagnostic connector.
E-53		Headlight bracket-LH	Change relay, Dome light switch, Meter, Meter Starter relay, Inhibitor switch, Lighting switch, Ignition relay, Front turn signal light, Brake fluid switch, Tail relay, Cornering light switch, Dimmer relay, Wiper motor, Washer motor, Intermittent relay, Heater and A/C relay, Radio and clock, Cigar lighter, Fan switch, Blower resistor, A/C Switch, Blower motor, Electronic thermostat, Cab interior switch, Flasher unit, Clearance light, I.D. light, Illumination, Power source relay, Hazard warning switch, Turn signal light switch, Diagnostic connector, Roof marker light, Illumination controller.
J-9	Frame front harness	Frame-RH (CRT)	Fuel pump relay, I.D. light relay, License plate light, Taillight, Rear turn signal light, Stoplight, Backup light inhibitor switch, Rear oxygen sensor (LH, RH).
J-61	Frame rear harness	Horn (LH)	Fuel pump, License plate light, Taillight, Rear turn signal light, Stoplight, Backup light inhibitor switch.
E-38	Engine harness	Engine-LH (RR)	Front oxygen sensor (LH, RH), Mass air flow sensor, Coil driver, Vehicle control module, Purge solenoid vacuum switch.
E-39		Engine-LH (RR)	Vehicle control module.

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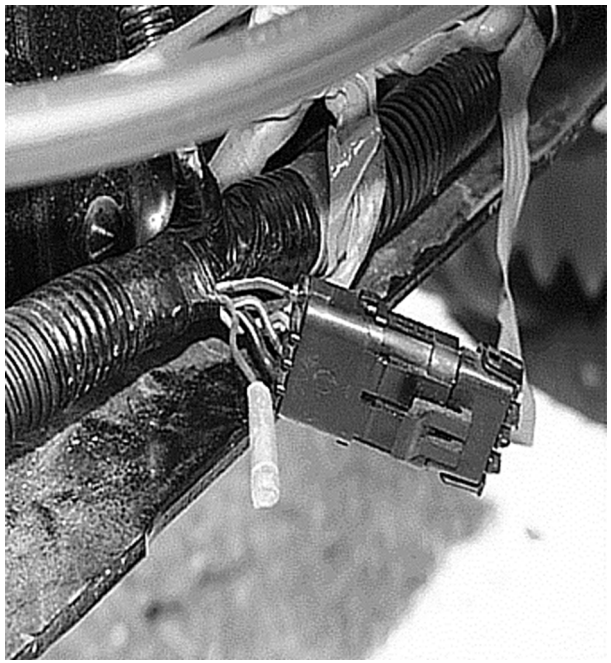
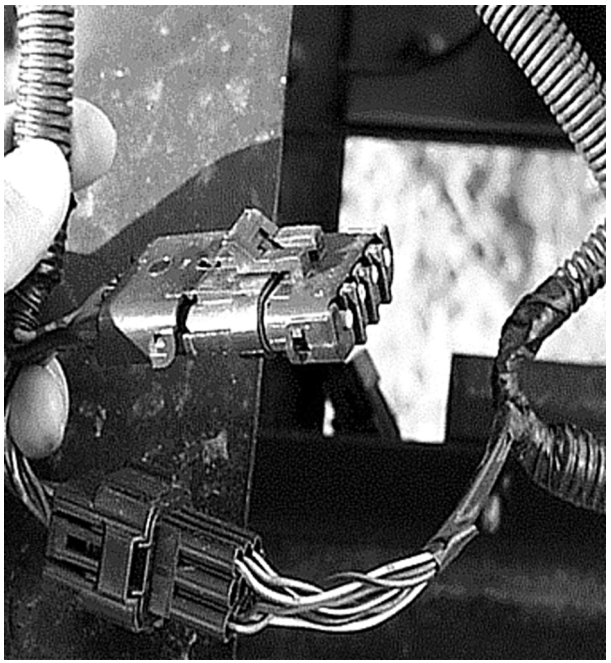
NPR/W3500 Body Room Light, I.D. and Marker Lamp, and Back-Up Lamp Connector Location

NPR/W3500 Body Connectors LH Frame



- **Packard Body Plug**
- **4-Pin Weather Seal Connector with Mating Plug**
- **Location:**
  Inside left-hand frame rail 28 to 31 inches BOC
- **Circuits:**
  Black = Ground
  Red/Green = Marker Lamp
  Red = Hot Wire
  Red/Yellow = Cargo Room Light (Keyed)

NPR/W3500 Body Connectors EOF



- **Packard Body Plug**
- **4-Pin Weather Seal Connector with Mating Plug**
- **Location:**
  Center of Crossmember
- **Circuits:**
  Black = Ground
  Red/Green = Marker Lamp
  Red = Hot Wire
  Red/Yellow = Cargo Room Light (Keyed)

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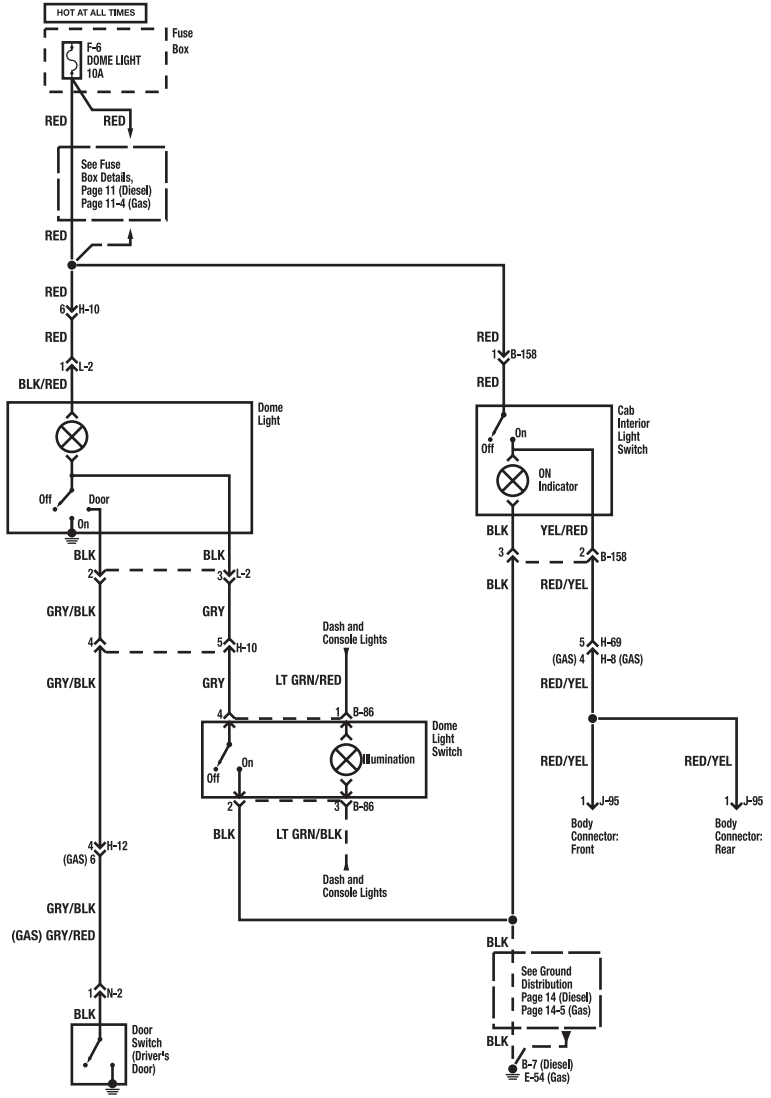
Dome and Interior Lights Circuit Diagram



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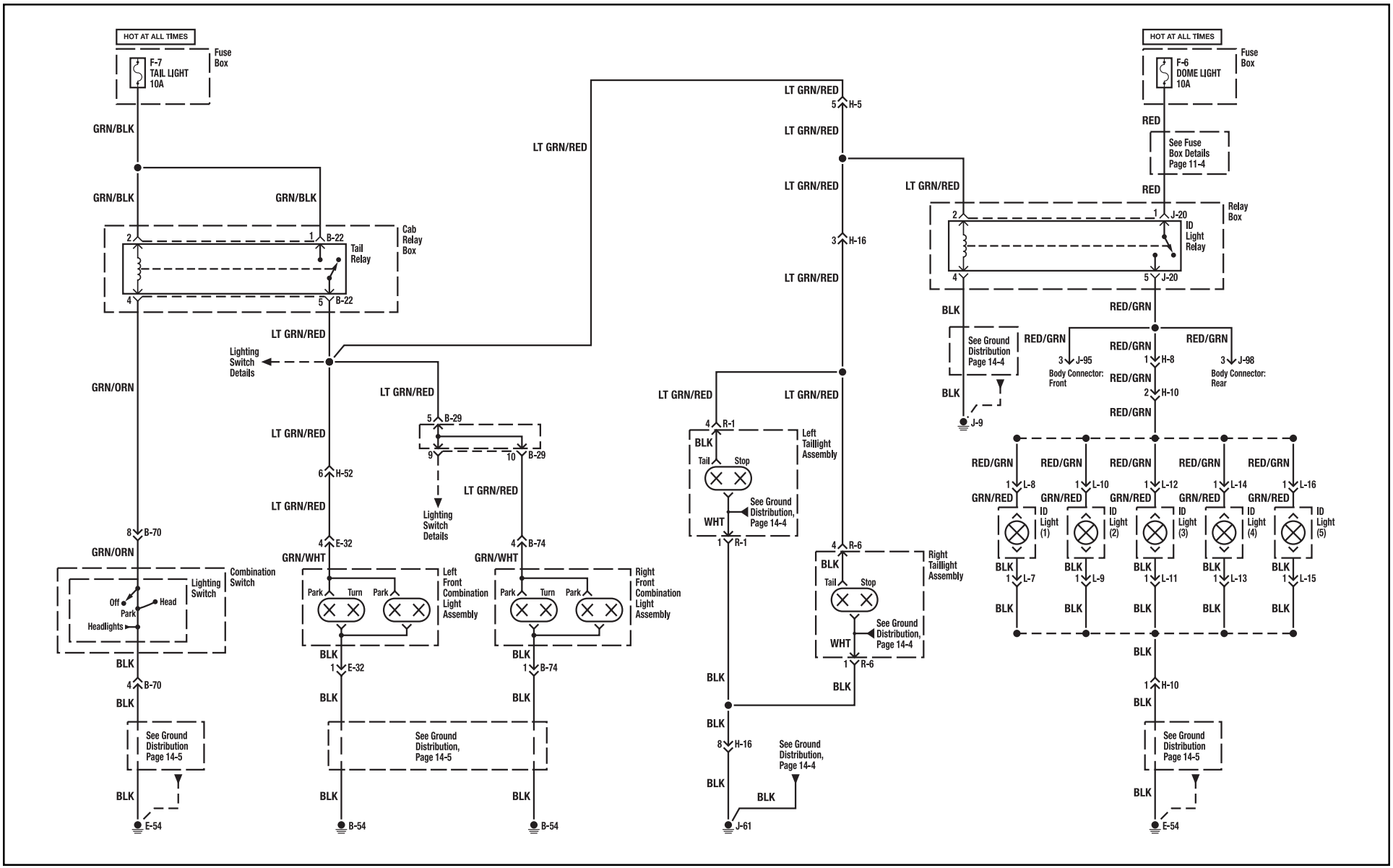
Park, Tail, License and I.D. Lights Circuit Diagram



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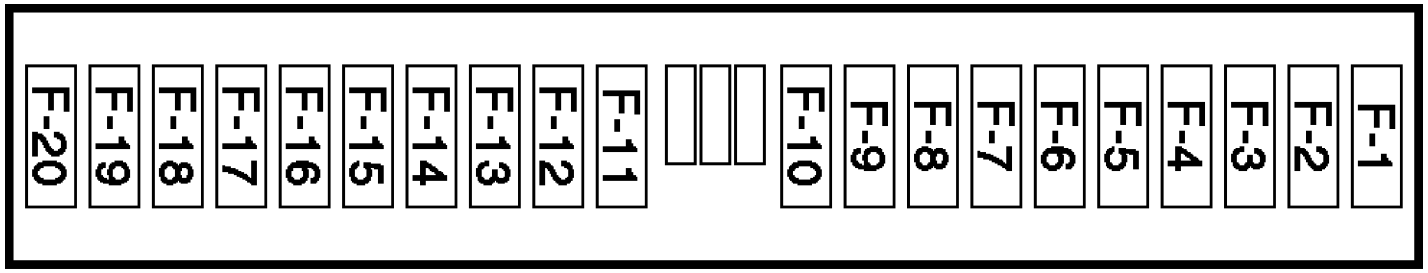
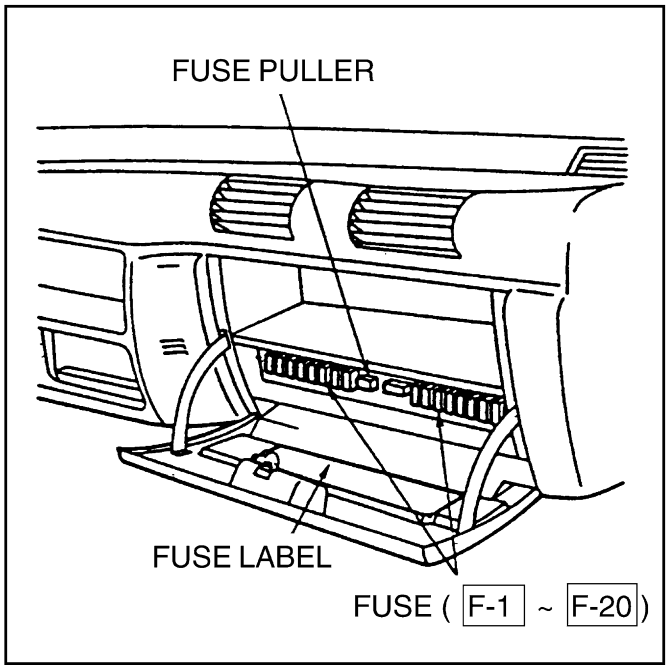
Fuse Location





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Fuse Box

Fuse No.	Fuse Name	Amps	Circuit Protected
F-1	HEATER	25A	Heater
F-2	AIR CON	10A	Compressor controls
F-3	EXHAUST BRAKE (Diesel)	10A	Exhaust brake system (Diesel)
	VCM (IGN) (Gas)		Engine controls (Gas)
F-4	D.R.L. (Diesel)	10A	Headlights (Diesel)
	ENGINE (IGN) (Gas)		Engine controls (Gas)
F-5	ECU (BAT) (Diesel)	10A	Engine controls (Diesel)
	A/T SOLENOID (Gas)		Automatic transmission controls (Gas)
F-6	DOME LIGHT	10A	Interior lights, Exterior lights, Sound system (Gas), Speedomoter (Gas)
F-7	TAIL LIGHT	10A	Dash lights, Exterior lights
F-8	STOP LIGHT	10A	Brake lights
F-9	HEAD LIGHT (RH)	20A	Headlights
F-10	HEAD LIGHT (LH)	20A	Headlights
F-11	WIPER, WASHER	20A	Windshield wiper/washer
F-12	GENERATOR	20A	Charging system
F-13	TURN S/LIGHT	10A	Turn lights
F-14	ECU (IGN) (Diesel)	10A	Engine controls
	VCM (ACC) (Gas)		
F-15	AUDIO, CIGAR LIGHTER	20A	Cigarette lighter, Engine controls, Sound system
F-16	POWER SOURCE	20A	Engine controls
F-17	ENGINE STOP (Diesel)	10A	Engine stop system (Diesel)
	FUEL PUMP (Gas)		Engine controls, Gauges (Gas)
F-18	HAZARD, HORN	20A	Engine controls, Gauges, Horn, Hazard lights

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Fuse Box (continued)

Fuse No.	Fuse Name	Amps	Circuit Protected
F-19	ABS (BAT)	25A	ABS
F-20	STARTER	10A	Starting system

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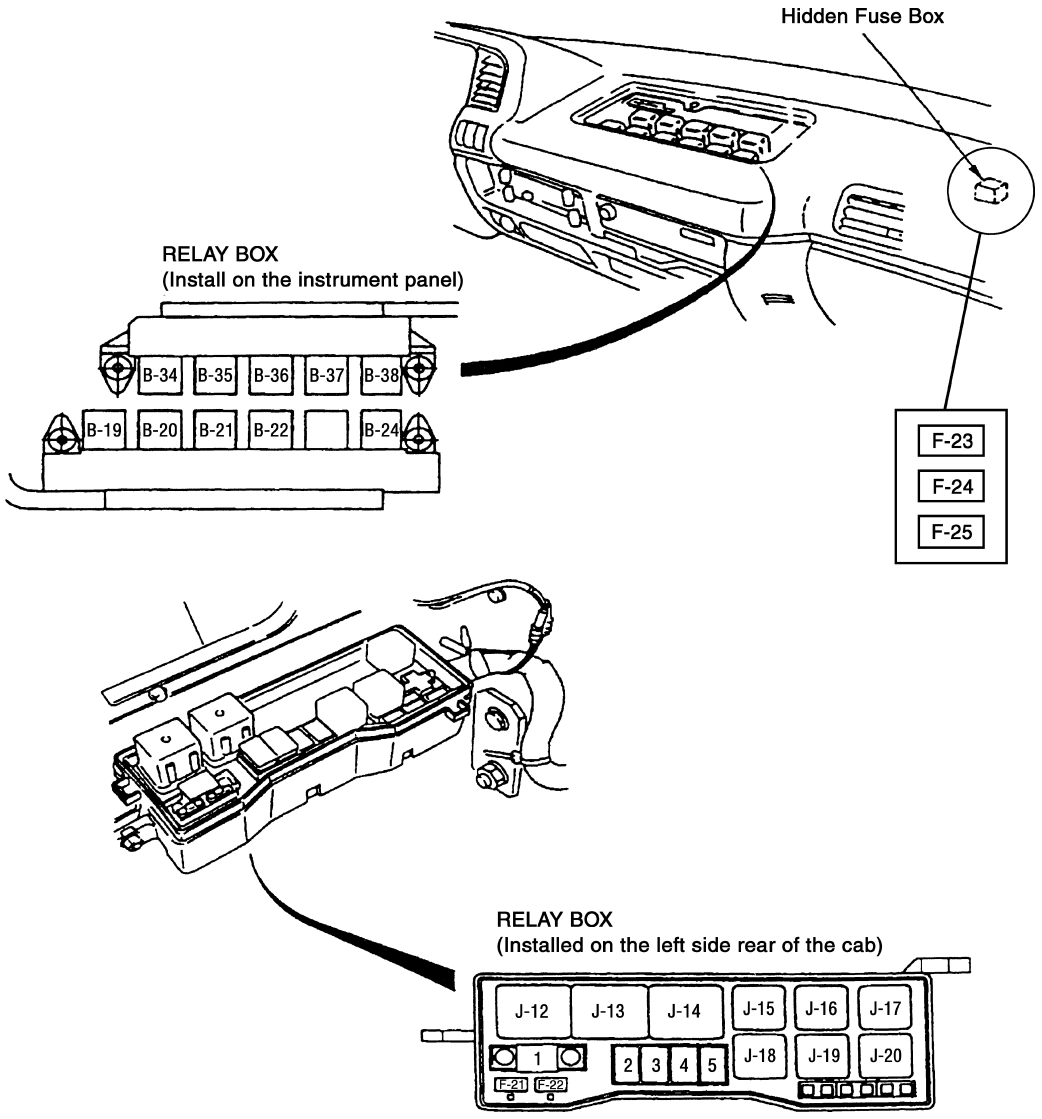
Relay Location



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Cab Relay

Diode Number	Circuits Protected	Diode Number	Circuits Protected
B-17	Brake warning system	B-25	Compressor controls
B-18	——	B-26	Exhaust brake system (Diesel)

Relay Number	Relay	Relay Number	Relay
B-19	Charge relay	B-35	Cornering
B-20	Headlight	B-36	Exhaust brake cut (Diesel)
B-21	Heater and A/C		Vacuum pump (Gas)
B-22	Tail	B-37	A/C thermo
B-23	Buzzer control	B-38	Exhaust brake (Diesel)
B-24	Horn		Ignition (Gas)
B-34	Power source		

Hidden Fuse Box

Fuse No.	Fuse Name	Amps	Circuit Protected
F-23	ABS-1	15A	ABS
F-24	ABS-2	10A	ABS
F-25	GAUGE, BACK	10A	ABS, Back-up lights (Diesel), Brake warning system, Compressor controls, Engine controls, Exhaust brake system (Diesel), Exterior lights, Starting system, Transmission controls (Diesel)

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Relay Box Outside Cab

Fuse No.	Fuse Name	Amps	Circuit Protected
1	MAIN	80A	Power distribution
2	KEY	50A	Power distribution
3	ABS (Gas)	60A	ABS (Gas), Engine controls (Diesel)
	GLOW (Diesel)		
4	ABS (Diesel)	60A	ABS
5	C/HEATER (Diesel)	60A	Ceramic heater
F-21	——	——	Not used
F-22	CONDENSER FAN (Diesel)	15A	Condenser fan

Relay Number	Relay	Relay Number	Relay
J-12	Starter	J-16	Fuel pump (Gas)
J-13	Glow-1 (Diesel)	J-17	Condenser (Diesel)
J-14	C/Heater (Diesel/MT)	J-18	Exhaust brake control (Diesel)
J-15	Warm cut 1 (Diesel)	J-19	Engine warm cut 2 (Diesel/AT)
	A/C enable (Gas)	J-20	I.D. light relay

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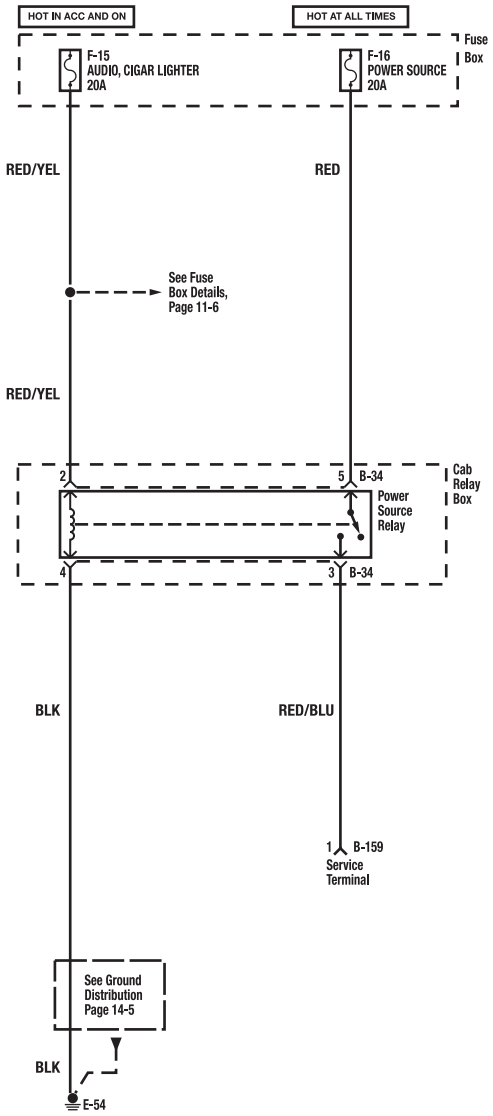
Auxiliary Power Source Circuit Diagram



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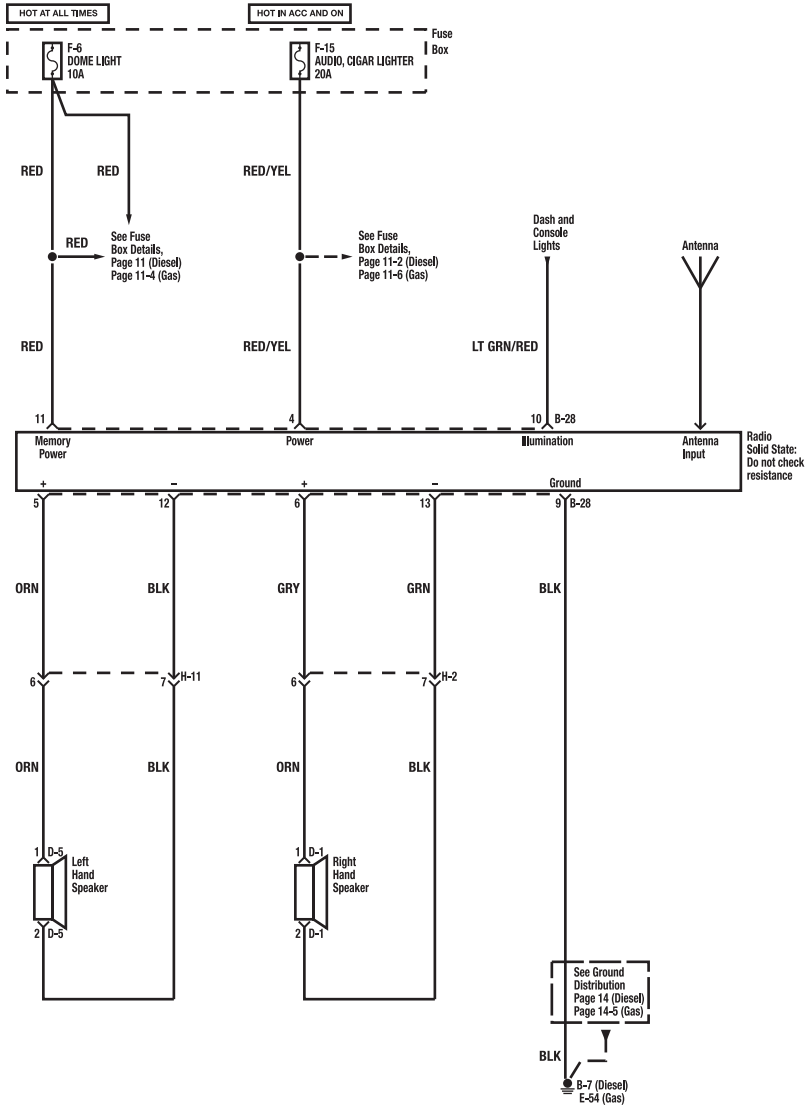
Sound System Circuit Diagram



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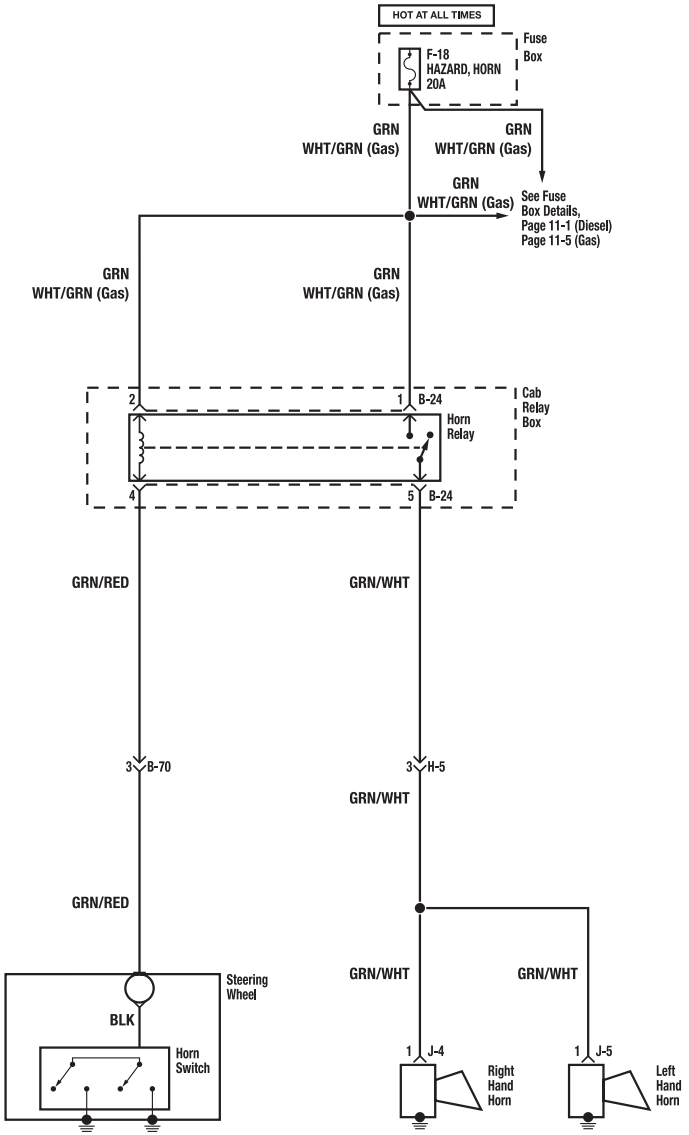
Horn Circuit Diagram



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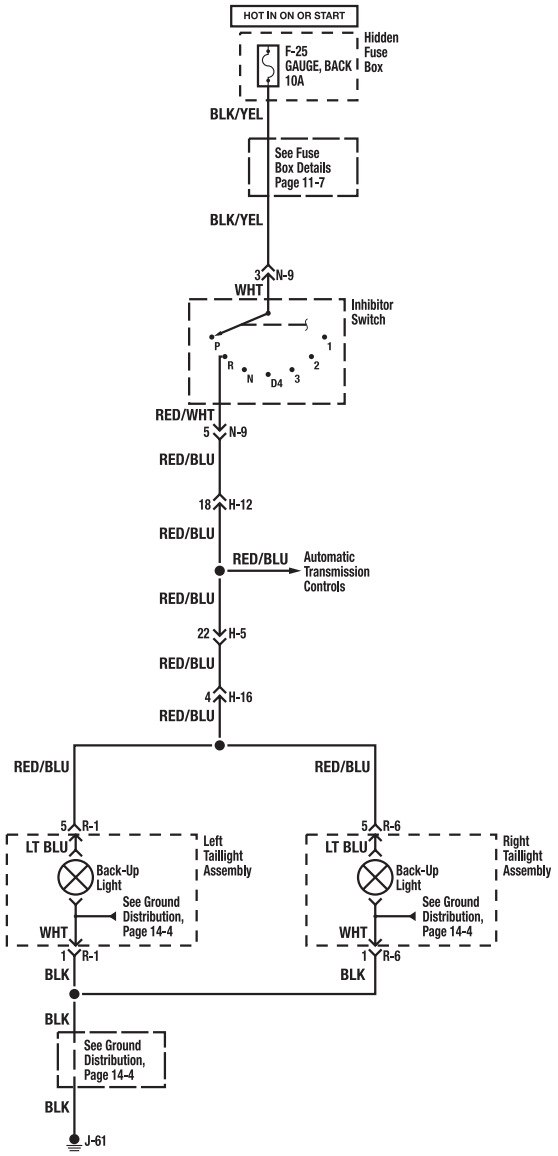
Back-Up Lights Circuit Diagram



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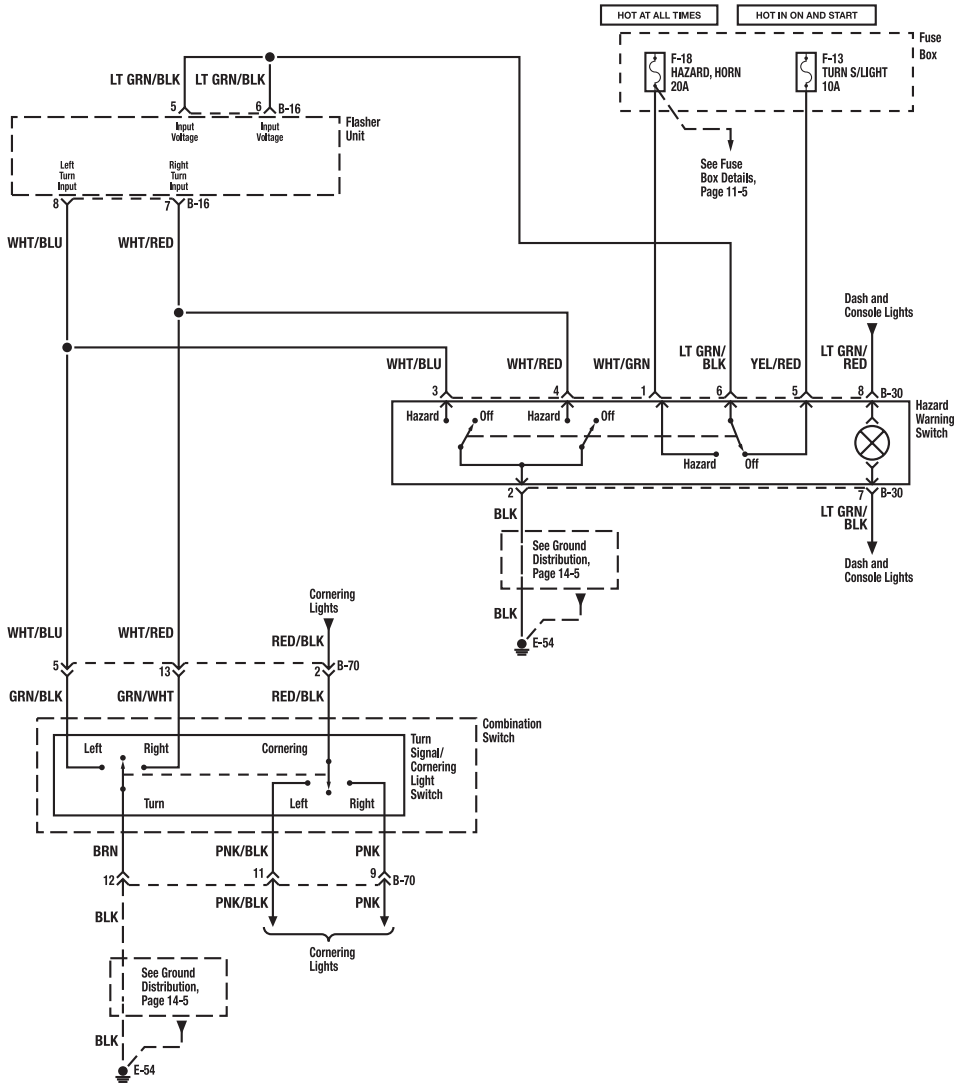
Turn and Hazard Lights Circuit Diagram



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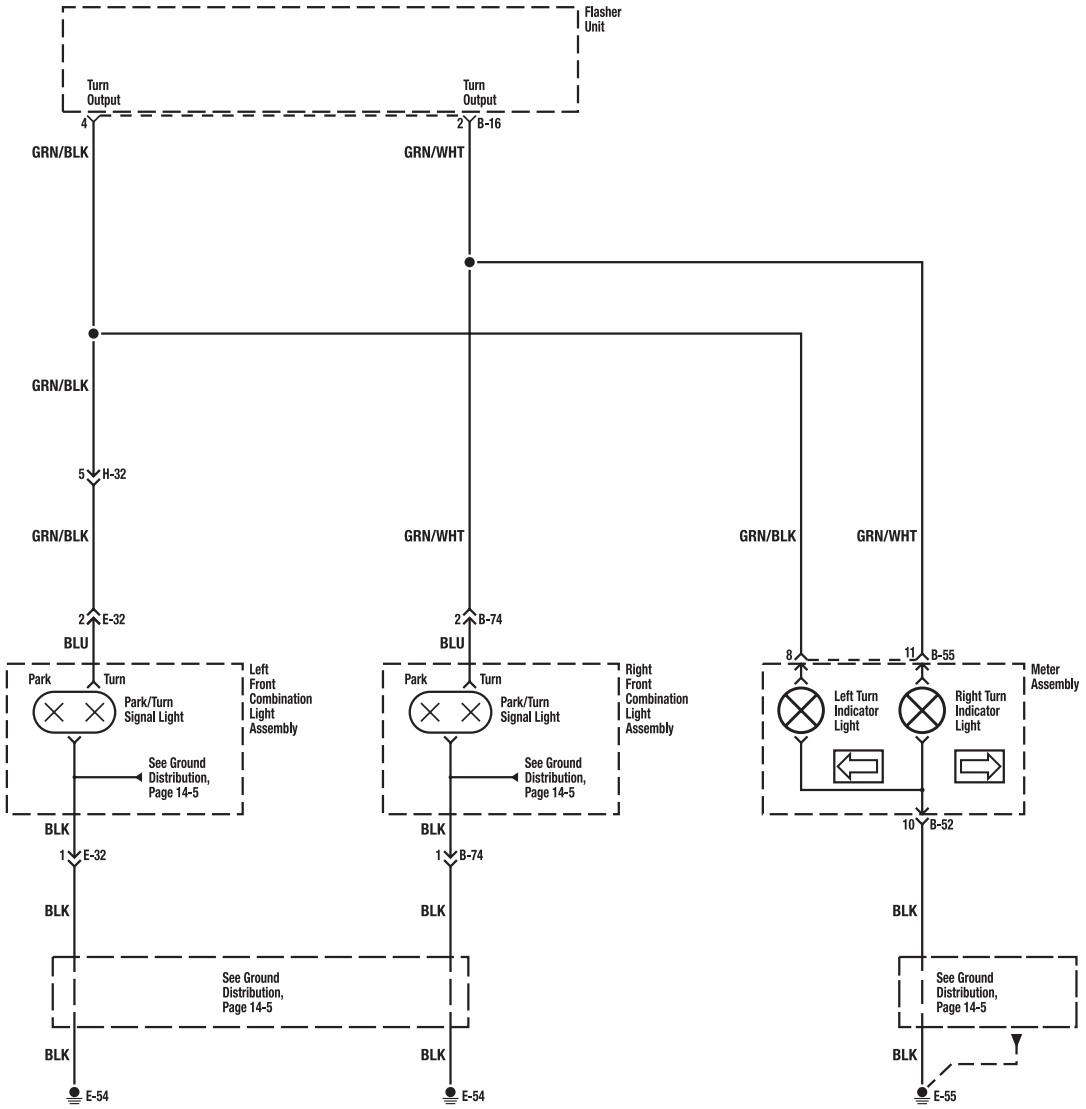
Turn and Hazard Lights Circuit Diagram



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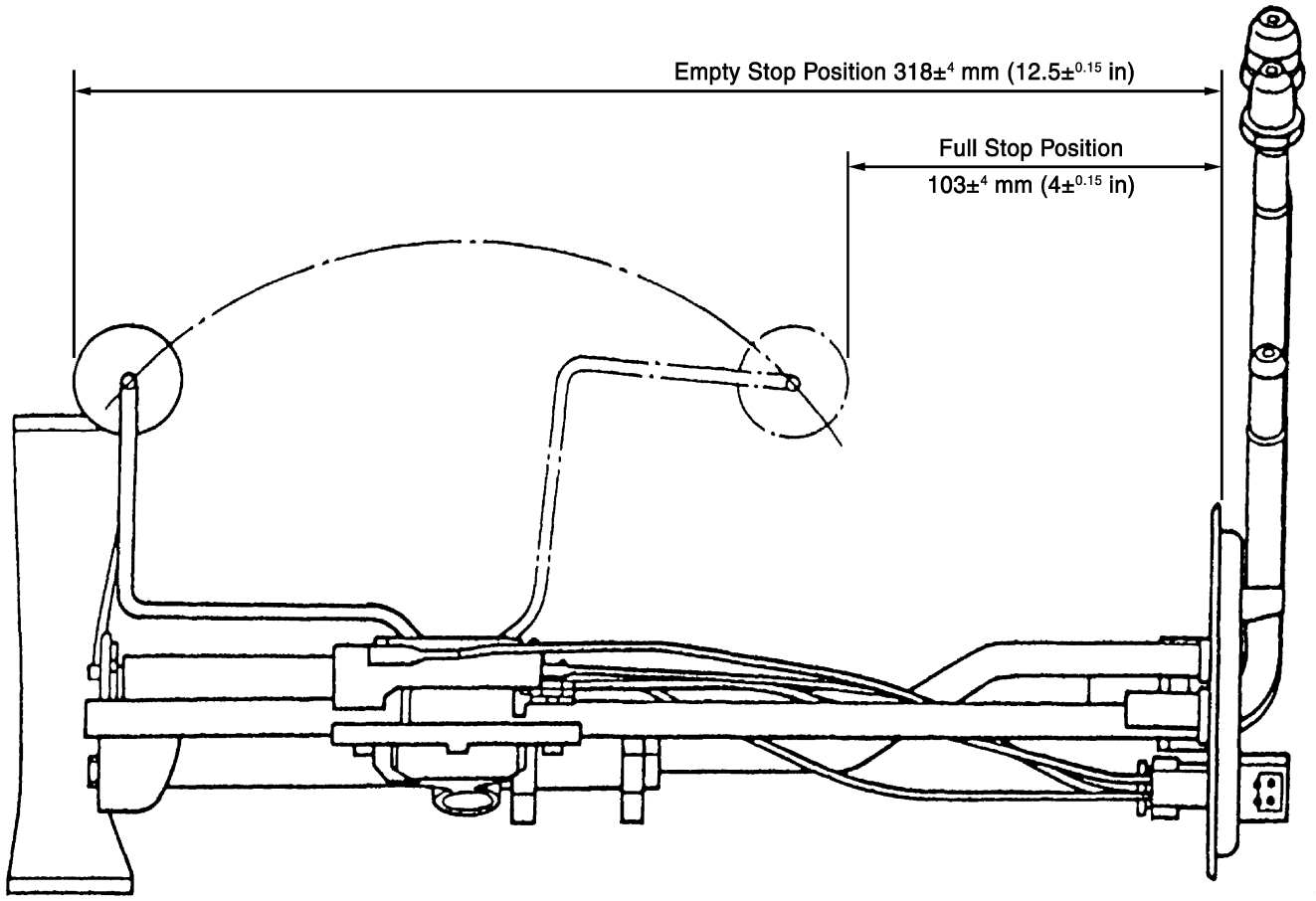
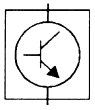
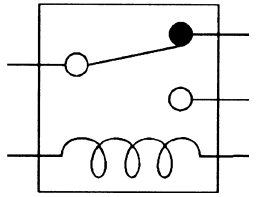
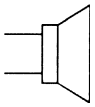
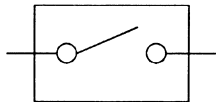
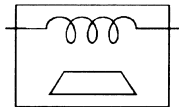
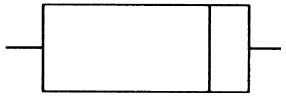
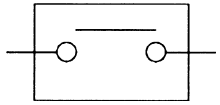
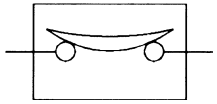
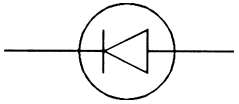
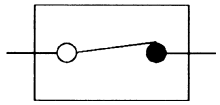
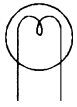
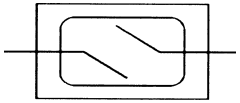
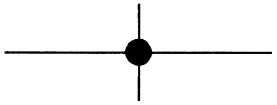
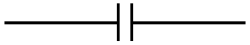
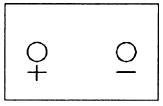
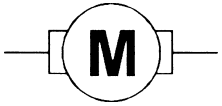
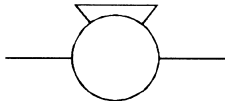
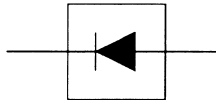
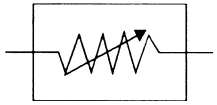
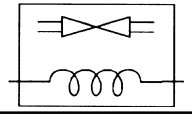
Fuel Tank Sending Unit Resistance

Float Position	Standard Resistance (Ω)
Empty Stop	110
Full Stop	3



NPR, NPR HD, NQR/W3500, W4500, W5500 Diesel Electrical

Symbols

Symbol	Meaning	Symbol	Meaning	Symbol	Meaning
	Fuse		Electronic Parts		Coil (Inductor), Solenoid Magnetic Valve
	Fusible Link		Resistor		Relay
	Fusible Link Wire		Speaker		
	Switch		Buzzer		Connector
	Switch		Circuit Breaker		Light-Emitting Diode
	Switch (Normal Close Type)		Bulb		Reed Switch
	Contact Wiring		Double-Filament Bulb		Condenser
	Battery		Motor		Horn
	Diode		Variable Resistor Rheostat		Vacuum Switching Valve

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Abbreviations

Abbreviation	Definition	Abbreviation	Definition
A	Ampere (S)	kW	Kilowatt
ABS	Anti-lock Brake System	LH	Left Hand
ASM	Assembly	LWB	Long Wheelbase
AC	Alternating Current	M/T	Manual Transmission
A/C	Air Conditioner	OD	Overdrive
ACC	Accessories	OPT	Option
A/T	Automatic Transmission	QOS	Quick on Start
C/B	Circuit Breaker	RH	Right Hand
CSD	Cold Start Device	RR	Rear
DIS	Direct Ignition System	RWAL	Rear Wheel Anti-lock Brake System
DRL	Daytime Running Lights	ST	Start
EBCM	Electronic Brake Control Module	STD	Standard
ECGI	Electronic Control Gasoline Injection	SW	Switch
ECM	Electronic Control Module	SWB	Short Wheelbase
ECU	Electronic Control Unit	TCM	Transmission Control Module
EFE	Early Fuel Evaporation	3 A/T	3-Speed Automatic Transmission
4 A/T	4-Speed Automatic Transmission	V	Volt
4 X 4	Four-Wheel Drive	VSV	Vacuum Switching Valve
FL	Fusible Link	W	Watt (S)
FRT	Front	WOT	Wide-open Throttle
HBB	Hydro Brake Booster	W/	With
H/L	Headlight	W/O	Without
IC	Integrated Circuit		

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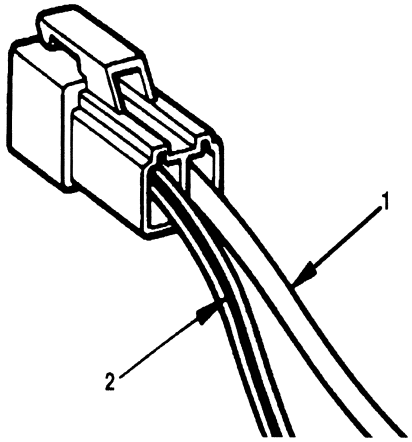
Wiring

Wire Color

All wires have color-coded insulation. Wires belonging to a system's main harness will have a single color. Wires belonging to a system's sub-circuits will have a colored stripe. Striped wires use the following code to show wire size and colors.

Example: 0.5 G / R

- R — Red (Stripe Color)
- G — Green (Base Color)
- 0.5 — Wire Size (0.5 mm^2)



1. Single Color Wire
2. Colored Stripe Wire

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Abbreviations are used to indicate wire color within a circuit diagram. Refer to the following table.

Color-Coding	Meaning	Color-Coding	Meaning
B	Black	BR	Brown
W	White	LG	Light Green
R	Red	GR	Grey
G	Green	P	Pink
Y	Yellow	LB	Light Blue
L	Blue	V	Violet
O	Orange		

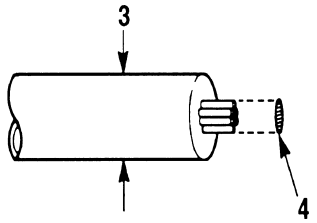
Distinction of Circuit by Wire Base Color

Base Color	Circuits	Base Color	Circuits
B	Starter Circuit	Y	Instrument Circuit
W	Charging Circuit	L, O, BR, LG, GR, P, LB, V	Other Circuits
R	Lighting Circuit		
G	Signal Circuits		

Wire Size

The size of wire used in a circuit is determined by the amount of current (amperage), the length of the circuit, and the voltage drop allowed. The following wire size and load capacity, are specified by AWG (American Wire Gauge). (Nominal size means approximate cross sectional area.)

3. Outside Diameter
4. Cross Sectional Area



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Nominal Size	Cross Sectional Area (mm^2)	Outside Diameter (mm)	Allowable Current (A)	AWG Size (Cross reference)
0.3	0.372	1.8	9	22
0.5	0.563	2.0	12	20
0.85	0.885	2.2	16	18
1.25	1.287	2.5	21	16
2	2.091	2.9	28	14
3	3.296	3.6	37.5	12
5	5.227	4.4	53	10
8	7.952	5.5	67	8
15	13.36	7.0	75	6
20	20.61	8.2	97	4

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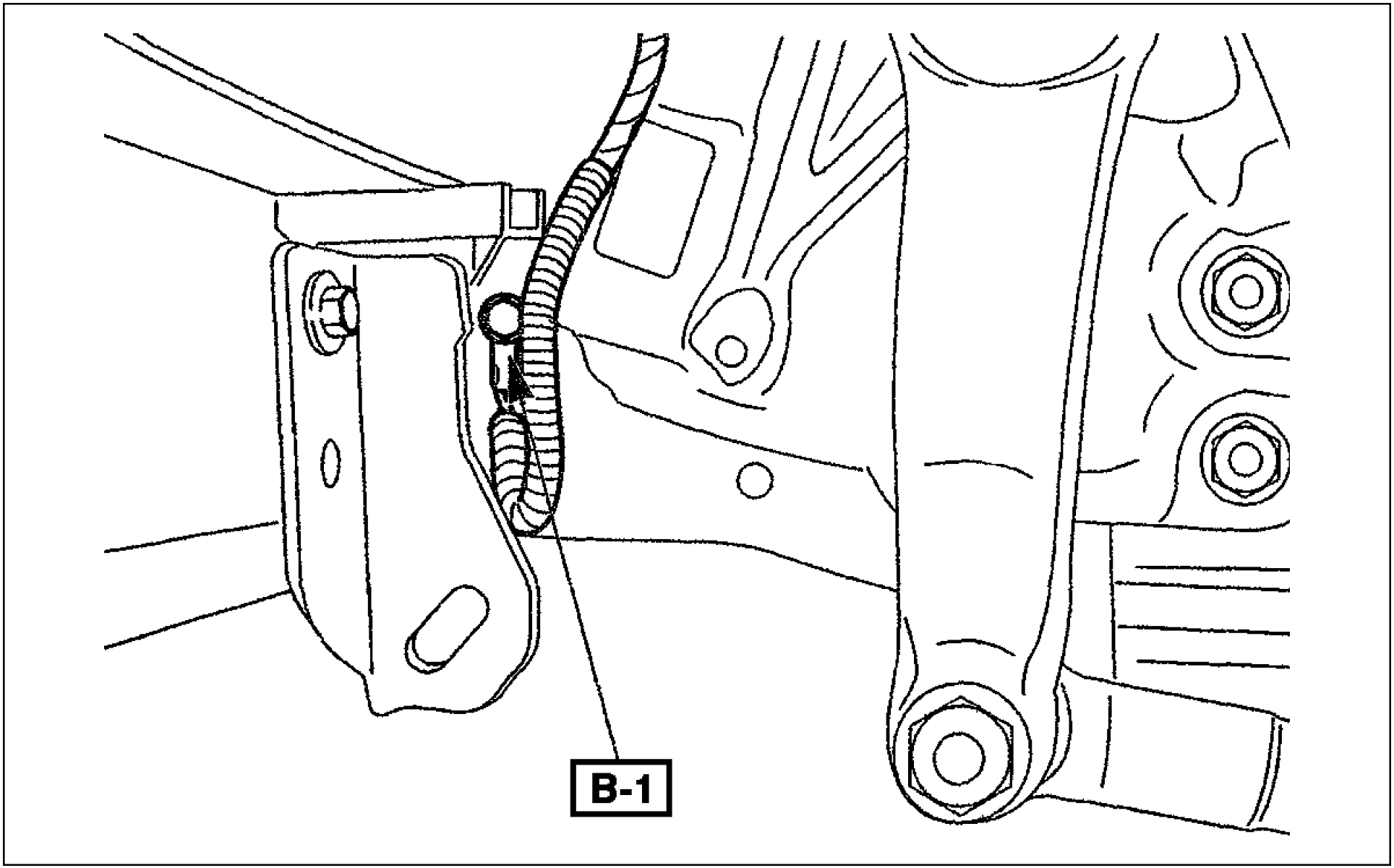
Grounding Point Location (B-1)



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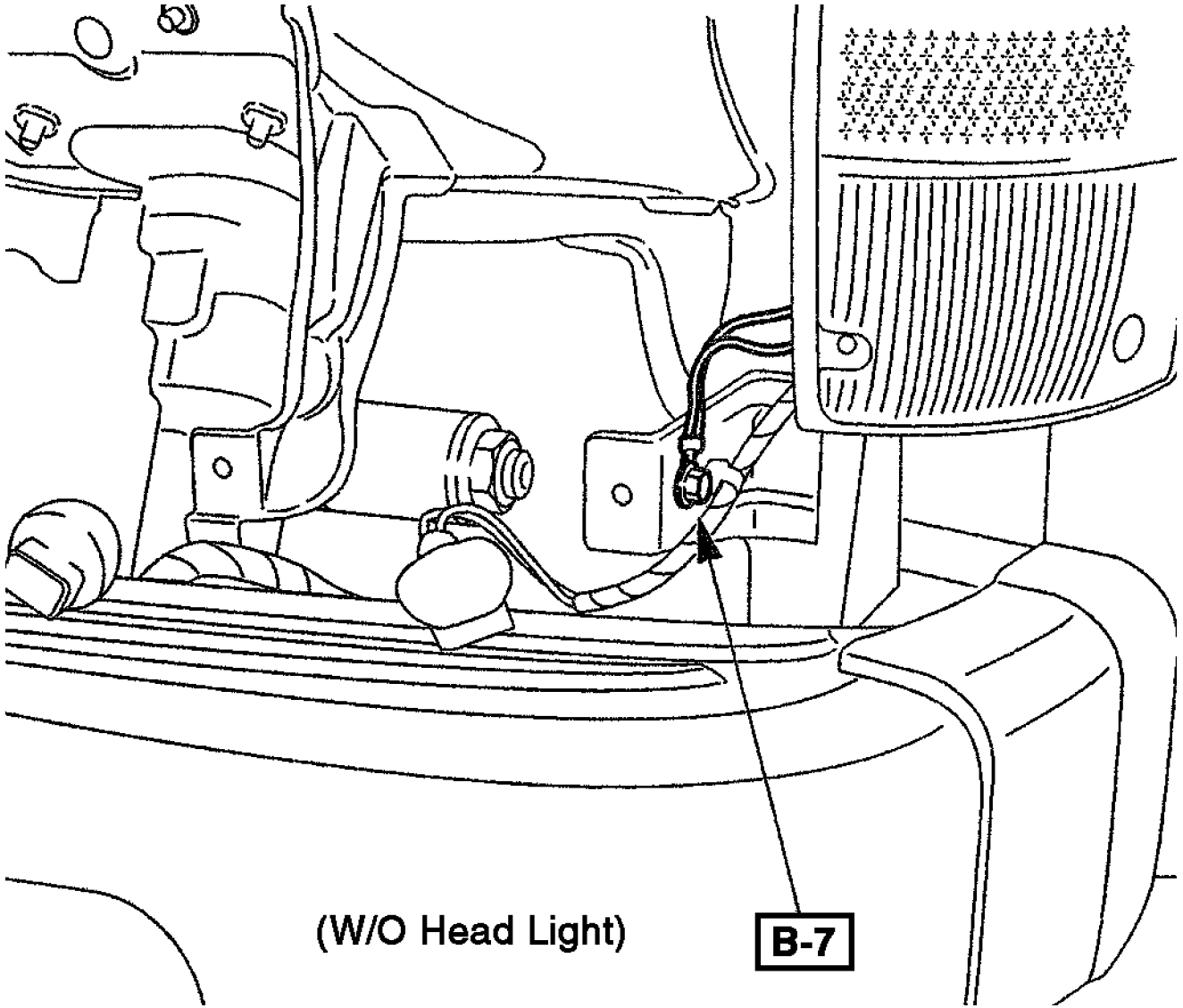
Grounding Point Location (B-7)



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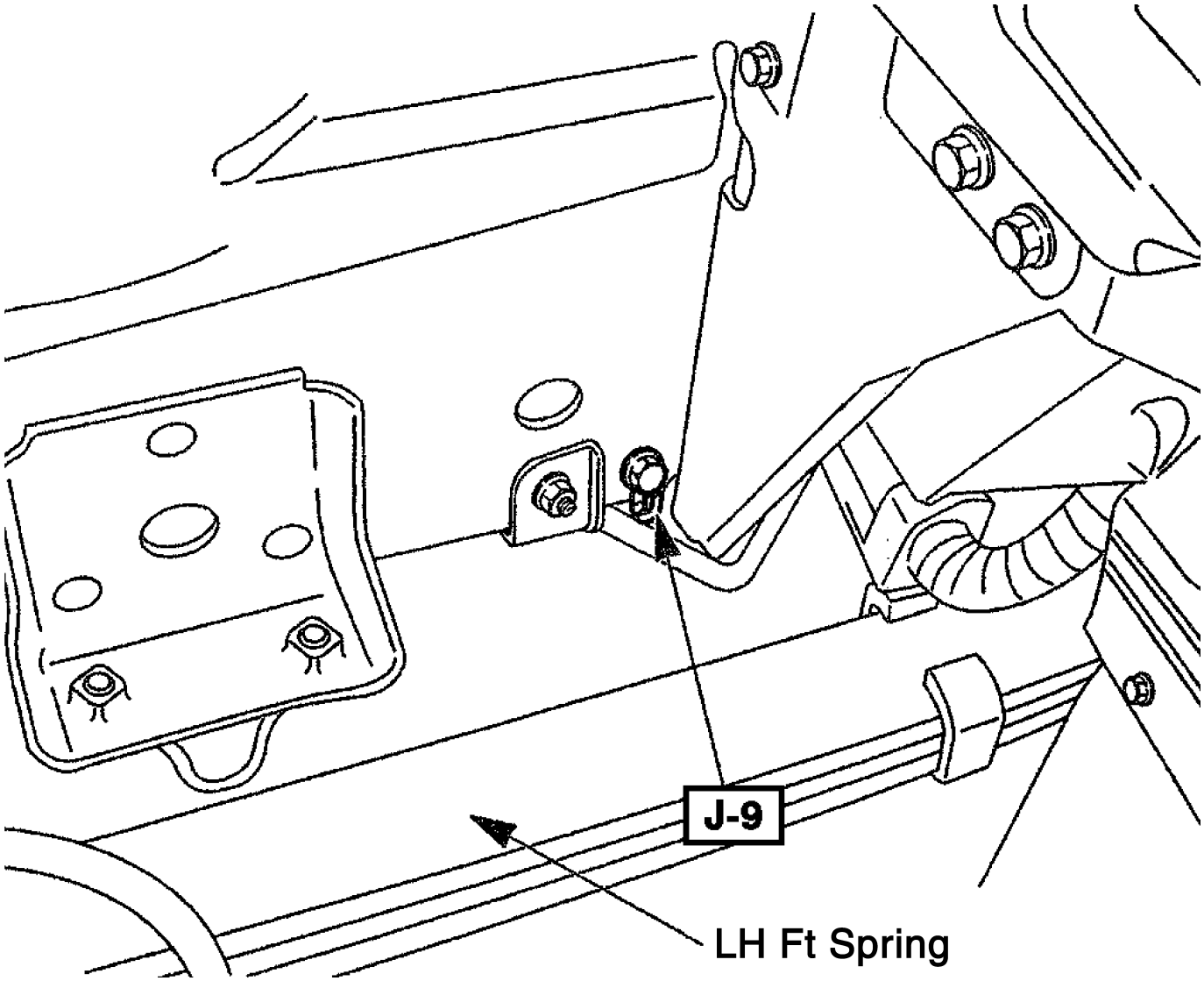
Grounding Point Location (J-9)



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Reference Table of Grounding Point

NOTICE: Abnormal phenomena of electrical components are considered resulted from defective grounding. In repair, be sure to inspect grounding points and to tighten all fastening parts surrounding the grounding points.

Connector No.	Cable Harness Name	Location	Main Parts (Load)
B-1	Body harness	Frame-LH (FRT)	Vehicle speed sensor, Turn signal indicator light, Meter, High beam indicator light.
B-7	Body harness	Headlight bracket-LH	Change relay, Exhaust brake relay, ECM, D.R.L. unit, Dome light, Meter, Brake fluid level switch, Tail relay, TCM, Cornering light, Cornering light relay, Wiper motor, Washer motor, Intermittent relay, Heater and A/C relay, Radio and clock, Cigar lighter, Fan switch, Blower resistor, A/C switch, Blower motor, Electronic thermostat, Accel switch, Cab interior switch, Flasher unit, Clearance light, I.D. light, Illumination control, Kick-down swich, Electronic vacuum pump, Power source relay.
J-9	Frame front harness	Frame-LH (CRT)	Fuel tank unit, Starter relay, Neutral switch, Pressure switch, Exhaust brake control relay, Exhaust brake magnetic valve, Accel switch, Clutch switch, Engine stop motor, Inhibitor switch, Engine warming cut relay, I.D. relay, Condensor fan relay, Condensor fan, License plate light, Taillight, Rear turn signal light, Stoplight, Back-up light, Air magnetic valve, VSV 2 EXH (FULL), VSV F1CD Engine warming-up switch.

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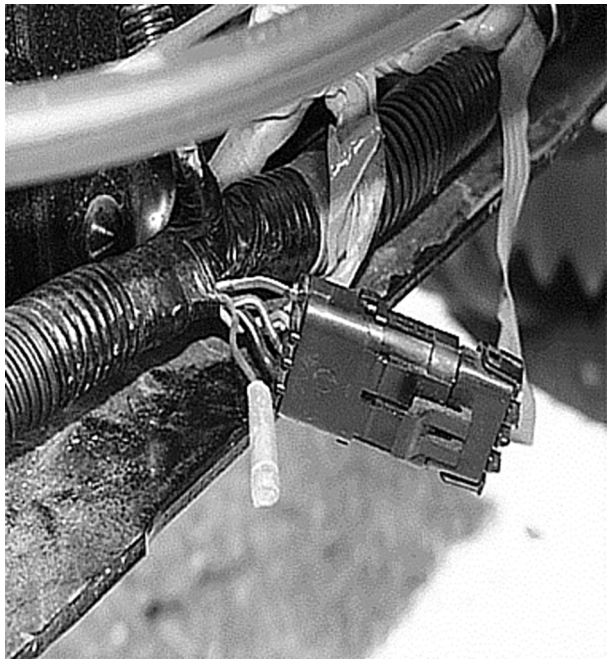
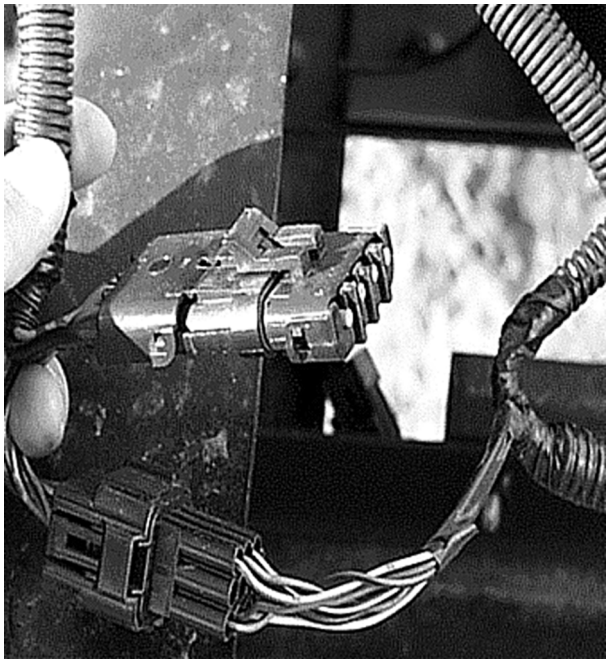
NPR, NQR/W3500, W5500 Body Room Light, I.D. and Marker Lamp, and Back-Up Lamp Connector Location

NPR, NQR/W3500, W5500 Body Connectors LH Frame



- **Packard Body Plug**
- **4-Pin Weather Seal Connector with Mating Plug**
- **Location:**
  Inside left-hand frame rail 28 to 31 inches BOC
- **Circuits:**
  Black = Ground
  Red/Green = Marker Lamp
  Red = Hot Wire
  Red/Yellow = Cargo Room Light (Keyed)

NPR, NQR/W3500, W5500 Body Connectors EOF



- **Packard Body Plug**
- **4-Pin Weather Seal Connector with Mating Plug**
- **Location:**
  Center of Crossmember
- **Circuits:**
  Black = Ground
  Red/Green = Marker Lamp
  Red = Stop Lamp
  Red/Yellow = Cargo Room Light (Keyed)

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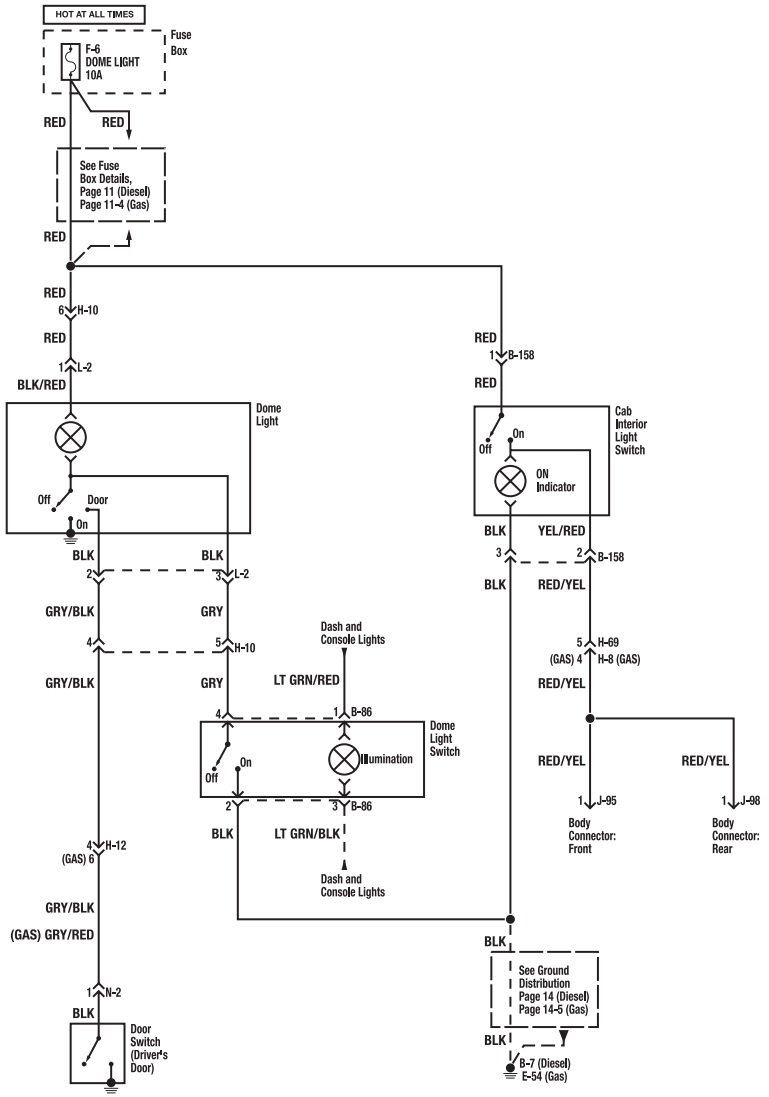
Dome and Interior Lights Circuit Diagram



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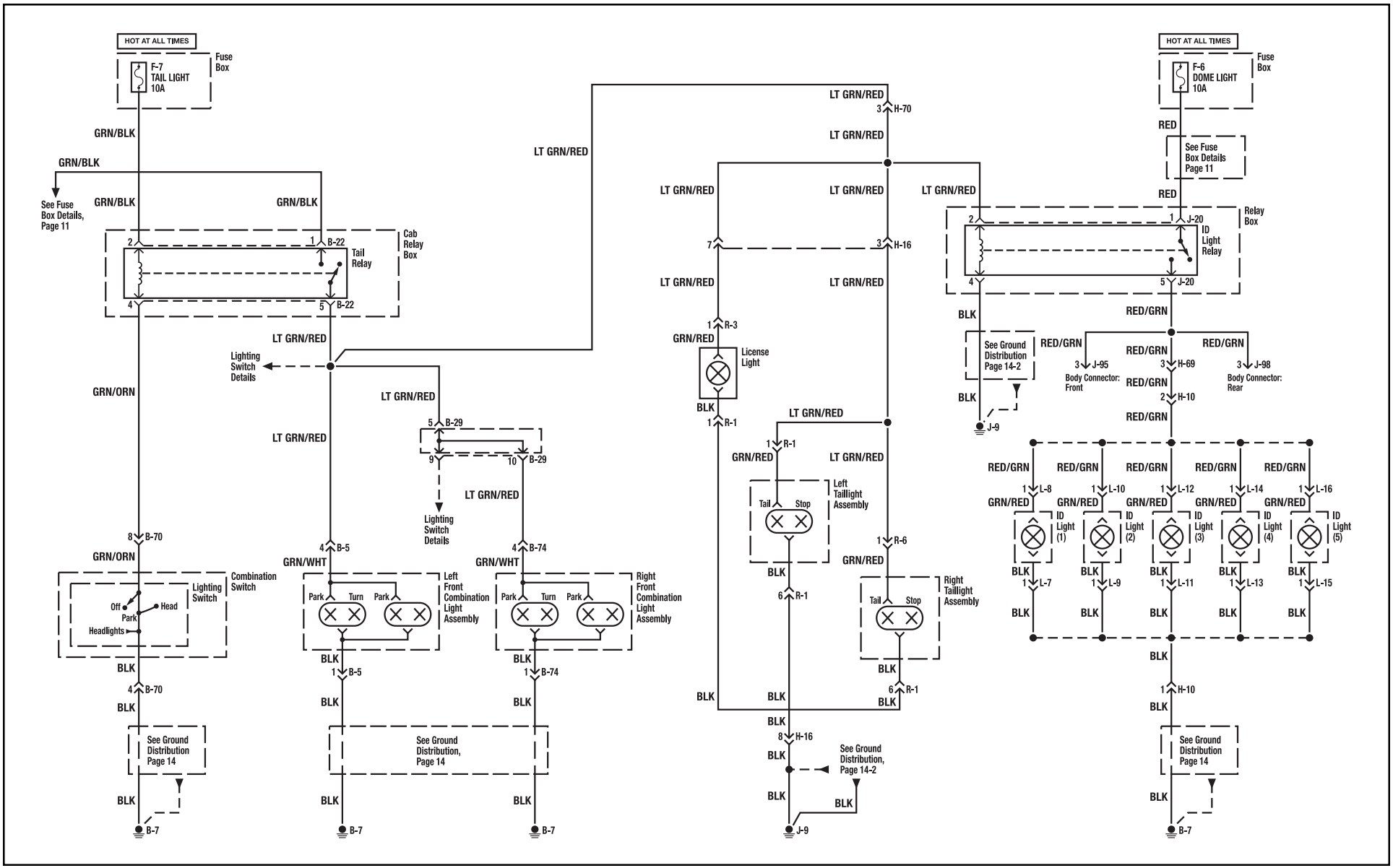
Park, Tail, License and I.D. Lights Circuit Diagram



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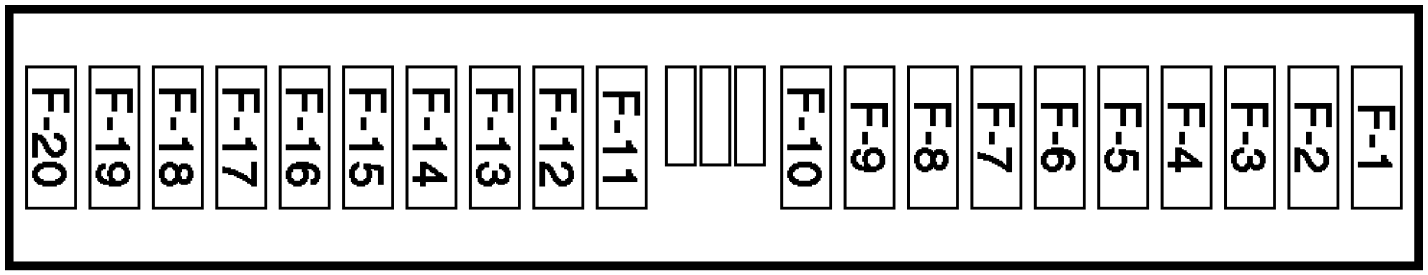
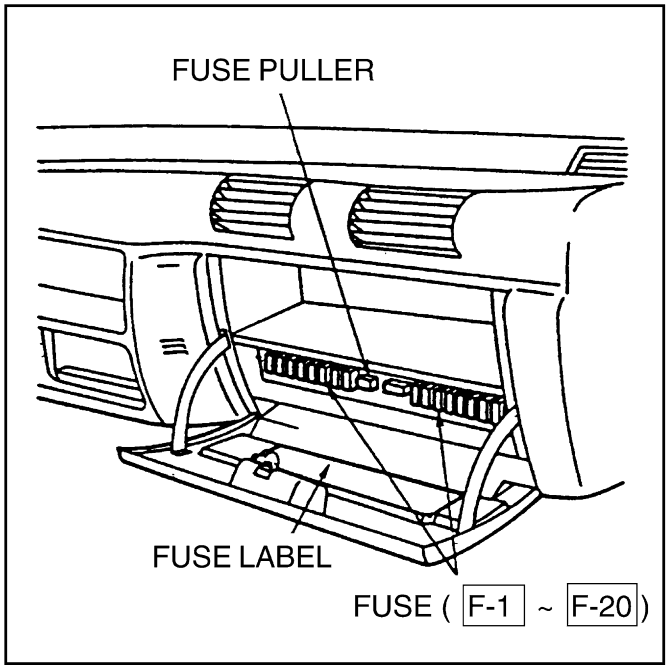
Fuse Location





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Fuse Box

Fuse No.	Fuse Name	Amps	Circuit Protected
F-1	HEATER	25A	Heater
F-2	AIR CON	10A	Compressor controls
F-3	EXHAUST BRAKE (Diesel)	10A	Exhaust brake system (Diesel)
	VCM (IGN) (Gas)		Engine controls (Gas)
F-4	D.R.L. (Diesel)	10A	Headlights (Diesel)
	ENGINE (IGN) (Gas)		Engine controls (Gas)
F-5	ECU (BAT) (Diesel)	10A	Engine controls (Diesel)
	A/T SOLENOID (Gas)		Automatic transmission controls (Gas)
F-6	DOME LIGHT	10A	Interior lights, Exterior lights, Sound system (Gas), Speedomoter (Gas)
F-7	TAIL LIGHT	10A	Dash lights, Exterior lights
F-8	STOP LIGHT	10A	Brake lights
F-9	HEAD LIGHT (RH)	20A	Headlights
F-10	HEAD LIGHT (LH)	20A	Headlights
F-11	WIPER, WASHER	20A	Windshield wiper/washer
F-12	GENERATOR	20A	Charging system
F-13	TURN S/LIGHT	10A	Turn lights
F-14	ECU (IGN) (Diesel)	10A	Engine controls
	VCM (ACC) (Gas)		
F-15	AUDIO, CIGAR LIGHTER	20A	Cigarette lighter, Engine controls, Sound system
F-16	POWER SOURCE	20A	Engine controls
F-17	ENGINE STOP (Diesel)	10A	Engine stop system (Diesel)
	FUEL PUMP (Gas)		Engine controls, Gauges (Gas)
F-18	HAZARD, HORN	20A	Engine controls, Gauges, Horn, Hazard lights

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Fuse Box (continued)

Fuse No.	Fuse Name	Amps	Circuit Protected
F-19	ABS (BAT)	25A	ABS
F-20	STARTER	10A	Starting system

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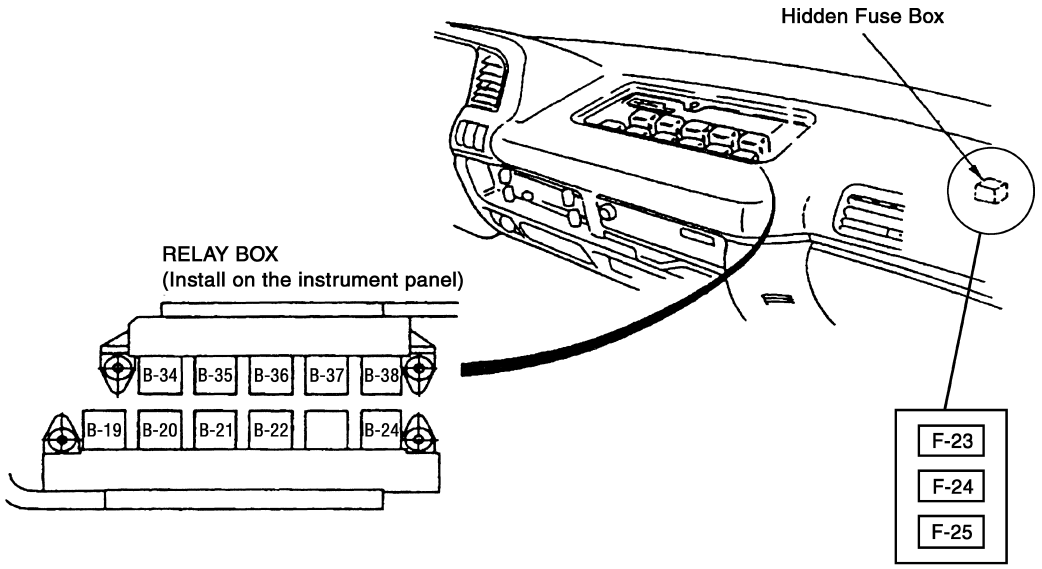
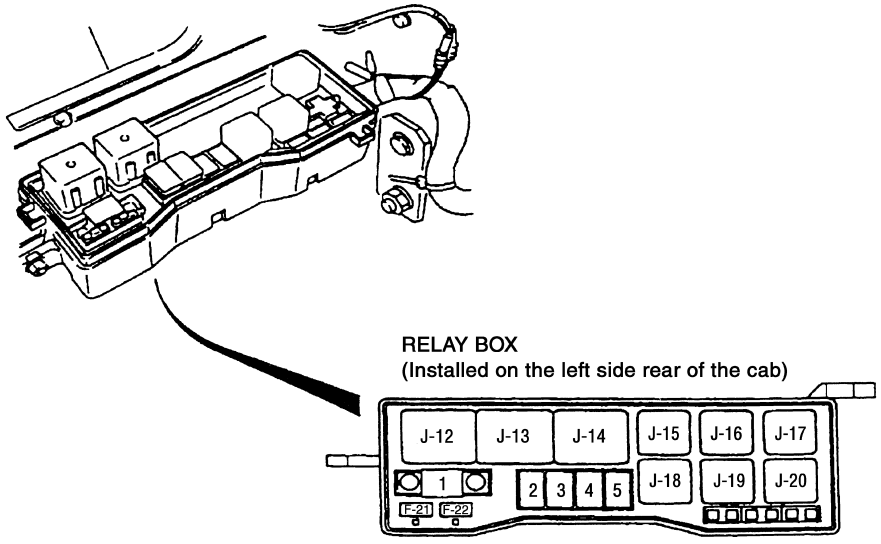
Relay Location





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Cab Relay

Diode Number	Circuits Protected	Diode Number	Circuits Protected
B-17	Brake warning system	B-25	Compressor controls
B-18	——	B-26	Exhaust brake system (Diesel)

Relay Number	Relay	Relay Number	Relay
B-19	Charge relay	B-35	Cornering
B-20	Headlight	B-36	Exhaust brake cut (Diesel)
B-21	Heater and A/C		Vacuum pump (Gas)
B-22	Tail	B-37	A/C thermo
B-23	Buzzer control	B-38	Exhaust brake (Diesel)
B-24	Horn		Ignition (Gas)
B-34	Power source		

Hidden Fuse Box

Fuse No.	Fuse Name	Amps	Circuit Protected
F-23	ABS-1	15A	ABS
F-24	ABS-2	10A	ABS
F-25	GAUGE, BACK	10A	ABS, Back-up lights (Diesel), Brake warning system, Compressor controls, Engine controls, Exhaust brake system (Diesel), Exterior lights, Starting system, Transmission controls (Diesel)

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Relay Box Outside Cab

Fuse No.	Fuse Name	Amps	Circuit Protected
1	MAIN	80A	Power distribution
2	KEY	50A	Power distribution
3	ABS (Gas)	60A	ABS (Gas), Engine controls (Diesel)
	GLOW (Diesel)		
4	ABS (Diesel)	60A	ABS
5	C/HEATER (Diesel)	60A	Ceramic heater
F-21	——	——	Not used
F-22	CONDENSER FAN (Diesel)	15A	Condenser fan

Relay Number	Relay	Relay Number	Relay
J-12	Starter	J-16	Fuel pump (Gas)
J-13	Glow-1 (Diesel)	J-17	Condenser (Diesel)
J-14	C/Heater (Diesel/MT)	J-18	Exhaust brake control (Diesel)
J-15	Warm cut 1 (Diesel)	J-19	Engine warm cut 2 (Diesel/AT)
	A/C enable (Gas)	J-20	I.D. light relay

(Vehicle Specifications Index Section – NPR, NPR HD, NQR/W3500, W4500, W5500 Diesel Electrical – continued on next page)

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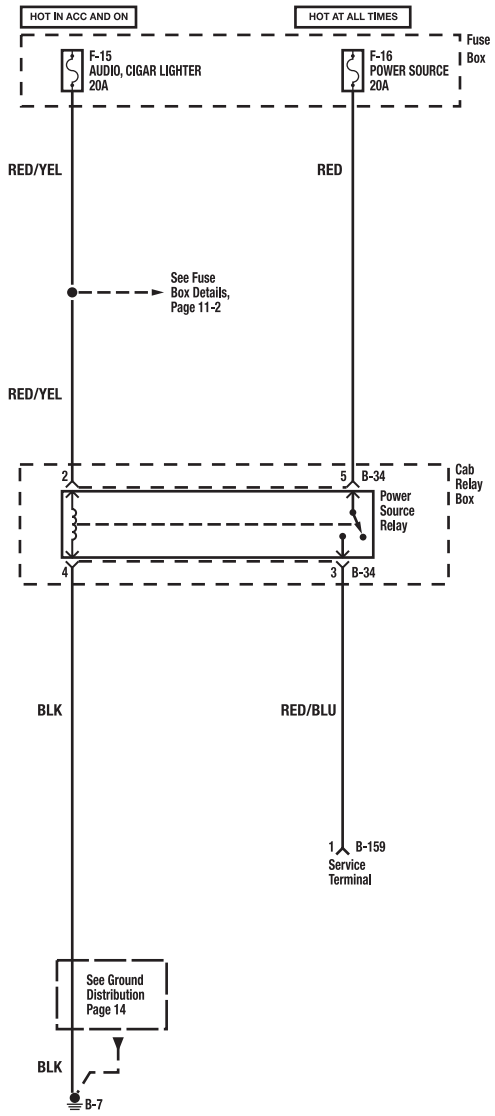
Auxiliary Power Source Circuit Diagram



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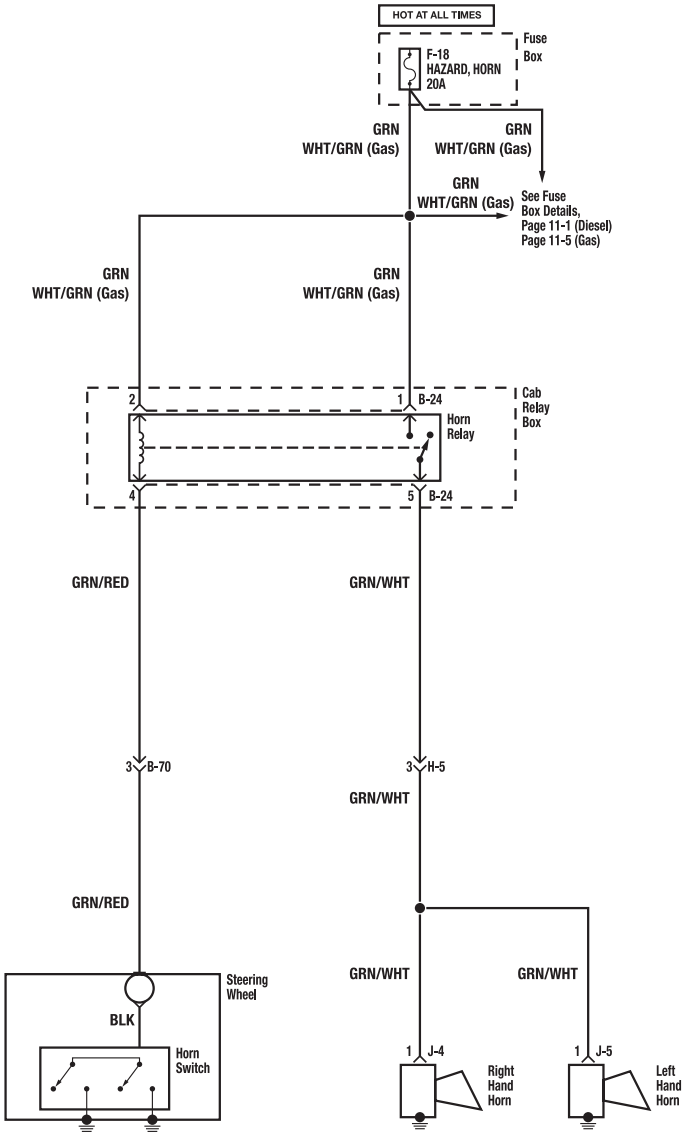
Horn Circuit Diagram



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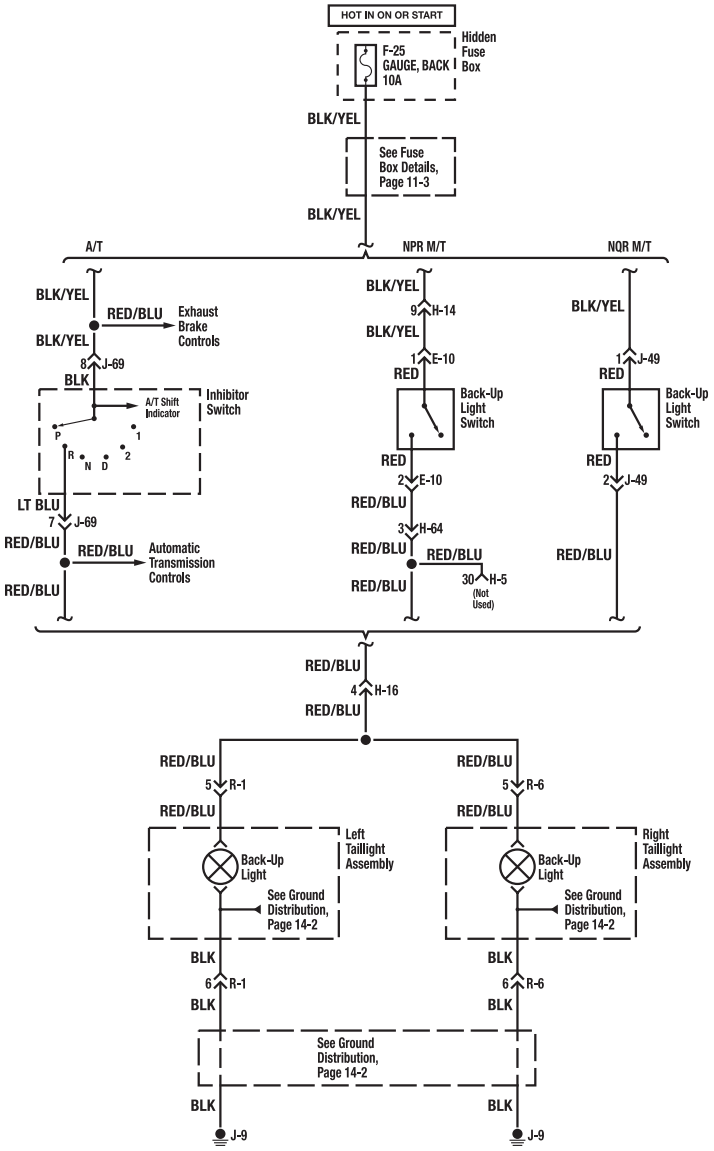
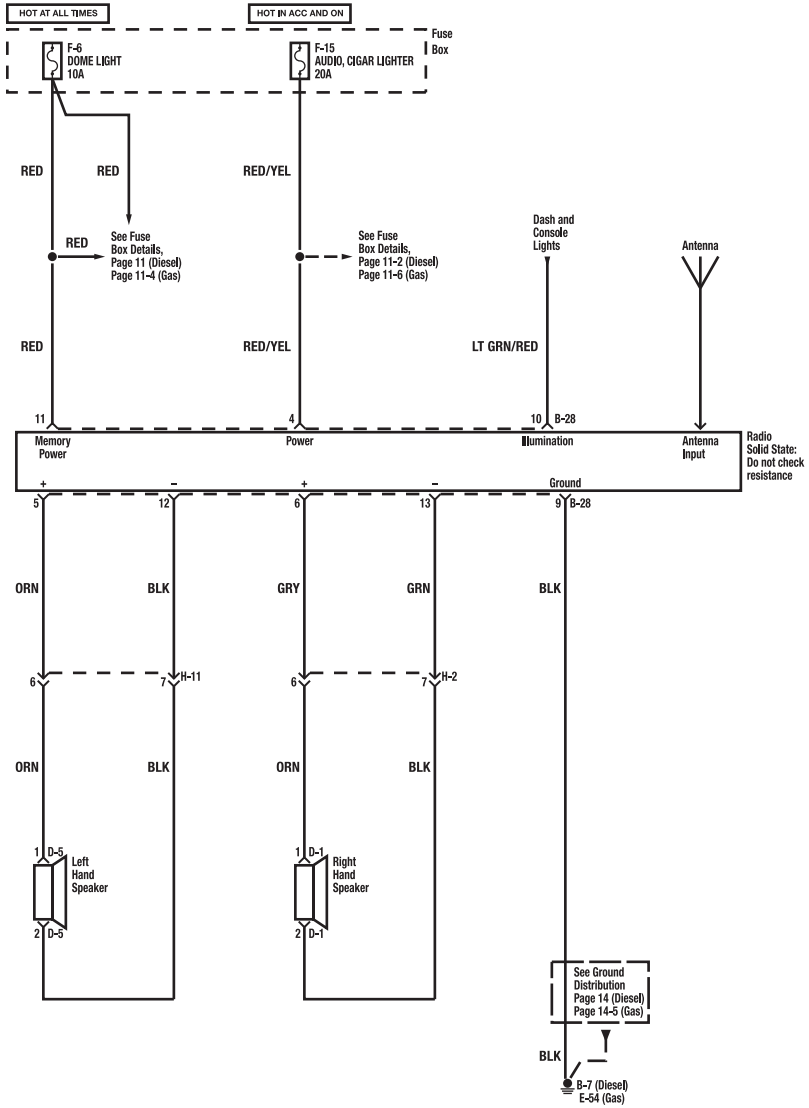
Back-Up Lights Circuit Diagram



(Vehicle Specifications Index Section – NPR, NPR HD, NQR/W3500, W4500, W5500 Diesel Electrical – continued on next page)

Sound System Circuit Diagram



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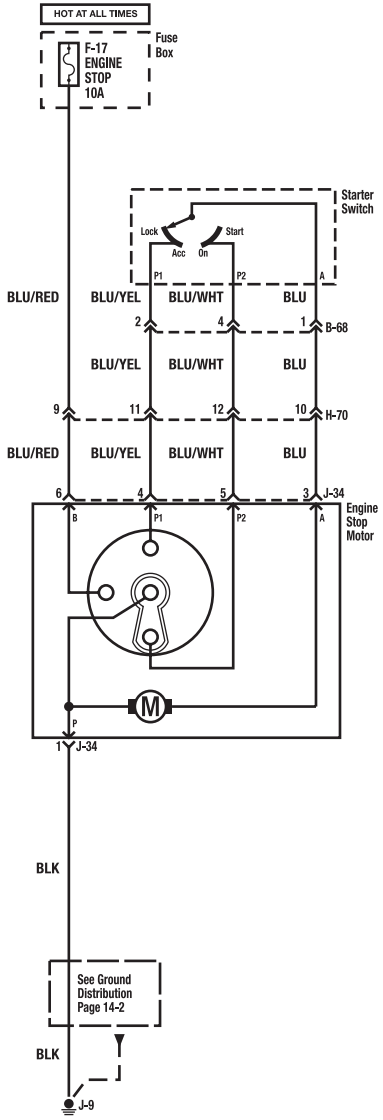
Engine Stop Motor Circuit Diagram



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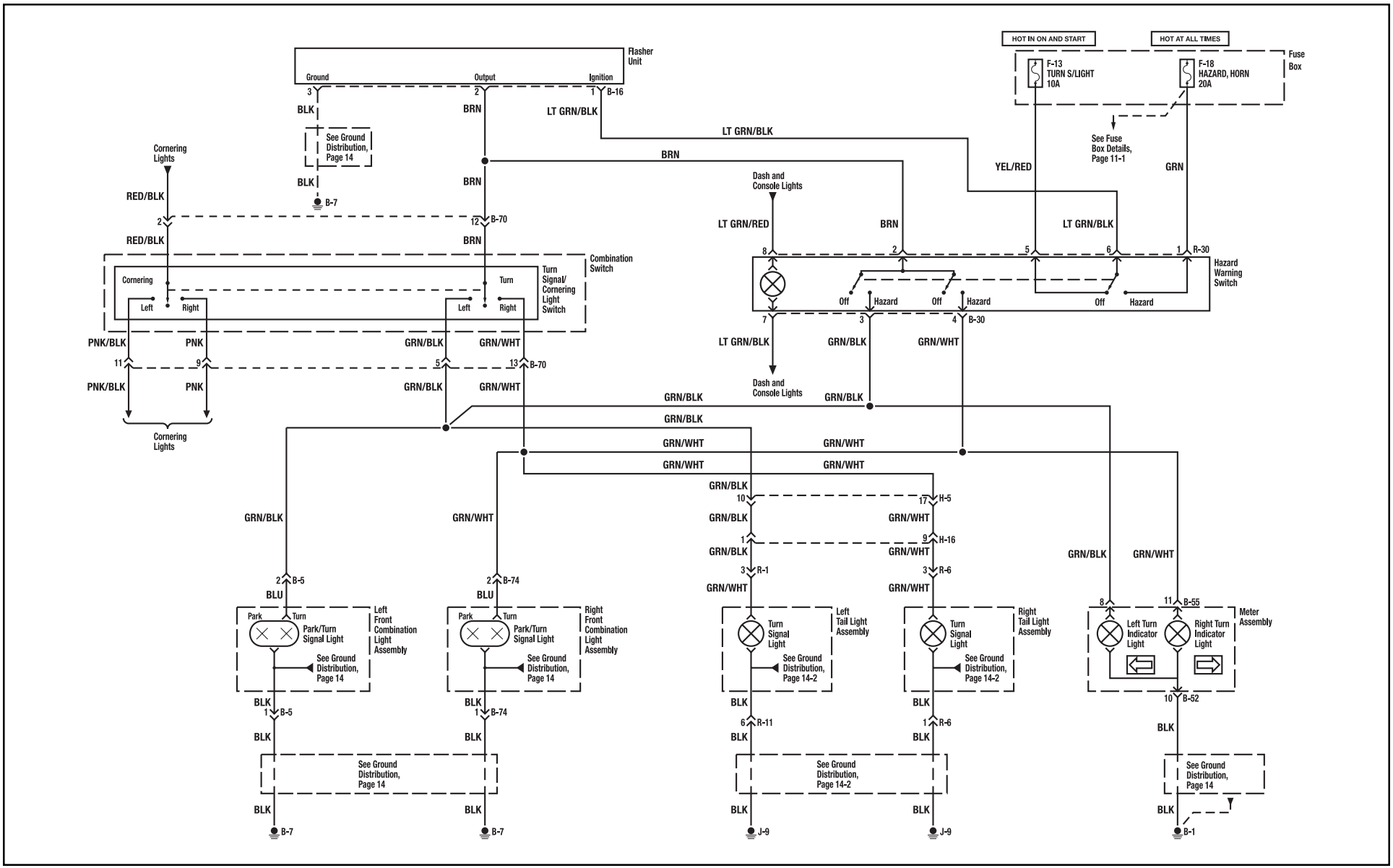
(Vehicle Specifications Index Section – NPR, NPR HD, NQR/W3500, W4500, W5500 Diesel Electrical – continued from previous page)

Turn and Hazard Lights Circuit Diagram



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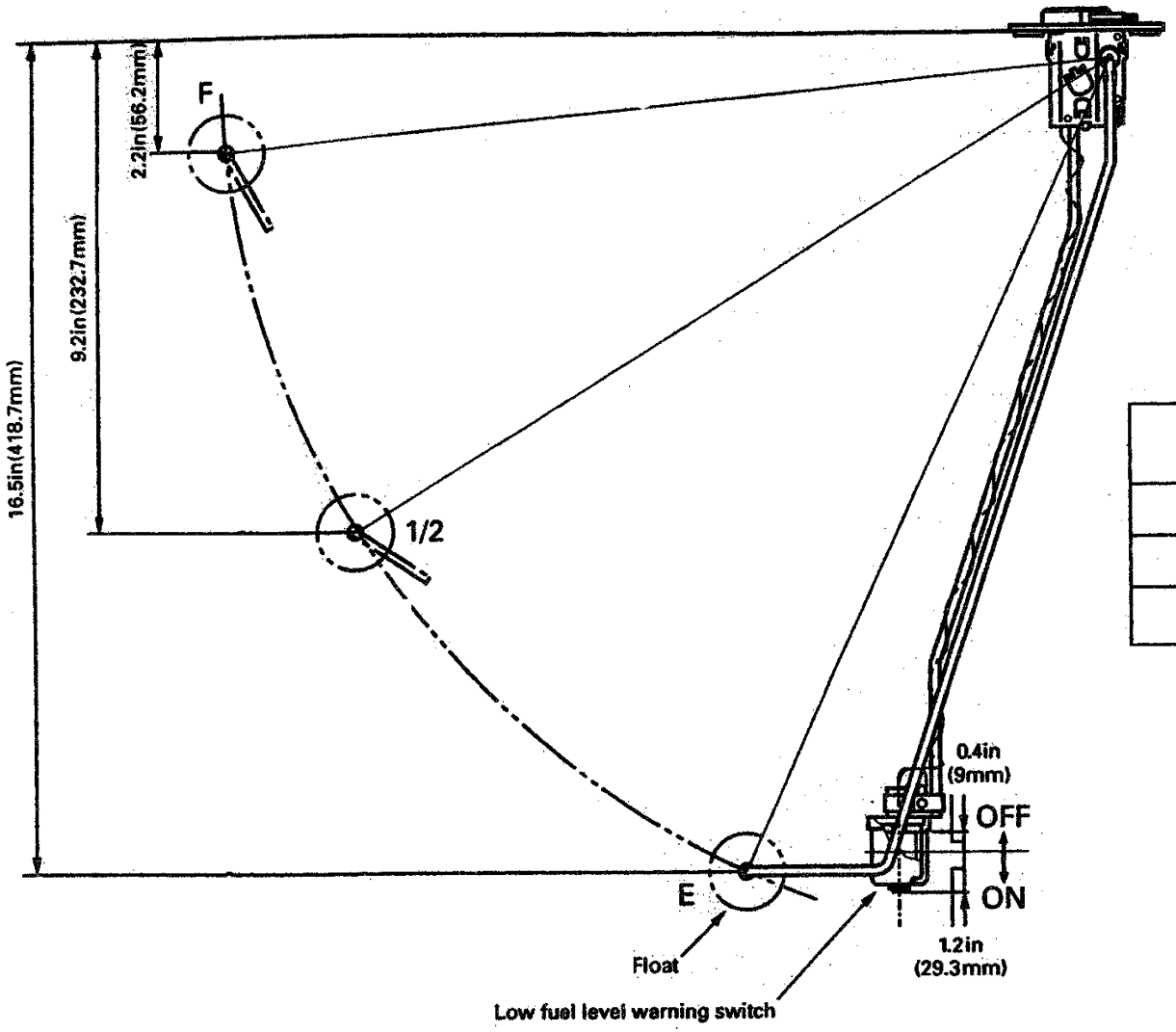
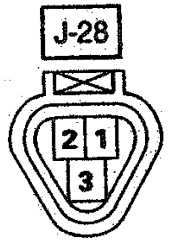
Fuel Tank Sending Unit Resistance (In-Frame Tank)





Float Position	Resistance value (Ω)
F	3 ± 2.1
1/2	32.5 ± 4.8
E	110 ± 7.7

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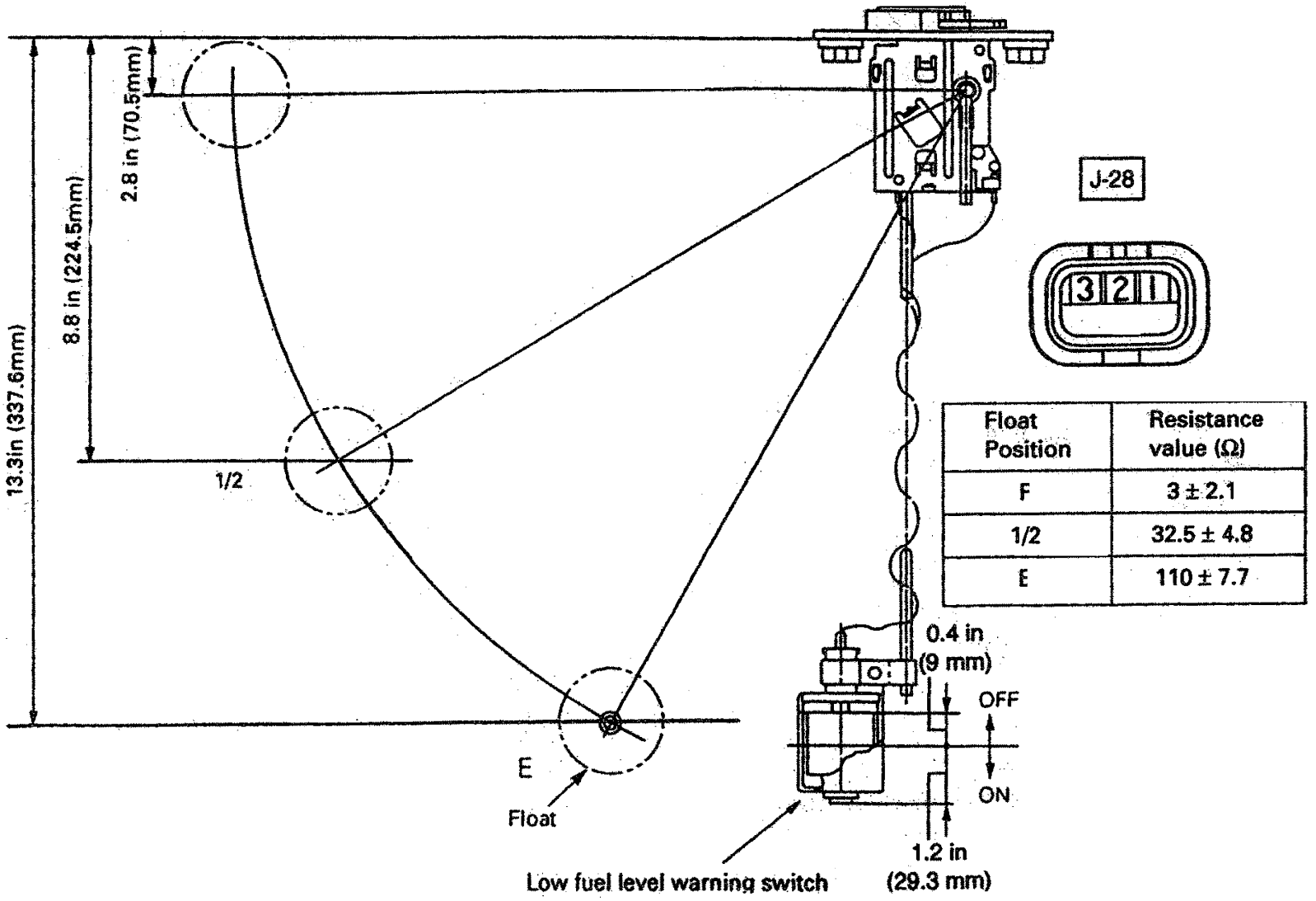
Fuel Tank Sending Unit Resistance (Side-Mounted Tank)



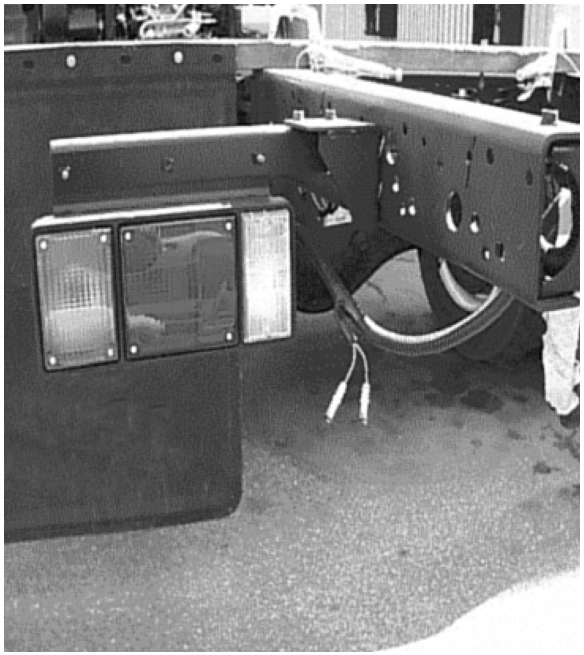
Float Position	Resistance value (Ω)
F	3 ± 2.1
1/2	32.5 ± 4.8
E	110 ± 7.7

FRR/WT5500 Electrical

FRR/WT5500 Series Taillight Connectors

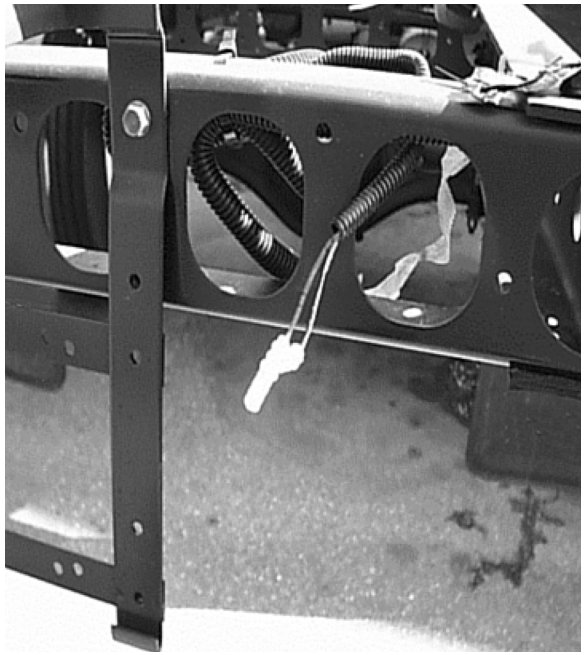
FRR/WT5500 Body Room Light, I.D. and Marker Lamp, and Back-Up Lamp Connector Location

FRR Body Connectors



- **Bullet Type Body Plug**
- **Location:**
  RH and LH end of frame
- **Circuits:**
  Brown = Marker Lamp
  Blue = Body Room Light

FRR Back-Up Alarm Wiring



- **Bullet Type Body Plug**
- **Location:**
  Center end of frame
- **Circuits:**
  Black/Blue = Ground
  Red = Power Back-Up Alarm