Body Builder's Installation Manual

Truck Model: ACX

www.autocartruck.com

Body Builder's Installation Manual

Autocar, LLC
Hagerstown, Indiana, U.S.A.

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INTRODUCTION

Foreword

The vehicles and components described in this Manual are under continuous development. Vehicles and components produced after this Manual's release date may have different specifications. Supplementary information may be issued to cover significant changes in design, or components. Any subsequent edition of this Manual will include all changes.

Purpose

The purpose of this Manual is to provide guidance to any Intermediate and/or Final Stage Manufacturer installing equipment to an Autocar chassis. Autocar assumes no liability by providing recommendations, guidance, limitations or any other information with regard to the installation of equipment onto an Autocar chassis, and the manufacturer and installer of such equipment remains fully responsible for the equipment, the installation thereof and any effects such equipment or installation may have on the Autocar chassis, its function or its performance. Please read and understand the information provided in this Manual before installing any equipment on the chassis. Please call the Autocar Sales department or Engineering department with any questions at 877-973-3486.

Relation to Incomplete Vehicle Document

This Manual is incorporated into the Incomplete Vehicle Document (IVD) of every Autocar chassis. The information provided in this Manual may be used in addition to the IVD for any Intermediate or Final Stage Manufacturer making alterations to an Autocar chassis. No alteration should be made to the chassis which either directly or indirectly results in any component, assembly or system being in nonconformance with the IVD or any applicable Federal Motor Vehicle Safety Standard (FMVSS) or Emissions Regulation.

Relation to Warranty

Autocar's limited warranty on the chassis to the purchaser of the complete vehicle is subject to and conditioned upon (1) each Intermediate and Final Stage Manufacturer not making any alterations or modifications to the chassis which did not conform to any applicable laws, regulations or standards; and (2) each Intermediate and Final Stage Manufacturer complying with the instructions contained in the IVD and this Manual with respect to completion of the vehicle. If an Intermediate or Final Stage Manufacturer (a) modifies or removes a component in violation of applicable laws, regulations or standards, the IVD or this Manual, (b) otherwise alters or converts the vehicle in any manner prohibited or not contemplated by the IVD or this Manual, or (c) fails to follow the instructions and requirements of the IVD and this Manual, such Intermediate or Final Stage Manufacturer will be responsible for all resulting liabilities, costs and expenses, including without limitation warranty claims, product liability claims and recall actions.

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SAFETY INFORMATION

Safety Definitions

This safety alert symbol appears with most safety statements. It means you should pay attention, and be alert, because your safety is involved! Read and abide by the message that follows the safety alert symbol.

⚠ DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

⚠ NOTICE

Indicates a property damage message.

General Safety Information

There is no substitute for common sense and careful practices in the workplace. Improper practices or carelessness can cause burns, cuts, mutilation, asphyxiation, other bodily injury or death. This information contains general safety precautions and guidelines that must be followed to reduce the risk to your personal safety. Special safety precautions are listed in specific procedures when they apply. Read and understand all of the safety precautions and guidelines before performing any work on the chassis.

Autocar is dedicated to protecting the environment. When servicing Autocar products, please dispose of all removed material, oils and coolant in an environmentally responsible manner.

Read and understand this entire Manual before working with the vehicle. Those who use and maintain this equipment must be thoroughly trained and familiar with the product. If incorrectly used or maintained, this equipment can cause severe injury or death.

These safety procedures are for your own protection. Do not perform work on the vehicle until you have read and understood this Manual and other instructions supplied with the vehicle. The safety precautions detailed in this Manual are not an exhaustive list of all safety precautions to be followed when working with a vehicle; additional measures and precautions may be warranted depending on the procedure or condition of the vehicle.

Safety and safe working procedures must be followed at all times. OSHA lockout procedures must be followed when maintaining this equipment. If you are unfamiliar with the OSHA lockout procedures or any safety requirements, please contact Autocar, LLC for assistance.

Tagout / Lockout Procedures

Before entering the vehicle or vehicle body, read and follow OSHA regulations concerning entry and working in "CONFINED SPACE" OSHA 1910.146 and "LOCKOUT / TAGOUT" OSHA 1910.147.

Follow OSHA regulations while performing any work on the vehicle.

Follow all safety instructions in your Autocar Service Manual.

The vehicle must be disabled by the following steps before proceeding:

1. Set the parking brake.
2. Place the transmission in NEUTRAL.
3. Shut the engine off.
4. Turn the battery switch off.
5. Lock cab doors, keep the key in your pocket and block the wheels before entering the body or performing any work on the vehicle.
6. Place magnetic "DANGER" signs on both cab doors before entering the body or performing any work on the vehicle.

⚠ DANGER

The safety messages that follow have DANGER level hazards. Failure to comply will result in death or serious injury.

Lifting

Use a hoist or get assistance when lifting components that weigh 50 lb. (23 kg) or more. Make sure all lifting devices such as chains, hooks, or slings are in good condition and are of the correct capacity. Make sure hooks are positioned correctly. ALWAYS use a spreader bar when necessary. The lifting hooks MUST NOT be side loaded. Failure to follow these warnings may result in personal injury or death.

Using Jacks

The Anti-lock Brake System (ABS) MUST be disabled prior to jacking up a vehicle that has a Traction Control System (TCS) and prior to placement of the jack stands. If the ABS is not disabled and one of the wheels starts to spin, the TCS will compensate and the vehicle may come off the jack and/or jack stands resulting in serious injury or death. The Automatic Traction Control (ATC) should be disabled by switching the ATC/OFF switch to the OFF position. NEVER work under a vehicle supported only by jacks. Jacks can slip out from under the truck or fall over and result in serious injury or death. ALWAYS use jack stands under the truck. NEVER work under or around a vehicle unless it is supported on jack stands of adequate rating. Failure to do so can result in the vehicle falling resulting in serious injury or death.

Pneumatic Components

Pneumatic components store compressed air and can separate violently during disassembly or removal. Before servicing any part of the pneumatic (air) system, completely release the compressed air from the entire system including the lift and/or load suspension air bags.

Hydraulic Components

Hydraulic systems and fuel injection systems can operate under extremely high pressures which can remain long after shutdown. Before servicing any part of the hydraulic system or fuel injection system, carefully relieve the pressure completely. Escaping fluid under high pressure can penetrate the skin causing severe injury. NEVER check for leaks using your hand. Use instead a piece of wood or cardboard.

If the skin is penetrated by high pressure fluid, seek medical attention immediately. Any fluid injected under the skin must be removed surgically or gangrene may result.

⚠ WARNING

The safety messages that follow have WARNING level hazards. Failure to comply could result in death or serious injury.

General Precautions

Stay clear when suspension air is energized or de-energized. The chassis may move quickly and cause serious injury or death to anyone under or around the vehicle.

NEVER service any part of the fuel system while smoking or in the presence of flames, sparks or hot surfaces. Failure to follow these precautions can result in a fire.

Clean up fuel spills immediately. Fuel leaked or spilled onto hot surfaces or electrical components can cause a fire.

Before working in or around the vehicle, apply the park brake, block the wheels and put the transmission in NEUTRAL.

Safety Decals

Immediately replace safety decals if they become damaged, unreadable or missing. Contact Autocar, LLC for replacement decals when required.

Eye, Ear, and Skin Protection

ALWAYS wear appropriate eye protection to prevent the risk of eye injury. Wear safety glasses to prevent eye contact with debris and fluids. Wear a welding face mask to protect eyes and face when welding.

ALWAYS wear ear plugs when working around loud noises to prevent the risk of hearing loss.

ALWAYS wear appropriate gloves to protect the hands. Wear welding gloves to protect the hands when welding. Wear appropriate gloves when handling extremely hot or cold equipment and fluids.

Test Equipment

Exhaust gases contain deadly poison. When testing a vehicle with the engine running, conduct the test outdoors or use a properly vented exhaust hose.

Use caution when installing test equipment, and keep away from hot engine or transmission components and/or fluids. A hot engine, transmission, and/or fluids can permanently damage test equipment or can cause personal injury due to burns.

If a vehicle is to be operated with test equipment connected, precautions must be taken to ensure that all equipment and related components are securely attached to prevent movement and interference.

Road Testing the Vehicle

Before driving this vehicle, you must have read and fully understand each and every step of the driving and handling information provided in the Vehicle's Operator Manual. You must fully understand and follow all safety warnings. It is extremely important that this information is read and understood before the vehicle is operated.

NEVER operate the starter without first placing the transmission in NEUTRAL and applying the park brake. Failure to follow these instructions may result in the unintentional movement of the vehicle.

NEVER release or drive a truck on the road that has a brake discrepancy – no matter how minor – until it has been repaired or corrected. Failure to repair brake discrepancies can result in compromised brake efficiency and lead to loss of control of the vehicle.

NEVER drive the vehicle without power assisted steering. When the power assist has failed, the required effort to turn the steering wheel is much greater, especially in sharp turns or at low speeds.

ALWAYS have one person drive while another performs a test. Failure to do so may cause a collision, which can result in serious injury or death.

A vehicle speed retardation device (such as "Jake Brake," "C-Brake," "Exhaust Brake," "Telma Retarder," etc.) is not intended to replace the service brake system on your vehicle, nor is it intended to bring your vehicle to a stop. A vehicle speed retardation device is only intended to retard the speed of your vehicle under certain conditions.

⚠ CAUTION

The safety messages that follow have CAUTION level hazards. Failure to comply will result in minor or moderate injury.

Loose Items

All items within the cab must be secured before the vehicle is set in motion. This includes, but is not limited to: drinks, clothes, books, tools, etc. In the event of a collision, loose items could fly around inside the cab.

Ground Straps and Antistatic Mats

ALWAYS work with proper grounding straps and antistatic mats around electric components.

⚠ *NOTICE*

The messages that follow have NOTICE level hazards. Failure to take proper notice could have unforeseen consequences leading to property damage.

While Servicing the Vehicle

Component damage may occur if cleanliness of the power steering hydraulic system is not maintained. The area around any component to be disconnected or connected must be cleaned prior to disconnecting or connecting. Used power steering fluid should NEVER be added to the system. Dirt in the power steering system can damage the pump or other components. Failure to follow these precautions could result in failure of the system.

GENERAL INFORMATION

Introduction

Properly mounting the body structure or any other type of equipment to a chassis is essential to ensure that both static and dynamic forces are transmitted freely without producing excessive localized loads that may eventually result in damage to the vehicle, or adversely affect vehicle handling characteristics and operation. In addition to any precautions that must be taken when physically mounting equipment to the frame, precautions must also be taken when connecting accessory components to the vehicle's electrical and air systems so that the systems continue to perform as originally intended.

Service Support

The following resources are available to the Intermediate or Final Stage Manufacturer when questions or situations arise that are not covered in this Manual.

Service Publications

To order service publications, contact Autocar at 877-973-3486.

Service Publications – Engine

To obtain service publications regarding Cummins engines, contact Cummins directly at 1-800-DIESELS or visit Cummins' website at www.cummins.com.

Customer Service/Product Support

For technical assistance, such as obtaining chassis drawings, contact Autocar at 877-973-3486.

Body Installation – General Precautions

The following items are prohibited:

- Modifications to the chassis frame, brake system, suspension, electrical system (i.e., lights, harness modifications, etc., except for those required to operate the installed body), powertrain, fuel system and exhaust system.
- Drilling of reinforcement gussets.
- Cutting grooves, notches or slots in the main frame rail flanges, gusset flanges or cross members.
- Modifications to original-equipment bolts and other fasteners for mounting of a body or sub-frame.
- Methods and procedures for lengthening and shortening the frame not outlined in this Manual.
- Relocation of air reservoirs and air valves.
- Using the power steering pump to power accessory hydraulic systems.
- Drilling into the cab uprights or back of cab structure.

⚠ NOTICE

Diesel particulate filters (DPF) and related components cannot be moved or altered from the original location in any fashion. Moving or altering the DPF or related components will result in emission system malfunction or failure.

⚠ NOTICE

In all cases, safety related systems (brakes, electrical, etc.) must remain in accordance with the FMVSS. Parties performing modifications not conforming with these standards do so at the risk of assuming all consequential liability.

⚠ NOTICE

Multiple body component installations, such as a hoist along with a roll-off flat bed, or other similar types of installations, require a single subframe for both units. Using a separate subframe for each component will result in frame damage.

⚠ NOTICE

Installation of a body and related equipment onto a chassis must not reduce the effectiveness of a component and/or system previously installed on the chassis. Reducing or obstructing the sound path of an audible backup warning device or reducing/obstructing the light path of a lamp or reflective device are examples of reducing the effectiveness of a previously installed component and/or system. Some components and/or systems may require relocation to ensure the intended level of effectiveness.

⚠ NOTICE

Whenever new electrical equipment is installed, it is the obligation of the installer to ensure that the new equipment does not interfere with the proper operation of all other electrical systems on the vehicle.

Underride Protection

Depending upon the final configuration of the rear of the vehicle, U.S. Federal or state regulations may require the addition of an appropriate rear impact guard for underride protection. Installation of the rear impact guard is the responsibility of the manufacturer who is responsible for the final certification of the vehicle.

Clearances – Chassis and Component

Minimum clearance should be maintained around the engine, transmission, driveshafts, carriers and tires to allow for ease of service, component removal, maximum air flow and vertical, horizontal and lateral movement.

Clearance – Transmission

Sufficient clearance, approximately 254 mm (10 in.), should be maintained to the rear of the transmission to allow its removal *(see Figure 1).*

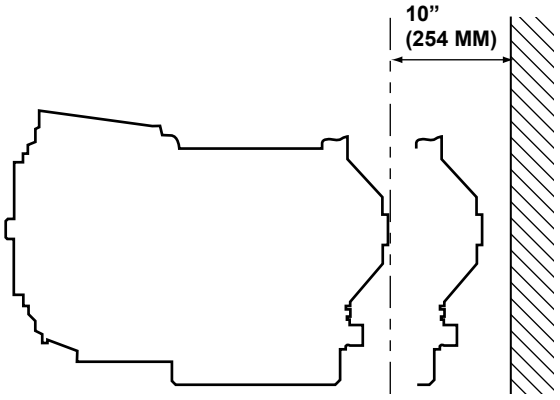


Figure 1

Transmission Cooling Lines

Sufficient clearance, approximately 25.4 mm (1 in.), should be maintained around the transmission cooling lines. When hydraulic lines are routed in this area, they must maintain 25.4 mm (1 in.) of clearance to the transmission cooling lines *(see Figure 2)*.

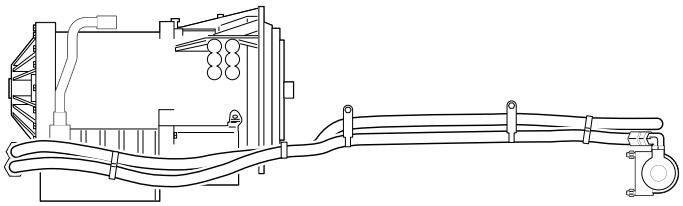


Figure 2

The transmission cooling lines should not be modified. In the event of any modification to the transmission cooling lines, the modifier will be financially responsible for warranty, recall, product liability and other costs, expenses and liabilities related to such modification.

Clearance – Driveshafts

The driveshaft lengths should not be modified. In the event of any modification to the driveshafts, the modifier will be financially responsible for warranty, recall, product liability and other costs, expenses and liabilities related to such modification.

Front Driveshafts

At least 31.75 mm (1.25 in.) clearance must be maintained around the front driveshaft.

Rear Driveshafts

At least 31.75 mm (1.25 in.) clearance must be maintained around the rear driveshaft, under full rear axle jounce and rebound condition.

Clearance – Rear Wheels and Axles

Sufficient clearance must be maintained to allow full movement of the rear axles and tires as the vehicle is subjected to axle articulation under extreme driving conditions. Please note that some vehicles may be equipped with tire chains as well *(see Figure 3)*.

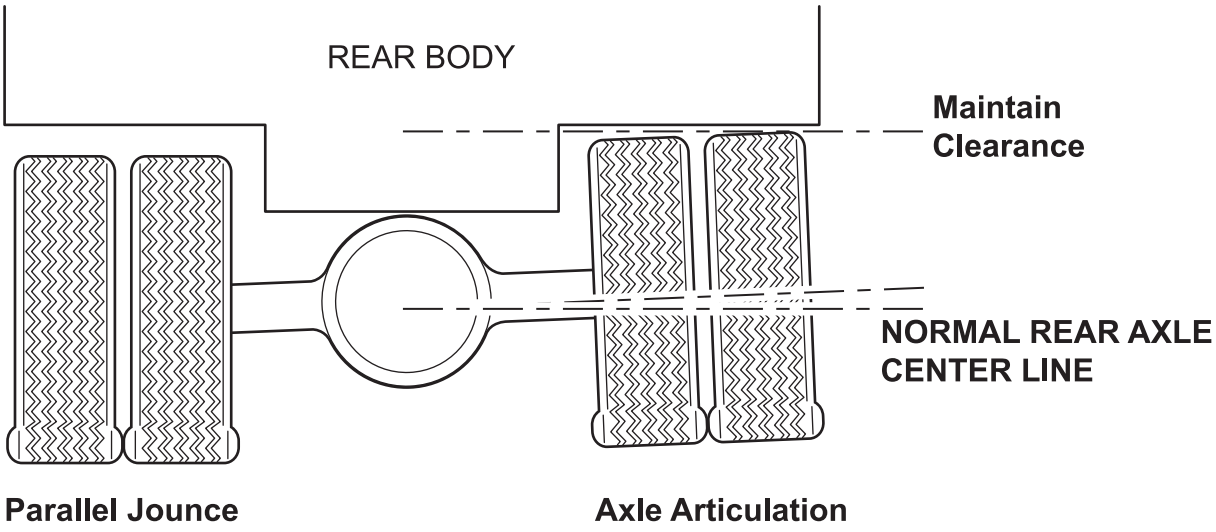


Figure 3

Body Installation – Electrical Precautions

- Battery Cables: If a battery box is relocated to a position that the cables shipped with the vehicle will not reach, install new cables. Do not splice extensions onto main power cables. New battery cables must be supported with properly sized non-conductive battery cable clamps, clamped every 609.6 mm (24 in.). If the distance to the battery box is greater than 5715 mm (225 in.), install duel cables.
- Telma: If the chassis Telma control box is relocated to a position that the cables shipped with the vehicle will not reach, install new cables. Do not splice extensions onto main power cables. See the Electrical System Section of this Manual for proper routing and clipping guidelines.
- Wire connections: Wires that carry crucial vehicle power or information (for example, power and ground to engine controller power or datalink, transmission controller power or datalink, throttle control wires, etc.) must not be spliced. Only plug into the dedicated body builders harnesses provided with the chassis *(see Body Builder Wiring section of this Manual for a listing of acceptable wires).*
- Do not change the size circuit breakers provided with the chassis.
- Ensure that mounting hardware does not come into contact with any wiring when mounting components on the chassis.

Fuel Tank and Battery Boxes

A body builder may choose to incorporate spacers when attaching fuel tanks and battery boxes to the chassis. Spacing fuel tanks and battery boxes will decrease ground clearance and/or increase vehicle width. A minimum of 304.8 mm (12 in.) of ground clearance, and a maximum of 2438.4 mm (96 in.) overall vehicle width, must be maintained when spacing fuel tanks and battery boxes.

For fuel tanks, if spacers are NOT used, a minimum of six fasteners must attach each fuel tank bracket to the rail. If spacers ARE used, a minimum of six fasteners must attach the spacers to the rail. In addition, a minimum of six fasteners must attach the fuel tank to the spacers *(see Figure 4)*.

For battery boxes, if spacers are NOT used, six fasteners should be used to mount the battery box to the rail. If the rail profile transition or liner does not allow for six fasteners, a minimum of five is required. If spacers ARE used, six fasteners should be used to mount the spacers to the rail. If the rail profile transition or liner does not allow for six fasteners, a minimum of five is required; however, a minimum of six fasteners must be used to attach the battery box to the spacers *(see Figure 4)*.

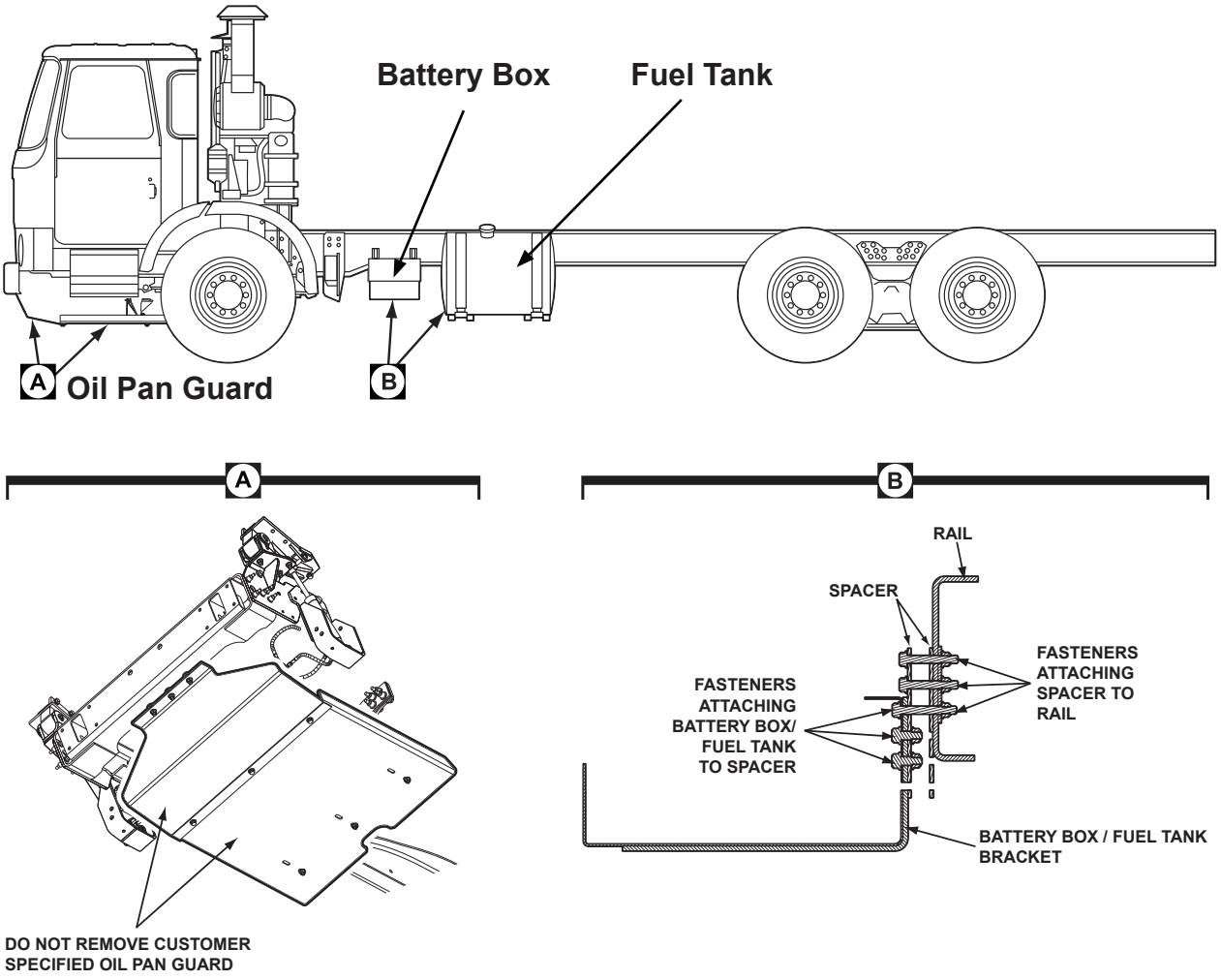


Figure 4

Crossmember Spacing

The maximum allowable spacing between crossmembers is 1371.6 mm (54 in.) *(see Figure 5)*.

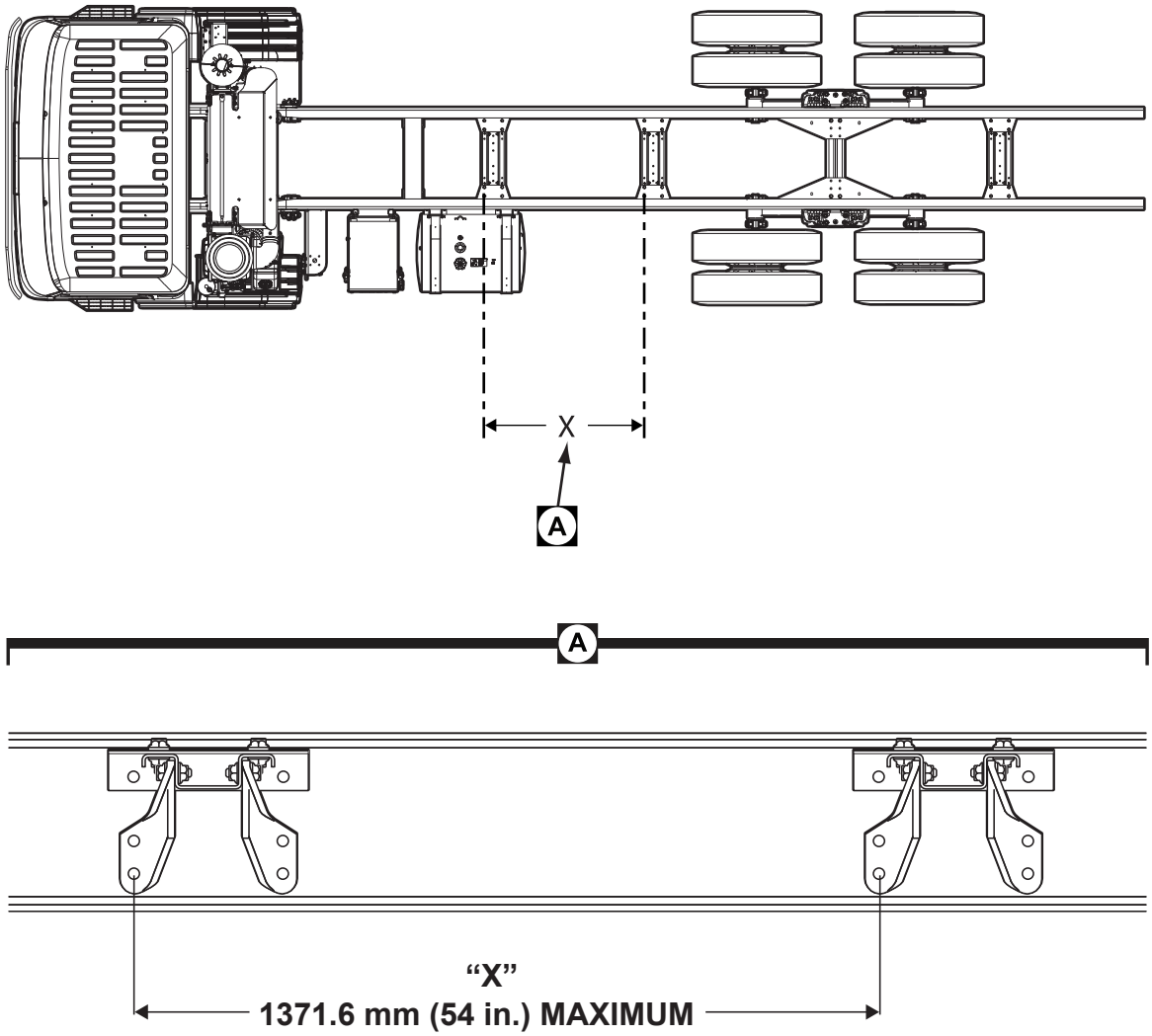
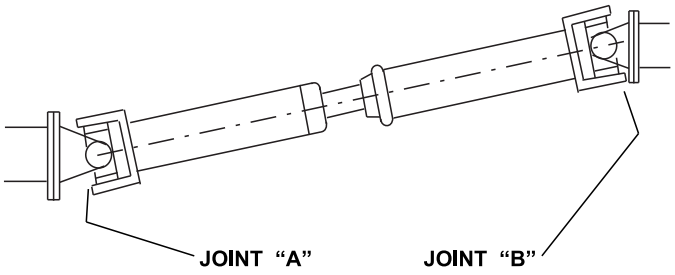


Figure 5

PTO Driven Equipment

When mounting pumps and other types of PTO driven equipment, follow the manufacturer's location and mounting recommendations. Components, such as pumps and hydraulic tanks, must be mounted so that weight distribution, both front to rear and side to side, will be equal. Avoid concentrating weight on one side of the chassis.

PTO driveshafts for equipment must meet angularity specifications to prevent premature driveline failure or harmonic noise. The center line of the PTO drive yoke and the centerline of the pump shaft yoke must be parallel, the driveshaft angles must be equal *(minimum of 1 degree and maximum of 5 degrees)* and driveshaft yokes must be in phase *(see Figure 6).*



JOINT ANGLES "A" & "B" SHOULD CANCEL AND YOKES SHOULD BE ALIGNED IN PHASE

Figure 6

PTO – Front Engine (FEPTO) – Autocar Engines

⚠ NOTICE

Maximum available FEPTO torque is engine specific. For more info consult with manufacturer.

To attach the FEPTO driveshaft to the engine front hub, an adapter is available *(see Figure 7)*.

Note: *Contact Cummins for required option number.*

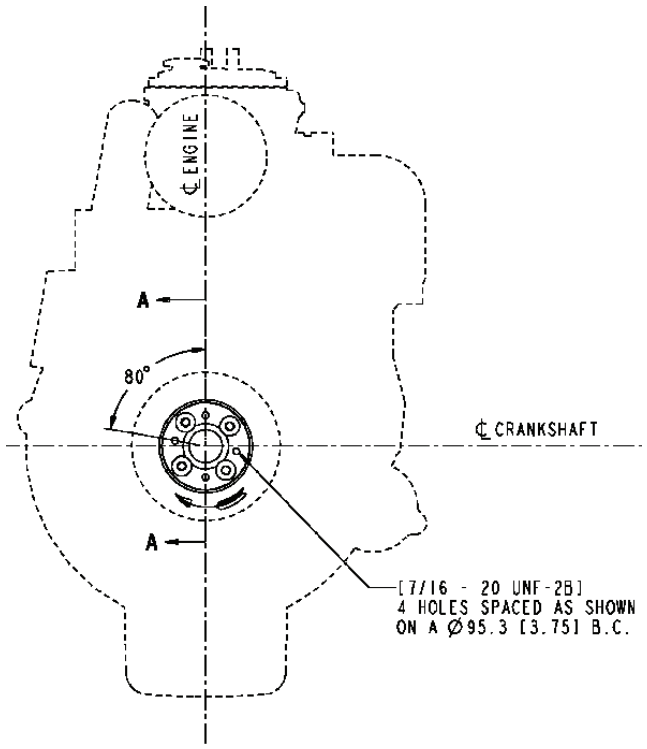


Figure 7

FEPTO/Engine Cooling System

Due to adverse effects on the cooling system, the following items are prohibited when installing a FEPTO system *(see Figure 8):*

- Modifications to the FEPTO seal in the radiator.
- Modifications to the engine mounted fan ring or the radiator mounted shroud.
- Modifications to the radiator or Charge Air Cooler (CAC) or their associated plumbing.

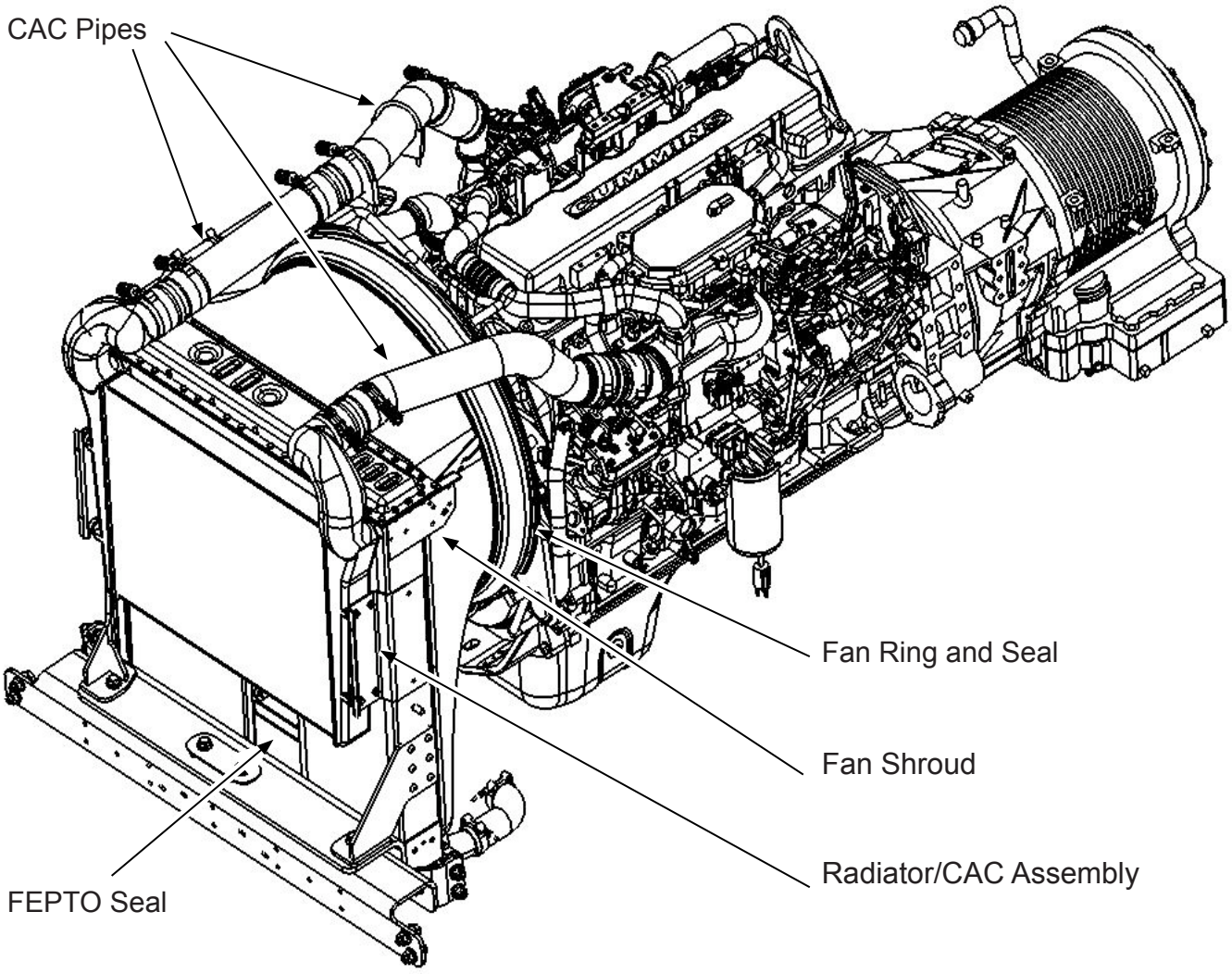


Figure 8

Any forward mounted pump or mounting bracket must never be mounted to or come into contact with the radiator suspension support. Using this element as a pump mounting point will adversely effect the chassis isolation of the radiator/CAC and can lead to early radiator/CAC failure.

The underlying radiator support crossmember will support a central load of 50 lbs. This load should be attached to the forward flange of the crossmember using a minimum of six grade 8 1/2-13 flange head bolts and nuts. Autocar recommends mounting any device between the radiator support crossmember and the bumper support crossmember so the mass is distributed between these two structural elements. If there are questions concerning items to be mounted in this area please contact Autocar Engineering at 877-973-3486 *(see Figure 9).*

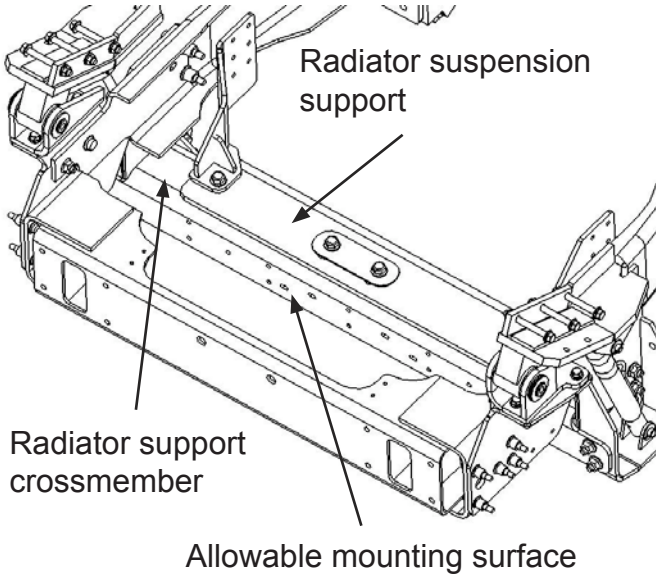


Figure 9

Transmission Mounted PTO's and Accessories

When mounting a PTO and/or it's accompanying elements such as a pump on a transmission the Intermediate and/or Final Stage Manufacturer is responsible for compliance of the bending moment allowance on the engine flywheel housing and the transmission torque converter housing or clutch housing. Contact the engine supplier and the transmission suppliers for the latest bending moment allowance details.

Any component mounted to the transmission must maintain a 25.4 mm (1 in.) clearance to any stationary element under the extreme limit of motion. No frame modifications are allowed to accommodate the mounting of these components.

PTO – Rear Engine (REPTO)

Autocar trucks equipped with Cummins engines are available with an optional rear engine power take-off (REPTO) unit.

Driveshaft Sizing

Several factors, such as continuous operating torque, slip torque, maximum low gear ratio and the presence of an auxiliary transmission, are used to determine driveshaft size, length, rpm and angle. If the engine horsepower, transmission model, rear axle model or gear ratios are modified, or tire size changes significantly, verify the driveshaft size to ensure that the original specification driveshaft will still perform satisfactorily.

Paint Codes

A paint code label is affixed to the cab of all Autocar chassis to provide an easy reference for the different color paints that were used to paint a particular chassis. The label is located on the inside of driver-side door hinge pillar. If it is necessary to match paint, refer to the paint code label to obtain the appropriate paint code.

Aluminum Part Protection

Aluminum parts must be protected when brought into direct contact with other metals, as corrosion may be accelerated due to this contact and exposure to moisture and air. An isolator must be used between the two mating surfaces of any dissimilar metals which have a difference greater than 0.15V Anodic Index *(see Metallurgical Chart below).*

Metallurgical Chart

Metallurgical Category	ANODIC INDEX (V)
Gold, solid and plated, Gold-platinum alloy	0
Rhodium plated on silver-plated copper	0.05
Silver, solid or plated; monel metal. High nickel-copper alloys	0.15
Nickel, solid or plated, titanium an s alloys, Monel	0.3
Copper, solid or plated; low brasses or bronzes; silver solder; German silvery high copper-nickel alloys; nickel-chromium alloys	0.35
Brass and bronzes	0.4
High brasses and bronzes	0.45
18% chromium type corrosion-resistant steels	0.5
Chromium plated; tin plated; 12% chromium type corrosion-resistant steels	0.6
Tin-plate; tin-lead solder	0.65
Lead, solid or plated; high lead alloys	0.7
Aluminum, wrought alloys of the 2000 Series	0.75
Iron, wrought, gray or malleable, plain carbon and low alloy steels	0.85
Aluminum, wrought alloys other than 2000 Series aluminum, cast alloys of the silicon type	0.9
Aluminum, cast alloys other than silicon type, cadmium, plated and chromate	0.95
Hot-dip-zinc plate; galvanized steel	1.2
Zinc, wrought; zinc-base die-casting alloys; zinc plated	1.25
Magnesium & magnesium-base alloys, cast or wrought	1.75
Beryllium	1.85

For outdoor, high humidity, salt environments there should be no more than 0.15V Anodic Index

Ref: http://www.engineersedge.com/galvanic_capatability.htm

Tilting the Cab

⚠ DANGER

Apply the parking brakes and, if equipped with a manual transmission, put the gear in NEUTRAL to prevent unwanted vehicle movement and possible injury or death.

⚠ WARNING

Due to the danger of sustaining personal injury and/or damage to the vehicle, never attempt to raise the cab outside under extremely windy conditions. The strong wind conditions could force the cab beyond the normal limits of its travel.

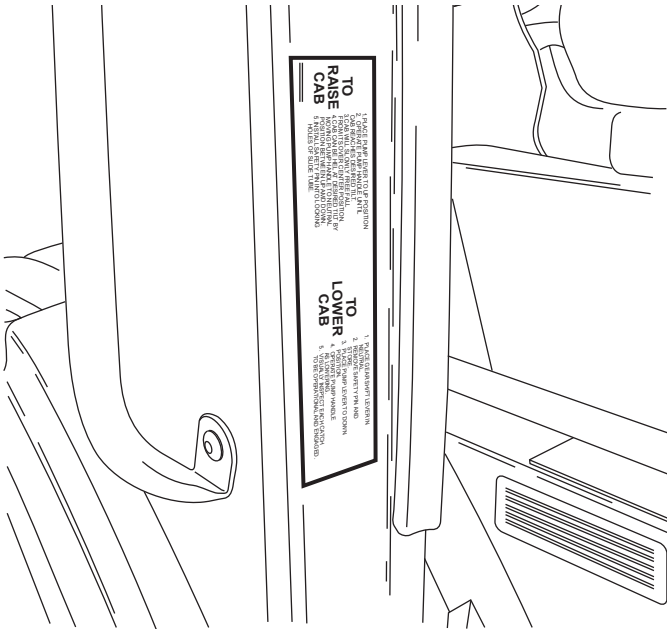


Figure 11

Raising the Cab

Read the label about cab tilting information, located on the right-hand door sill *(see Figure 11)*. Remove or secure all loose articles and close all doors before raising the cab. The area above and ahead of the cab must be clear from obstructions. Place the front wheels in a straight ahead position. Remove the cab pump handle from its storage location. It is held to the cab wall corner with two clips *(see Figure 10).*

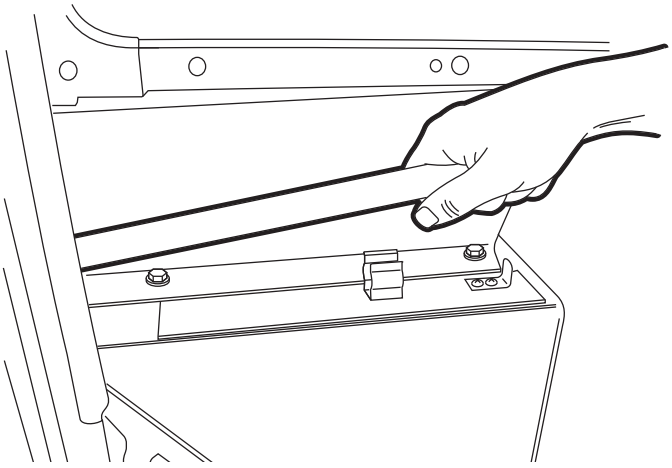


Figure 10

Place the selector lever on the hydraulic pump in the RAISE (push circuit) position. Insert the pump handle into the pump and operate the handle in an up and down motion *(see Figure 12)*. The cab latch hooks securing the cab to the frame are automatically released with the first two to three strokes of the pump handle *(see Figure 13)*. This will be evident when the pins at the rear hydraulic latch extend from the latch body *(see Figure 14)*. The hydraulic cylinders then lift the cab until the over center position is reached. Once the cab has reached this position the cab will free fall forward to the fully open position. The safety pin in the cab lock device can be installed when the holes line up.

⚠ CAUTION

Remove the pump handle when not in use. It may stick out and could cause injury to passersby.

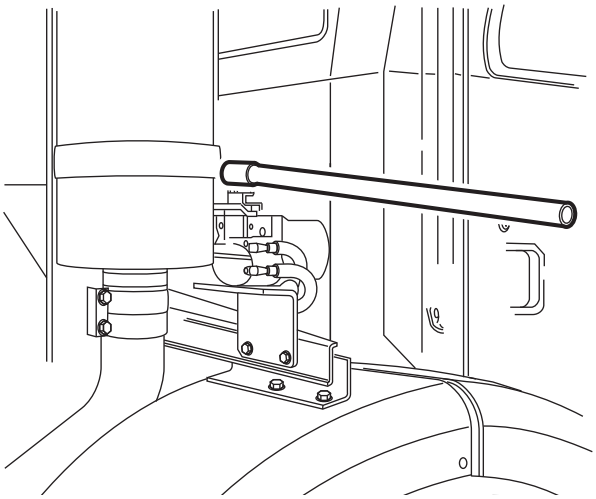


Figure 12

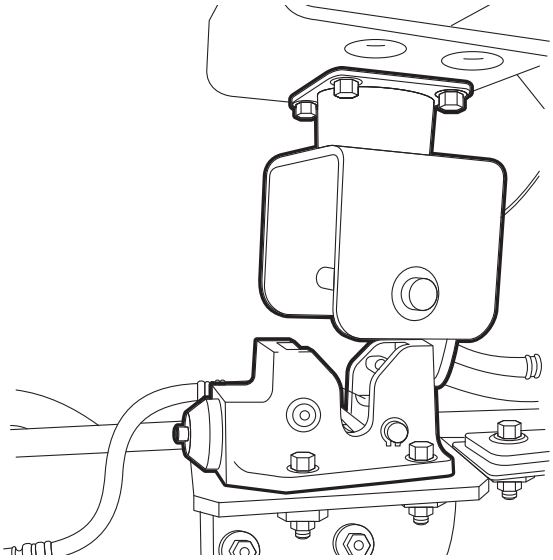


Figure 13

⚠ DANGER

Never rely on the hydraulic pressure to hold the cab in a partially open position. Always use the safety pin in the cab tilt lock tube to prevent serious personal injury or death (see Figure 14).

To stop the cab in a partially tilted position while raising the cab, stop pumping and place the flow valve selector in the HOLD position. Install the safety pin in the cab tilt lock tube wherever the holes line up. Fit the safety pin from below.

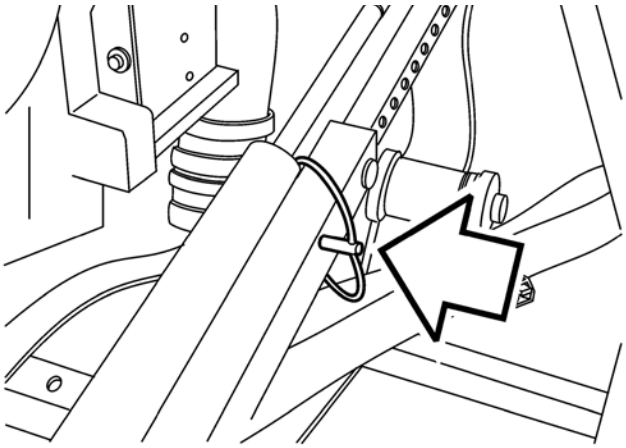


Figure 14

Lowering the Cab

⚠ CAUTION

Remove the pump handle when not in use. It may stick out and could cause injury to passersby.

Remove the safety lock pin. It may be necessary to remove weight from the pin by operating the cab jack pump. Do not use excessive force on either the pin or pump. The pin should be free to turn in order to remove it. Place the selector lever on the hydraulic pump to the LOWER (pull circuit) position. Insert the pump handle into the pump and operate the handle in an up and down motion. The hydraulic cylinders then lower the cab until the over center position is reached. Once the cab has reached this position, stop pumping and the cab will free fall rearward to the fully lowered position. When the cab is lowered, the crossbars of the cab brackets will automatically engage the hydraulic cab latches. The weight of the cab then triggers the hydraulic latches to lock. This will be evident when the pins in the hydraulic latches retract into the latch body.

Notes

WEIGHT RATINGS

Weight Ratings

U.S. Federal Motor Vehicle Safety Regulations require vehicle manufacturers to provide a certification label on completed vehicles that includes specific statements as to the amount of weight (vehicle plus payload) that can be carried on each axle system of the vehicle. Similarly, Canadian Motor Vehicle Safety Regulations require vehicle manufacturers to provide both in information label(s) on incomplete vehicles, and a certification label on completed vehicles. These labels include the same type of weight information as required by U.S. Federal Motor Vehicle Safety Standards. This information is necessary for determining vehicle application. Specific weight rating nomenclature is explained below.

Gross Axle Weight Rating (GAWR)

The Gross Axle Weight Rating is the value of the load-carrying capacity of a single-axle system (comprised of the axle, suspension, rims/tires and possibly other components such as the frame rails and transmission) as measured at the tire-ground interface. The actual rating is determined by the lowest rated component. In other words, if an axle and its suspension system are rated at 38,000 lbs, but the load rating of the tires and rims is less than 38,000 lbs, the load rating of the tires and rims would be used as the GAWR.

Gross Vehicle Weight Rating (GVWR)

The Gross Vehicle Weight Rating is (usually, but not necessarily) the sum of the GAWRs. This weight rating is the specified loaded weight of the vehicle as measured at the tire-ground interface. The GVWR could be limited by the frame or transmission.

Weight Distribution

Proper weight distribution is essential for vehicle safety, performance, reliability and functionality. The weight, location and/or load carrying capacity of a body and its related equipment, must not cause the GAWRs and/or GVWR to be exceeded. Improper weight distribution may result in the following:

- Hard and imprecise steering and lack of directional stability.
- Rough, erratic ride.
- Longer than normal stopping distances.
- Rapid tire wear and possible sudden tire failure.
- Excessive tie rod and kingpin wear, and possible front axle failure.
- High maintenance costs.

Improper weight distribution and overloading cause excessive wear and premature failure of various components of the vehicle. The additional stresses placed on the frame by misapplication of wheelbases may cause frame rail cracks or breakage. These conditions could result in an accident and personal injury.

EMISSIONS AND EXHAUST

General Fuel System – Diesel

Diesel powered Autocar trucks are plumbed with DOT approved fuel lines and compression fittings. Any modifications made to this system must maintain these type of fittings and lines and is the sole responsibility of the Final Stage Manufacturer. Further, any fuel line modifications are subject to the appropriate Cummins AEB (21.81 for 2010 ISX, ISL/ISC), (21.33 for ISM). Secondary fuel filters or their plumbing on the ISL or ISC engines are not to be modified.

General Fuel System – Natural Gas

Autocar provides a coolant loop for its natural gas (NG) powered chassis. This loop is to be used for the gas heat exchanger. Do not connect this heat exchanger into the coolant circuit for cab heat *(see Figure 15)*.

Note: *Any natural gas installation is required to meet Cummins requirements (see Appendix A).*

Exhaust

For 2007/2010 emission compliance, all diesel engines are equipped with a Diesel Particulate Filter (DPF). The exhaust system between the turbo outlet and the DPF on 2007 emissions engines, and the Selective Catalyst Reduction (SCR) outlet on the 2010 emissions diesel engines can not be modified. Similarly, the exhaust on gas engines from turbo to the Three Way Catalyst (TWC) outlet are not to be modified.

The outer skin of the DPF unit reaches a temperature of approximately 300 degrees Fahrenheit while the exhaust outlet temperature can reach approximately 1,200 degrees Fahrenheit during regeneration cycles. Outlet temperature may be lowered by as much as 480 degrees Fahrenheit, (measured 152.4 mm (6 in.) from the outlet) by installing an exhaust gas diffuser. All chassis are equipped and shipped with a diffuser.

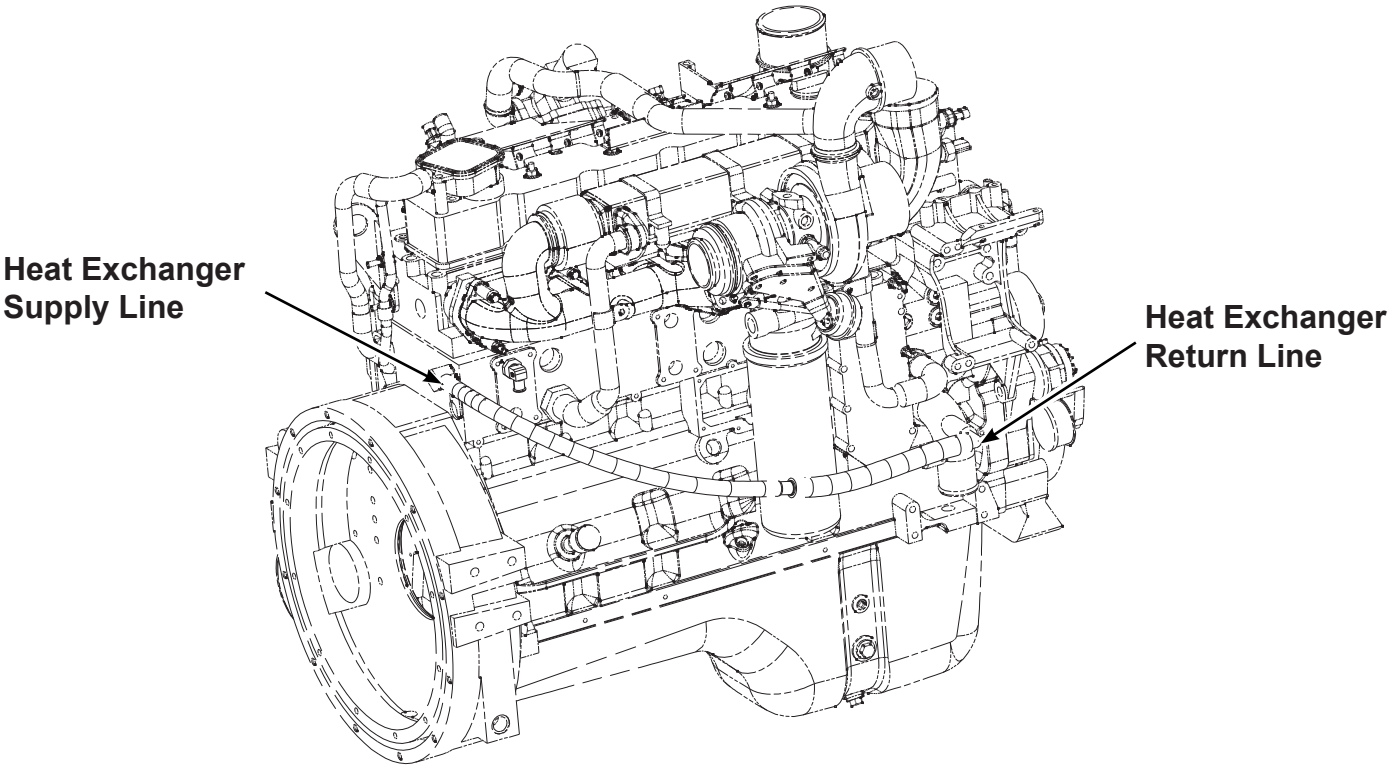


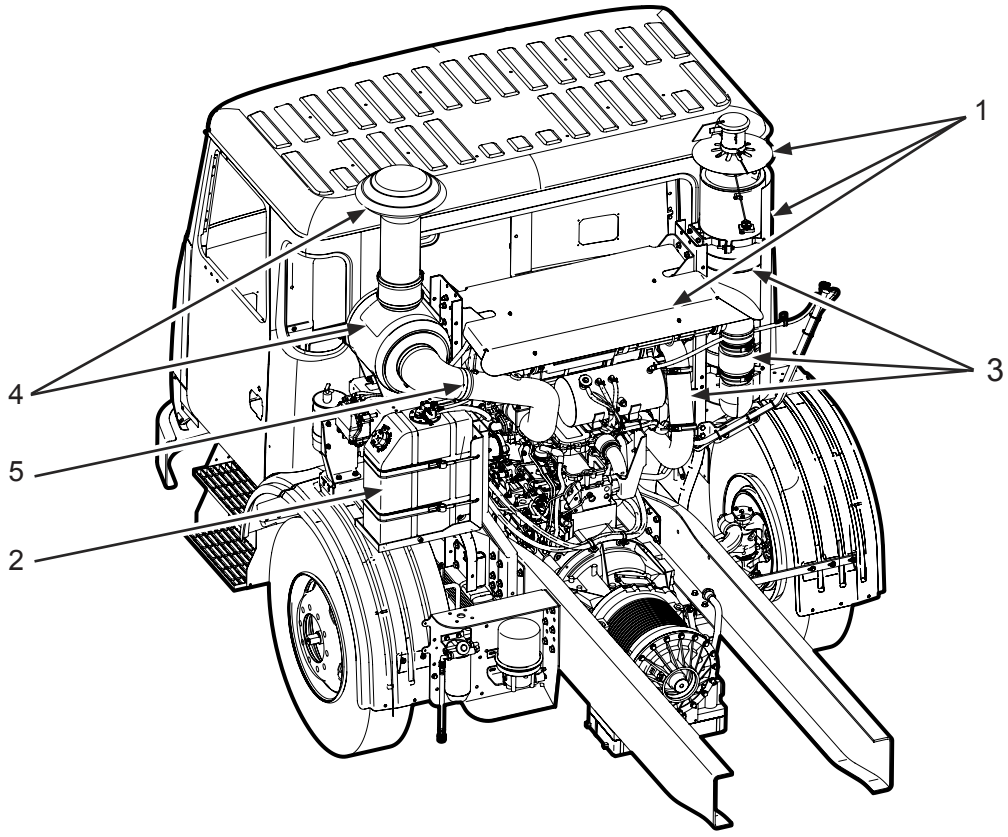
Figure 15

The Final Stage Manufacturer must make accommodations for the diffuser or protect the engine from water entrainment and evaluate the effect of the elevated exhaust outlet temperatures on body equipment, as well as the final functionality of the vehicle. Autocar strongly recommends the diffuser be retained in order to reduce the exhaust outlet temperature during the full operation of the vehicle . If modifications are made to the outlet systems, they must fall within Cummins AEB requirements (21.78 for 2010 ISL/ISC/ISX, 21.64 for ISM). Any damage to the engine, chassis, or body as a result of not installing the provided diffuser will be the responsibility of the Intermediate and/or Final Stage Manufacturer.

Maximum tail pipe mass and bending moment without additional tailpipe support must adhere to the requirements of Cummins AEB 21.63.

Intermediate and/or Final Stage Manufacturers are responsible for any damage due to exhaust system modification or removal.

All chassis are equipped with debris shields *(see Figure 16, item [1])* to prevent contact with hot exhaust elements. These shields should not be removed or modified. If removed or modified, the results and implications are the sole responsibility of the Intermediate and/or Final Stage Manufacturer. The basic systems which include the urea system *(see Figure 16, item [2])*, the exhaust system *(see Figure 16, item [3])*, the air cleaner *(see Figure 16, item [4])*, the air intake *(see Figure 16, item [5])*, the charge air system, and entire back of cab structure are considered emission sensitive. The Intermediate and/or Final Stage Manufacturer must not modify these elements.



Note: *(item 2) – The urea system includes a urea tank, dosing module, supply module, connecting coolant lines (between the elements comprising the urea system and the engine), and the connecting urea lines (between the elements comprising the urea system).*

Figure 16

Notes

BODY MOUNTING CHASSIS RELATED ITEMS

Definitions of Terms Used in this Section

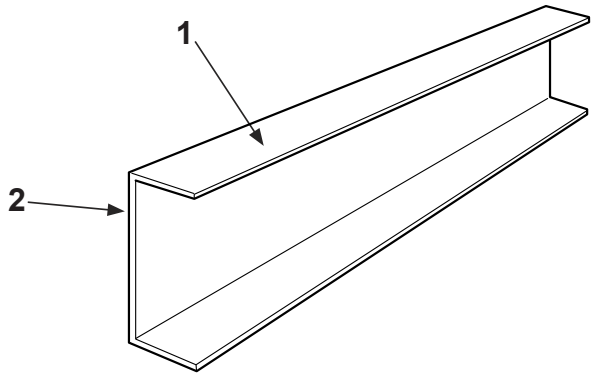
Term	Definition
Section Modulus	Measure of strength of a frame member cross section based on height, width, thickness and shape. It does not account for the strength of the material used in the frame.
Yield Strength	Measure of strength of the material from which the frame is made. It is the maximum load (Mpa) (psi) that a material can withstand and still return to its original shape. Note: A degree of permanent deflection set is allowed in order to establish the yield limit.
Resisting Bending Moment (RBM)	Single measure of strength that accounts for both the section modulus and the yield strength of the material used; that is, the product of multiplying the section modulus times the yield strength.
Sag	Condition in which a frame rail or side rail is bent down from where it should be.
Bowed	Condition in which a frame rail or side rail is bent up from where it should be.
Diamond	Condition in which one entire frame rail is moved forward from, or to the rear of, its correct parallel alignment with the other rail.
Twist	Condition in which the entire frame has been twisted. One rail basically slopes up while the other will slope down.
Side-sway	Condition in which a side rail is bent to the side of where it should be.
Tracking	Alignment of vehicle axles with each other. A misaligned frame can cause improper tracking. In correct vehicle tracking, all axles are parallel to each other and perpendicular to the center line of the frame.
Web	Vertical part of a channel-type frame rail.
Flange	Horizontal part of a channel, top and bottom.

Frames

The truck frame is the backbone of the truck. Its primary function is to provide structural support to the truck and its components. Since all truck components are directly or indirectly attached to the frame, satisfactory operation of the truck depends on proper frame alignment and integrity. The frame also functions as a mounting platform for the body and equipment to be used. It transmits the loads imposed by these attachments to the ground through the suspension and axles. The interaction of the body and frame is critical to the performance and life of the truck, and is a major focus of the following information.

The most common type of frame used in trucks today is the steel C-channel *(see Figure 17).*

C-Channel



1 – Flange

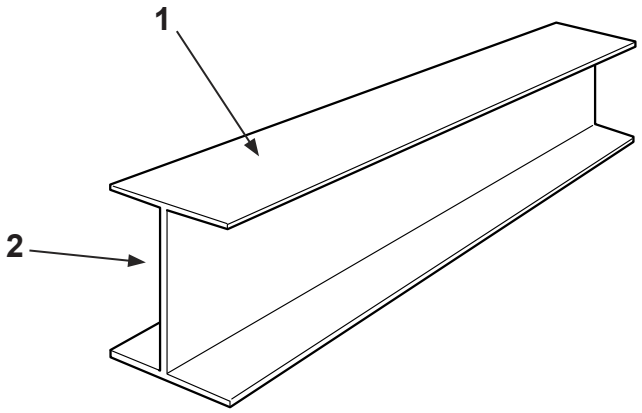
2 – Web

Figure 17

The steel channel frame is popular because components can be attached to it easily, and it exhibits relatively high strength compared to other shapes. It is fairly easy to modify and is compatible with several types of reinforcements. Channels are available in a wide variety of shapes and sizes, making it easy to specify an optimum size for a particular application.

I-beams or wide flange beams are used by some heavy truck manufacturers and crane manufacturers *(see Figure 18)*. These beams offer a very high section modulus which is important in crane applications. However, because of difficulty in mounting components to I-beams, they are not widely used in this industry.

I-Beam



1 – Flange

2 – Web

Figure 18

Frame Material

The material chosen for the frame depends on the strength required for the application. There are three types of steel commonly used in truck frames today:

- Low Carbon or Mild: 30,000-50,000 psi
- High Strength Low Alloy: 50,000-90,000 psi
- Heat Treated: 120,000 psi

The strength of the steel used is expressed as the yield strength (S). This value, expressed in pounds per square inch (psi), is the maximum stress the material can withstand without experiencing permanent deformation or damage. The yield strength of the steel is determined in a testing laboratory by subjecting samples to tensile tests.

The section modulus (Z) of a frame rail is a number that mathematically represents a function of the cross sectional area of the frame related to the center or neutral axis of the rail. This value is

obtained by use of a complex formula. The section modulus is a function of the shape and size of the frame rail and not the material used in it.

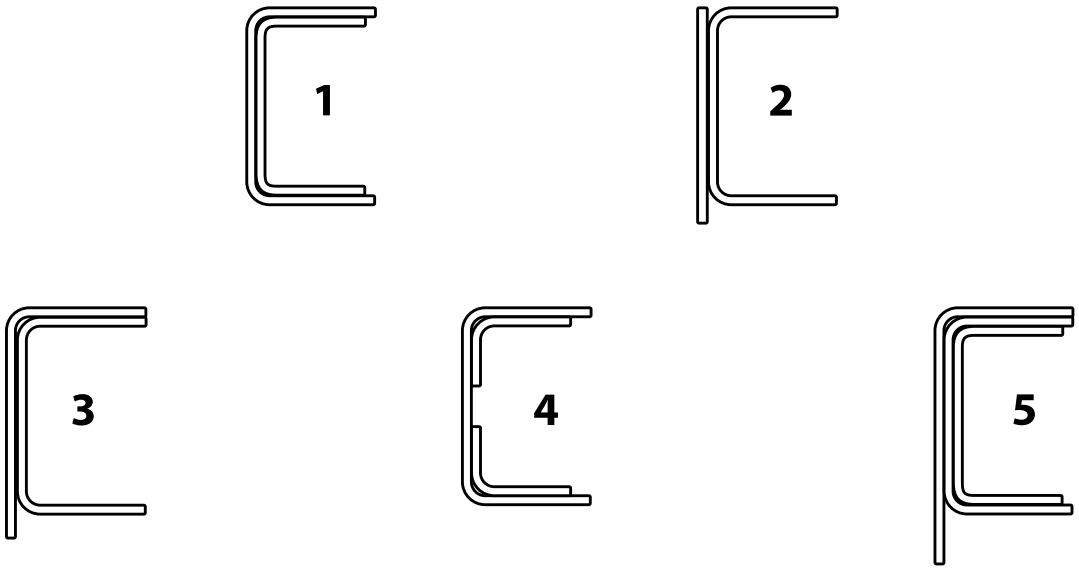
The resisting bending moment (RBM) is defined as the yield strength (S) multiplied by the section modulus (Z). **Formula: RBM = S·Z.**

The RBM is important because it represents the maximum bending moment that the frame rail can withstand without permanent deformation or damage. The RBM is usually expressed in inch pounds per rail.

Most trucks are built with frame rails that are strong enough to handle average loads such as those imposed by a van body or platform body.

When bodies or equipment are installed that cause the stresses in the frame to exceed the manufacturer's recommendations, additional reinforcement of the frame is necessary. Reinforcements that could be used include: double channels, fish plates, L-shapes and angle reinforcements *(see Figure 19).*

These reinforcements could be combined to provide additional strength when required.



1 – Inner Channel Liner
2 – Fish Plate
3 – Inverted "L"
4 – Inside Angels
5 – Inner Liner and Inverted "L"

Figure 19

Minimizing Frame Failure

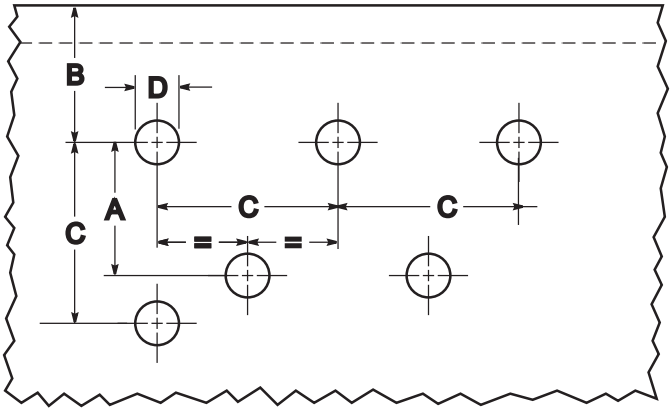
1. Use vehicles only for those purposes for which they are designed.
2. Follow these practices when mounting a body or equipment on a frame:
   - Avoid abrupt changes in section modulus. For example, heating the frame.
   - Do not drill holes in the frame rail flanges.
   - See Figure 20 for minimum spacing requirements and maximum diameter for holes in the web section of the rail.
   - Use existing holes whenever possible.
   - New holes must be drilled as close as possible to the neutral axis of the web (halfway between the flanges) or on the same horizontal line as adjacent holes.
   - Do not cut holes with a torch.
   - Do not cut notches in the rails.
   - Do not heat steel frame rails.
   - Do not weld on the rails.
   - No more than four holes should exist on the same vertical line of the frame webface.
   - Any holes drilled in a reinforcement must be spaced a distance equal to at least two times the thickness of the material being installed as measured from the edge of the reinforcement to the side of the hole being drilled.
   - Any unused holes in the frame rails must not be plug welded. Fill unused holes with the appropriate sized bolt.

Bolted Attachments

Matched drilled bolting requires the use of shoulder bolts, which are driven through slightly undersized mounting holes. The shank of the bolt must be long enough to penetrate both parts being joined. This technique assures proper alignment of the mating parts and eliminates working between the mating parts if the bolts should loosen. Use SAE grade 8 bolts 12.7 mm (1/2 in.) or larger.

NEVER use a torch to cut out mounting holes. Caution should be taken to assure that air and electrical lines are protected when drilling. Mounting holes are not to be drilled in the upper or lower flanges of the frame rail except at the very rear end of the frame rail. Holes drilled in the frame must not exceed the fastener diameter by more than 0.8 mm (1/32 in.). Maximum fastener diameter allowable 15.9 mm (5/8 in.), maximum drilling 16.7 mm (0.66 in.). Figure 20 shows the minimum spacing allowed between bolt holes and the flanges of the frame.

Minimum Hole Spacing



A = Min. 3 x (D)

B = 3 x (D), min. 57.1 mm (2.25 in.)

C = Min. 4 x (D)

D = 16.7 mm (0.66 in.) max.

Figure 20

All body and equipment mounting brackets must be bolted to the truck frame web area. Use SAE Grade 8 bolts 12.7 mm (1/2 in.) or larger. Hardened flat washers or flanged head nuts and bolts must be used on both sides. Holes must be drilled or reamed out and the diameter must not be more than 0.8 mm (1/32 in.) oversized *(see Figure 21, item [1])*.

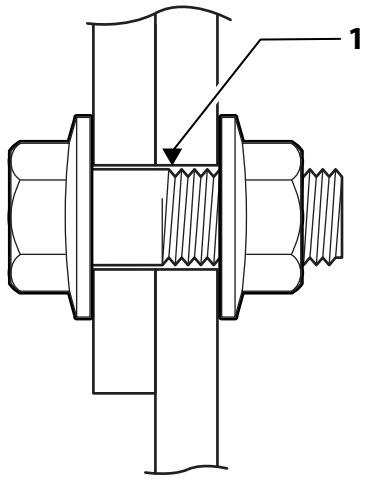


Figure 21

Mountings where alignment is critical or where high loads and stresses develop must utilize matched drilled bolting techniques *(see Figure 22, item [1]).*

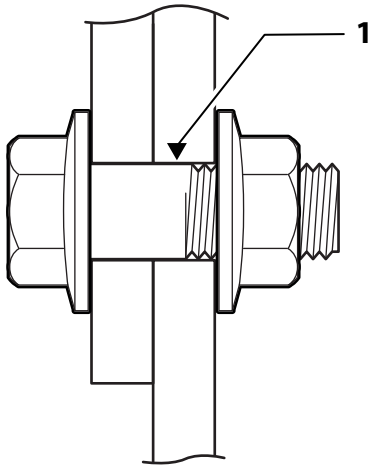


Figure 22

Huck Attachments

The illustrated equipment can be purchased from Huck Fasteners. Look on their web page at www.huck.com under "tooling/order information" for a distributor near you and for fastener installation procedures.

- 940 Frame Repair Kit *(see Figure 23)*
- HS20CC Kit - 15.9 mm (5/8 in.) Huck Fastener
- HS16CC Kit - 12.7 mm (1/2 in.) Huck Fastener

Each of these part numbers includes:

- Huck POWER Hydraulic unit
- Hydraulic hoses
- Hydraulic gun
- Installation nose for hydraulic gun
- Cutter nose for hydraulic gun

Figure 23

All body and equipment must be bolted to the truck frame web. Use SAE Grade 8 bolts 12.7 mm (1/2 in.) or larger or 12.7 mm (1/2 in.) or larger Huck spin pins and collars. Hardened flat washers or flanged head nuts and bolts must be used on both sides. Holes must be drilled or reamed out and the diameter must not be more than 0.8 mm (1/32 in.) oversized *(see Figure 24, item [1])*.

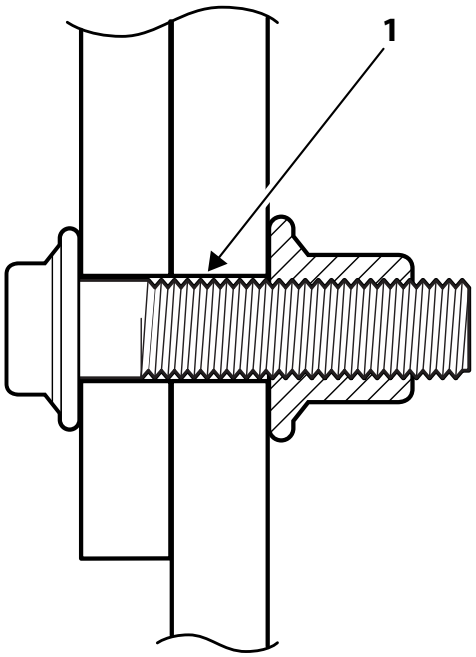


Figure 24

Welded Attachments

The welding of bodies, equipment or mounting brackets to the truck frame is strictly forbidden, except for the rear hinge of a dump body or tilting flatbed body which may be welded in place, provided it is located at the very end of the frame and that the welding does not occur within 101.6 mm (4 in.) of the edge of the rear most spring hanger bracket.

When welding, care must always be taken to protect the electrical components of the vehicle. First, disconnect the negative battery cable. Second, disconnect all cables from the alternator. Finally, all vehicle electrical control modules must be disconnected. Modules include, but are not limited to, engine Electronic Control Unit (ECU), transmission ECU, anti-lock brake system ECU, vehicle electrical control module and any other component that uses the truck's electrical system to power the ECU. Air and electrical lines must also be protected from damage during the welding process.

The negative or ground cable of the welding machine must be connected properly to the section of the vehicle under modification and should be as close as possible to this area. Connection of the ground cable to parts of the vehicle that will bring components, including bearings, into the welding circuit may result in damage to these components.

Welding

⚠ NOTICE

Welding on trucks can damage the vehicle electrical system/components due to the voltage and current spikes that normally occur when welding. It is preferable to avoid welding on an assembled truck, but if any structure on or in contact with the vehicle must be welded, follow the recommendations in this section, and in service bulletin General Safety Precautions for Vehicle Electronics, System Group 300. Never weld on the engine or engine components. Welding on the engine or components mounted on the engine can cause serious damage to the engine ECU.

Before welding the vehicle, disconnect power to the component being welded.

- Disconnect both the positive (+) and negative (-) battery cables. Disconnect the negative cable first. Reconnect the positive cable first. Vehicles equipped with battery "quick disconnect" must still have the cables removed directly at the battery.
- Disconnect engine/starter ground from the chassis. This connection is located outside the left-hand frame rail in the engine compartment. Disconnect the power harness and vehicle interface harness at the engine (ECU).

- If vehicles are equipped with systems that have their own ECU, such as ABS Brakes, disconnect each ECU at each electrical connection. This "opens" the circuit and will prevent transient voltage from reaching one ECU to another.
- Attach the welder ground cable as close to the weld as possible (no more than 61 cm (2 ft.) from the part being welded).
- Do not connect the welder ground cable to the engine ECU or the ECU cooling plate.
- Welding cables should not be allowed to lay on/near or cross over any electrical wiring or electronic component during the welding procedure.
- After the welding process has been completed and the welded parts have cooled, inspect wiring and components for possible shorts or damage which would allow the possibility of drawing excessive currents or cause short circuits when the batteries are reconnected.

Frame – Welding and Cutting

Certain frame modifications, such as lengthening and shortening, require welding and cutting the frame. In general, frame welding is not recommended. However, for modifications that do require cutting or welding the frame (such as frame lengthening, shortening, etc.), the following welding and cutting practices are recommended.

The only acceptable method of lengthening a frame is by adding a section behind the rear axles. Cutting and splicing the frame ahead of the rear axles will severely weaken the frame in the area of the splice and will result in frame failure. DO NOT splice a frame.

Frame Cutting

Mechanical sawing is the preferred method for cutting the frame. However, the oxygen gas process (either oxygen and acetylene or oxygen and MAPP) is acceptable. Surface areas of the parts to be joined must be ground smooth to prepare them for welding.

Edges must be bevelled to a 30 degree angle with a 1.588 mm (1/16 in.) land *(see Figure 25).*

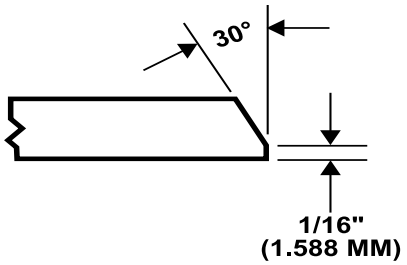


Figure 25

When joining frame members, the bevel must be away from the frame. Parts being joined must be brought as close together as possible. A gap of approximately 1.588 mm (1/16 in.) should be maintained. Align the sections and clamp them in place *(see Figure 26 and Figure 27).*

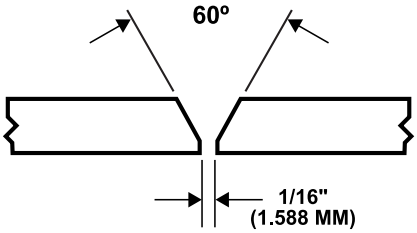


Figure 26

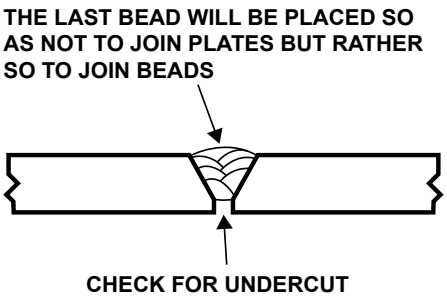


Figure 27

When the gap between parts is greater than 1.588 mm (1/16 in.), edges may be built up by welding and grinding. DO NOT use fillers.

Frame Welding

Weld using a 2.38 mm (3/32 in.), E11018M welding rod with either direct or alternating current, reverse polarity and a positive electrode. Use the following voltage and current for either process:

Volts — 21–24

Amperes — 70–120

When assembling or joining parts by welding, the procedure must be completed so as to minimize distortion and shrinkage. For multiple pass welds, slag must be completely removed before proceeding with subsequent weld passes. Slag must be completely removed from finished welds, and the finished weld must be ground completely smooth on both sides of the joint. Cracks, porosity, overlaps and deep undercuts greater than 1.588 mm (1/16 in.), must be ground out and re-welded.

Wheelbase Alteration

Truck wheelbases can be altered by removing the bolts in the rear suspension and crossmembers and sliding the axle suspension and crossmembers forward or backward to the required location.

The optimum frame type for a truck depends on wheelbase and axle loading. Consult the chassis diagram section of Frame Rails and Crossmembers Service Manual, AC-SM-710-0306-P46-R001 to determine the minimum frame requirements for the application being considered.

Longer or shorter wheelbases, require approval from Application Engineering (call Autocar at 877-973-3486). Additional frame reinforcements required are not specified and must be considered separately.

When altering wheelbases, it may be necessary to shorten or lengthen a driveshaft. It is important that the driveshafts be properly balanced, aligned, driveshaft calculations must meet Allison driveline requirements when reinstalled.

Air and electrical lines will have to be shortened or lengthened depending on the modification performed. To shorten air lines, the ends may be cut off and reinstalled in the fittings where they were originally connected. (DOT approved fittings must always be used). When air lines are lengthened, an additional length of tubing can be added to one end of a line (only one splice) providing the same tube diameter is used and that the DOT approved union does not restrict the flow of air to the point that the actuation and release times of the brakes are affected. If this cannot be done, new, compete lengths of air line must be installed. The actuation and release times must be checked to be sure that the vehicle is in compliance with FMVSS 121 whenever any alterations are made to the brake system.

Electrical wires may be lengthened by connecting additional lengths of wire. Use appropriate solder and seal connections *(refer to page 63 on the Manual for proper instructions)*.

Note: *Anti-lock brake system lines must not be extended.*

All connections should be made according to the recommendations in the electrical section of this Manual.

Once the axles and suspension are properly aligned, the mounting holes for the spring hanger brackets and crossmembers can be backdrilled into the frame. When altering the wheelbases, it may be necessary to add or remove crossmember(s) from the chassis.

Crossmembers

Do not modify existing crossmembers. Maximum allowable spacing for crossmembers is 1371.6 mm (54 in.) *(see Figure 5)*. When adding

additional crossmembers, use Autocar crossmembers. Do not move crossmembers that attach to suspension components or lift axles. If the wheelbase is altered the suspension components and crossmembers must be moved as a unit. If a lift axle is moved, the lift axle and its crossmember must be moved as a unit.

See Figure 20 *(page 37)* for minimum spacing requirements and maximum diameter of holes in the web section of the rail.

Frame Reinforcements

Channels

On certain models, center crossmembers are designed for 6.35 mm (1/4 in.) frame liners *(see Figure 28)*. On trucks with single-channel frames, 6.35 mm (1/4 in.) spacers are used in conjunction with the crossmembers. The spacers must be removed when adding an inner reinforcement to the frame. Engine mounts and rear suspension crossmembers for Hendrickson rear suspensions also use spacers.

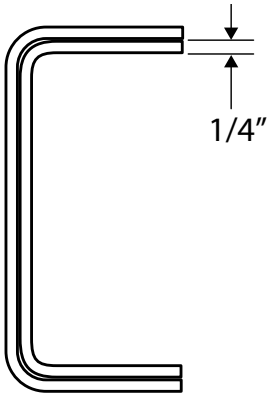


Figure 28

Note: *The bend radius of the inner channel should be large enough so that the corners of the two channels do not touch each other.*

The ends of the inner channel should be tapered 45° *(see Figure 29, item [1])*, except at the rear of the frame, where the liner may be cut squarely. The ends of a liner should not terminate at the center of a suspension bracket or crossmember, but must continue completely through the bracket and then begin to taper.

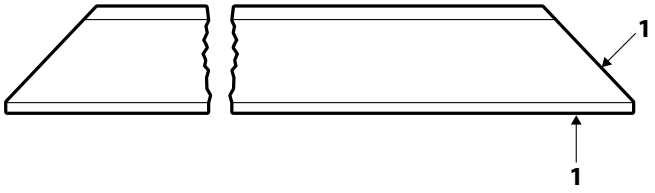


Figure 29

When necessary modifications to the crossmembers have been completed, the assembly can be bolted together. It is recommended that huckbolts be used. Huckbolts are required for all rear suspension components. Bolt holes can be backdrilled into the inner channel liner and reamed to the proper dimensions.

Fish Plates

Fish plates are large flat plates bolted to the web of the frame rail. They are usually 9.5 mm (3/8 in.) to 12.7 mm (1/2 in.) thick and increase the section modulus considerably. The height of the fish plate often exceeds that of the frame rail *(see Figure 30, item [1])*. Fish plates are often installed between the rear of the cab and the end of the frame to handle the stresses imposed by a crane mounted directly behind the cab.

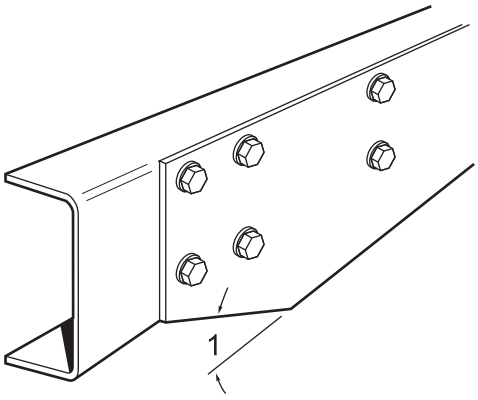


Figure 30

The ends of the fish plates must be tapered to reduce stress concentration in this area *(see Figure 31 and Figure 32)*. Fish plates must be bolted using the match-drilled technique so the fish plate and frame act as one. Rivets, brackets and other components in the area where a fish plate is to be installed will have to be removed and reinstalled with the fish plate in place.

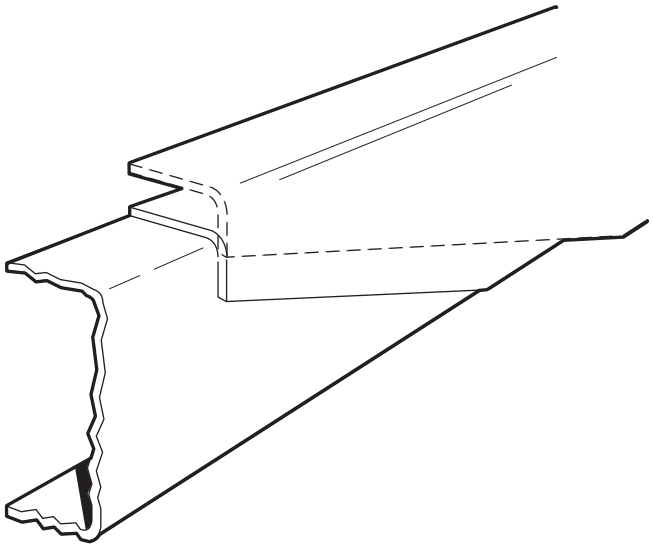


Figure 31

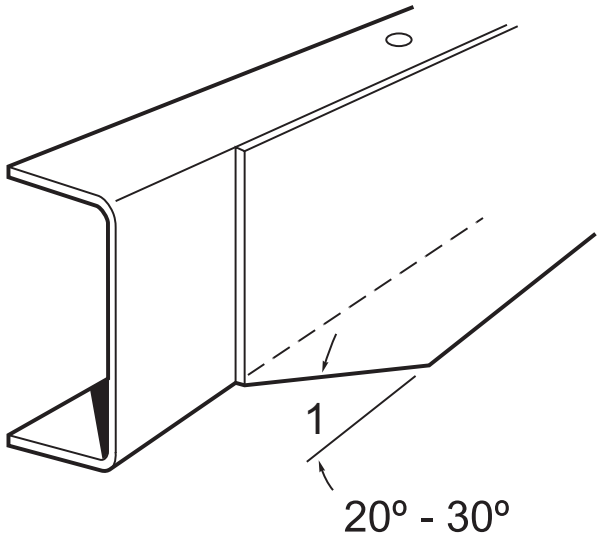


Figure 32

L-Shapes

L-shapes are used in similar applications as fish plates. The advantage of an L-shape is its flange, which increases the section modulus considerably. L-shape reinforcements are installed similarly to fish plates and the ends must also be tapered *(see Figure 33 and Figure 34)*.

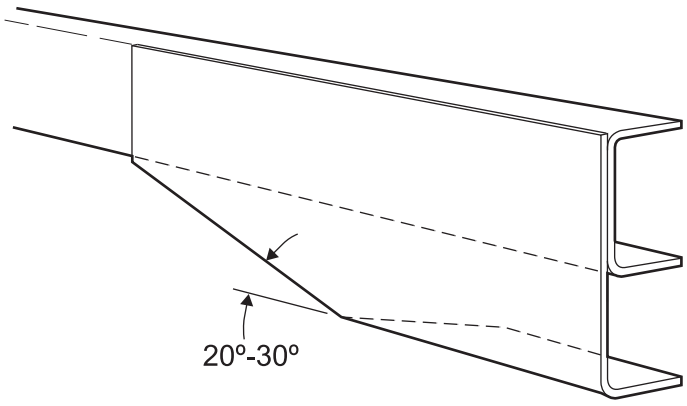


Figure 33

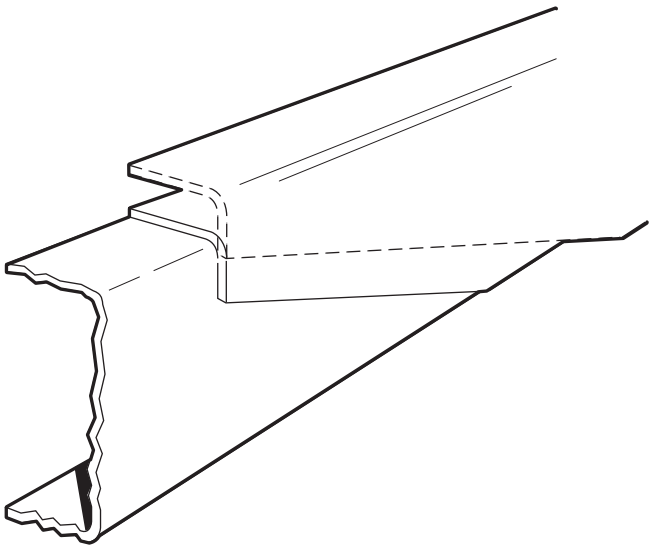


Figure 34

Subframes

A subframe is an additional frame mounted on top of the existing truck frame *(see Figure 35)*. Of all the types of reinforcements used, the subframe is the easiest to install. However, the subframe adds considerable weight to the vehicle and raises the height of the body and equipment being installed.

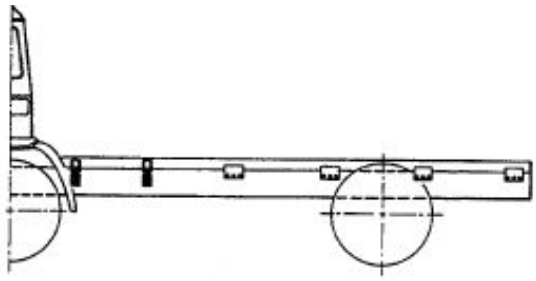


Figure 35

The subframe can be almost any shape; however, the C-channel is the easiest shape to mount. Except for the two front anchorages, subframes are rigidly attached to the truck frame by welding flat plates to the side of the subframe and bolting these plates to the web of the truck frame *(see Figure 36).*

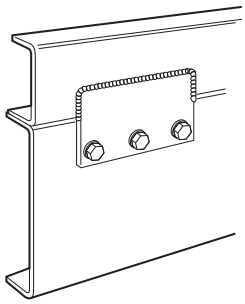


Figure 36

The two front attachments must allow longitudinal movement between the chassis and subframe. U-bolts could also be used at the front *(see Figure 37)*.

The flat mounting plate bolts should be match drilled. This type of attachment causes the subframe to act as one piece with the truck frame and results in a dramatic increase in section modulus *(see Figure 37)*.

Figure 37

Note: *This type of reinforcement should not be confused with the C-channel longitudinal member found in most van, platform and other bodies. These types of bodies are normally attached to the frame with U-bolts, which allow the truck frame and body longitudinal member to act independently.*

When cranes are mounted directly behind the cab, the rigid attaching plates can be used the full length of the subframe.

The front end of the subframe should be tapered 25° to reduce stress concentrations at the end, and chamfered on the bottom leading edge to prevent chafing against the truck frame. An adequate number of crossmembers should also be installed in the subframe to prevent lateral movement *(see Figure 38, item [1]).*

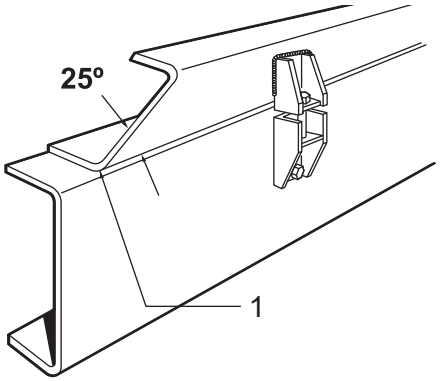


Figure 38

Truck Bodies

Truck bodies are either torsionally resilient (i.e., van and platform bodies) or torsionally stiff or rigid (i.e., tank or refuse bodies). Loads imposed on trucks are either uniformly distributed or spot loads. Uniformly distributed loads are spread out evenly along the length of the truck frame. Bodies such as vans and flatbeds impose a uniformly distributed load on the truck frame. Spot loads, or concentrated loads, result from fifth wheel installations or bodies where the weight is transmitted through a few mounting points *(see Figure 39 and Figure 40)*.

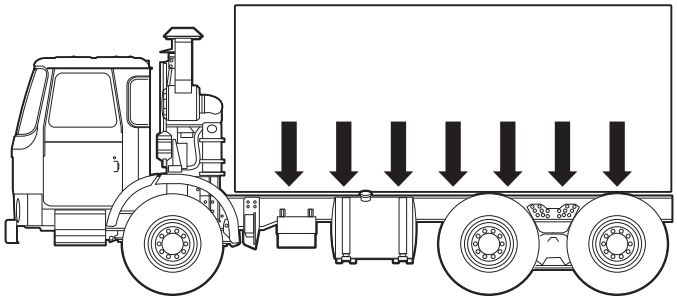


Figure 39

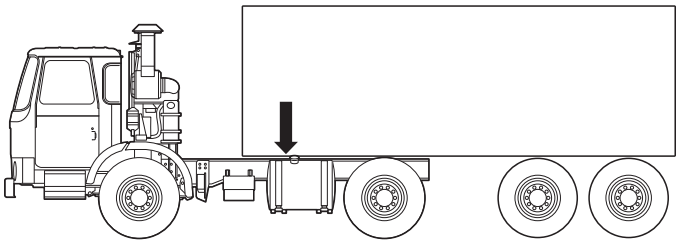


Figure 40

An additional loading condition which must often be considered is the moment or bending force imposed on the frame by a crane, liftgate or other piece of equipment. Often a liftgate or other piece of equipment is mounted with a body and the combined frame stress created must be considered to determine if any additional reinforcement is required *(see Figure 41).*

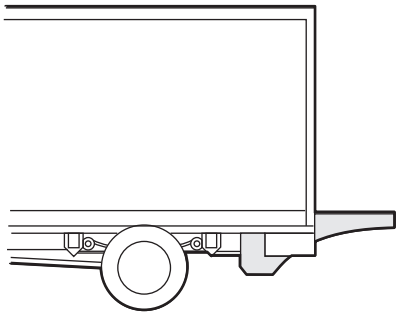


Figure 41

Torsionally Stiff Bodies

Torsionally stiff bodies must be mounted so as to allow for flexing of the truck frame encountered under normal driving conditions. This can be accomplished by using rubber mountings, spring-loaded brackets or other similar types of attachments *(see Figure 42 and Figure 43).*

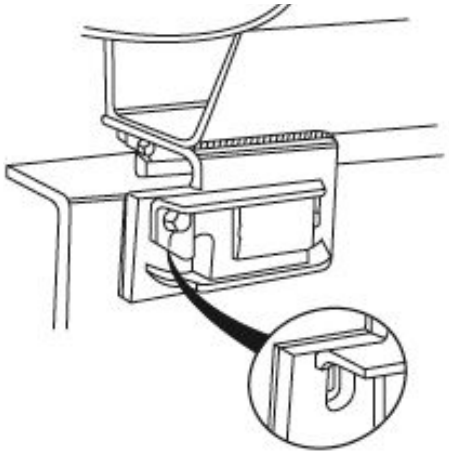


Figure 42

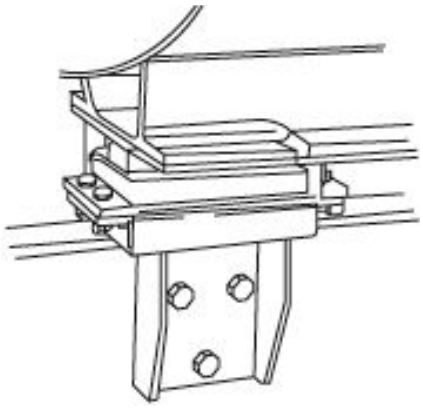


Figure 43

Torsionally Resilient Bodies

Torsionally resilient bodies can be rigidly mounted to the truck frame. However, longitudinal movement between the frame of the truck and the frame of the body must be permitted. This is accomplished by attaching the body with U-bolts or other similar methods *(see Figure 44 and Figure 45)*.

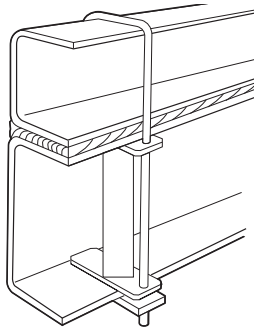


Figure 44

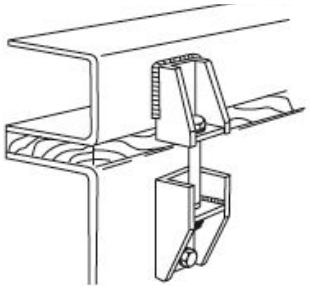
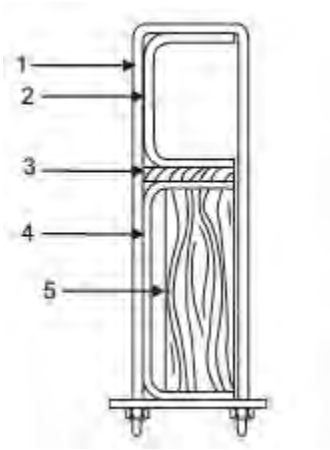


Figure 45

Generally, the frames of Autocar trucks are adequate to handle bodies with uniformly distributed loads, provided the Gross Vehicle Weight Rating (GVWR) of the truck is not exceeded. Bodies or equipment imposing spot loads or other torsional loads require reinforcement of the truck frame. When using U-bolts, it is recommended that a spacer be installed on the inside of the truck frame to prevent the flanges from collapsing when the U-bolts are tightened. The spacers can be fabricated from steel or made of hardwood blocks. The U-bolts must be located to prevent chafing of the inside edge of the frame flanges. A mounting sill of wood, rubber or other suitable material must be installed between the body and frame to protect the top surface of the frame flange *(see Figure 46 and Figure 47)*.

⚠ NOTICE

Damage to frame rails caused by improper installation of bodies and equipment is not covered by warranty.



1 –U-bolt

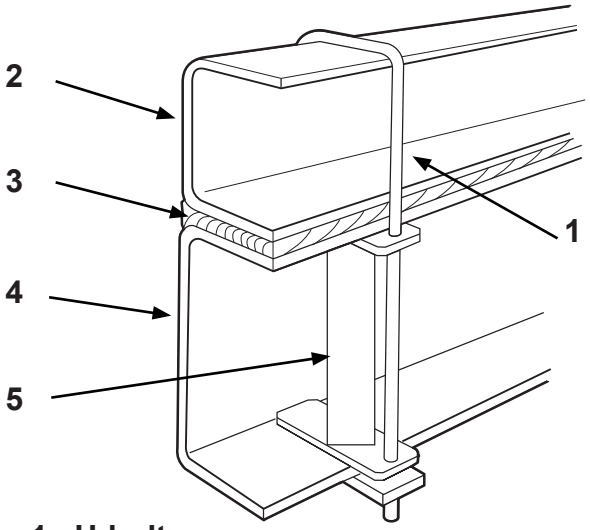
2 –Body Longitudinal

3 –Wood Sill

4 – Truck Frame

5 –Wood Spacer

Figure 46



1 –U-bolt

2 – Body Longitudinal

3 –Wood Sill

4 – Truck Frame

5 – Fabricated Steel Spacer

Figure 47

Tank Bodies and Other Torsionally Rigid Bodies

Care must be taken when installing tank bodies or other torsionally stiff bodies to permit normal movement of the chassis in relation to the body. If this is not done, stresses can develop in the frame or body which could result in damage to the frame or body. In particular, the area of the frame just behind the cab experiences most of this movement and it is this area that must be taken into consideration when mounting the body *(see Figure 48)*.

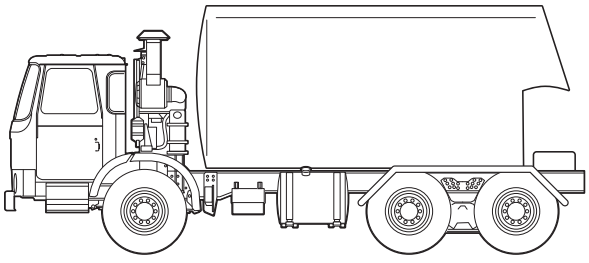


Figure 48

There are two different tank-mounting procedures commonly used today. The first is to mount the tank to the chassis with rubber-cushioned mounts, usually three or more per side, that allow vertical movement of about 6.35 mm (1/4 in.) *(see Figure 49)*. The attachments must allow movement up and down.

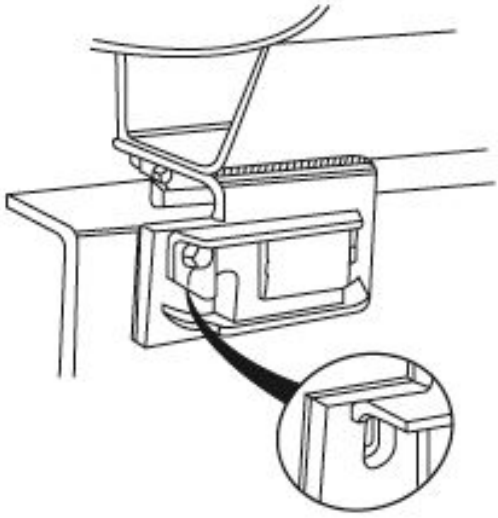


Figure 49

The rubber mounts must be located as close as possible to the front and rear axle spring brackets of the truck to utilize the bearing capacity of the frame and reduce the bending moment imposed by the body. Two or three rubber mounts per side must be used on 2-axle trucks, and four mounts per side must be used on 3-axle trucks.

The second method used to mount tank bodies is to mount the longitudinal member of the body to the frame with U-bolts or similar clamping attachments *(see Figure 50)*. When this is done, care must be taken to allow normal frame movement behind the cab. This is done by using a spring-loaded attachment at the first mounting point behind the cab. The mounting sill should also be tapered 6.35 mm (1/4 in.) for the first 304.80 mm (12 in) to allow upward movement of the frame *(see Figure 50)*.

Figure 50

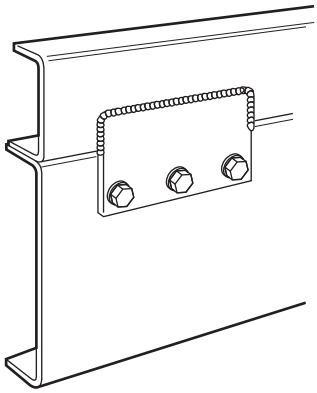


Figure 52

Refuse Bodies

Refuse bodies are torsionally stiff and must be mounted to allow normal movement of the frame behind the cab. This can be accomplished by using the spring-loaded attachment and tapered wood sill *(see Figure 51)* or by similar methods. The center and rear attachments can be rigid types *(see Figure 52 and Figure 53).*

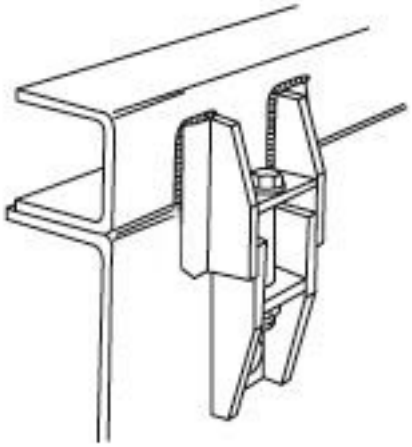


Figure 53

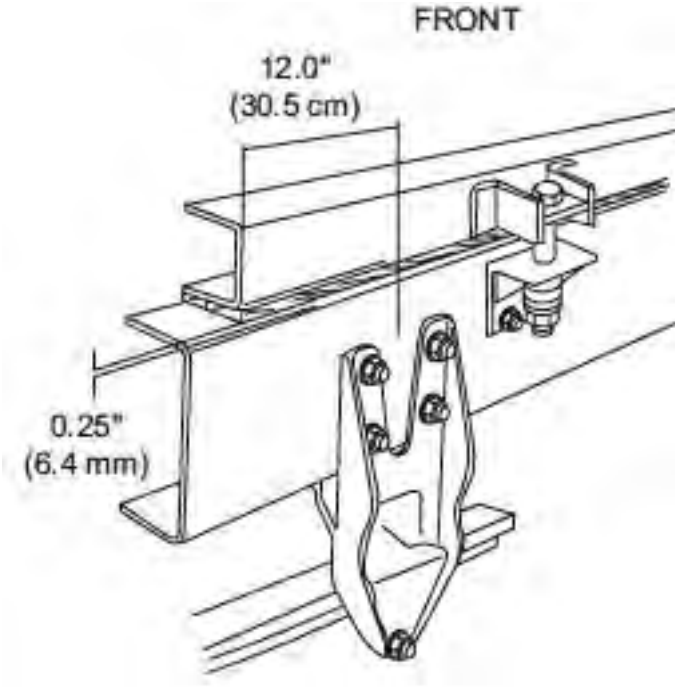


Figure 51

Tilting Bodies, Concrete Mixers and Agitators

Tilting bodies (dump bodies, tilting flatbeds or other tilting bodies) can exert forces on the truck frame in both a uniformly distributed manner and as spot loads when they are dumping. Concrete mixers and agitators normally exert spot loads on the chassis where the front and rear pedestals are attached. In either case the intermediate and/or final stage manufacturer must determine if the stresses in the frame caused by the body require additional reinforcement of the frame either by addition of a subframe or by some other means.

Tilting bodies are normally mounted by bolting or welding the rear hinge assembly of the body to the end of the truck frame or to the rear of a subframe. In severe applications or when the rear axle capacity (including auxiliary axle, if installed) exceeds 44,000 lbs, the intermediate and/or final stage manufacturer must determine if it is necessary to install a subframe with diagonal bracing at the rear to handle transverse forces caused when dumping on inclined surfaces. This type of mounting will greatly improve the stability of the truck when dumping.

When tilting bodies are installed without a subframe, the upper flange of the frame must be protected by a mounting sill of wood, steel, rubber or other suitable material. Guides must also be installed along the chassis to keep the body centered on the frame when in the "DOWN" position. When subframes are used, a mounting sill is not required. If possible, the rear crossmember should not be omitted when shortening the rear overhang for body installation. In the case of a tilting body, this crossmember must be mounted as close to the hinge point as possible.

⚠ NOTICE

See Figure 54 below as an example of recommended subframe bracing for severe off-highway dump applications or for trucks with rear axle capacities greater than 44,000 lbs.

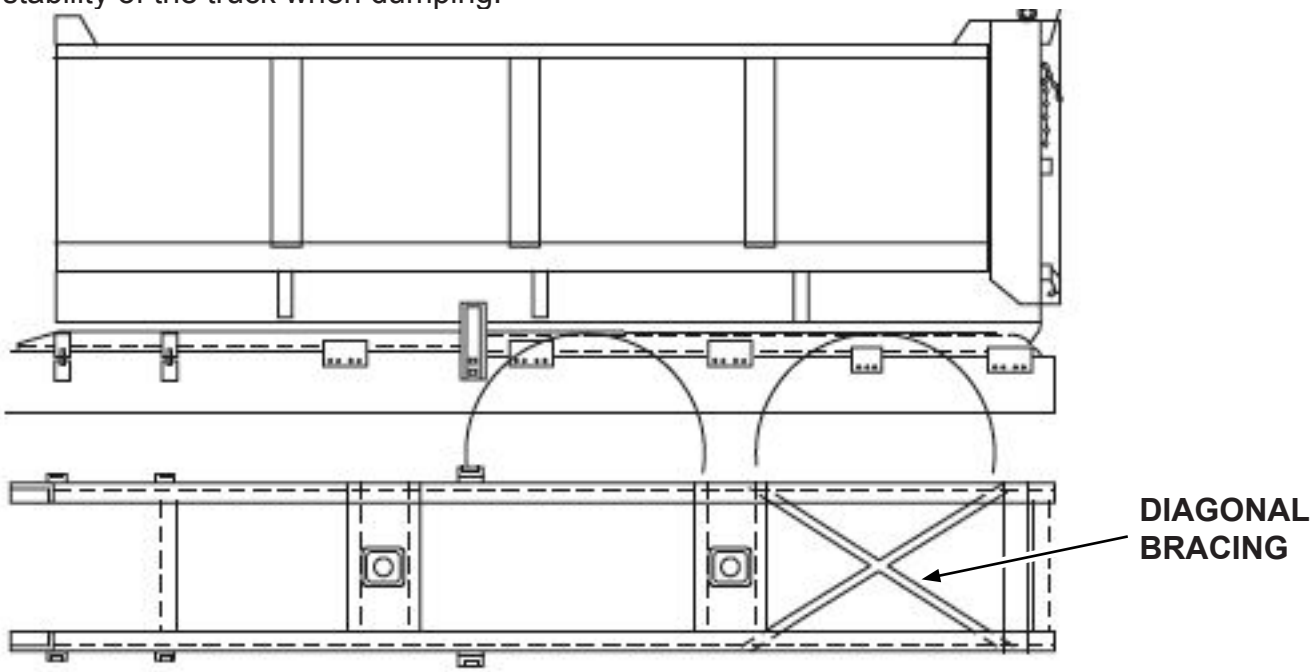


Figure 54

Cranes

In most cases, the installation of a crane will require some type of frame reinforcement *(see Figure 55)*. Before mounting any crane, you must consult the manufacturer's crane specifications and recommended chassis specifications to determine if any reinforcement is required, and, if so, what kind. In most cases, the crane manufacturers are familiar with the calculations used to determine the type and size of reinforcement required for an application. Inquiries may also be directed to Autocar Engineering at 877-973-3486.

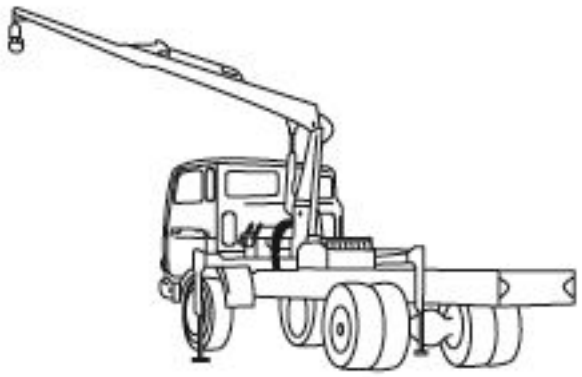


Figure 55

Figure 56, Figure 57, Figure 58 and Figure 59 show possible frame reinforcements for different types of cranes and truck chassis. If U-bolts or other clamping devices are used, they must not cause deformation of the frame flanges or web. The ends of the reinforcements should be tapered as shown and should extend at least 254 mm (10 in.) in front of a crane mounted behind the cab. The length of the reinforcement is determined by the magnitude of the bending moment imposed by the crane. In many cases, the crane is mounted together with a flatbed or other body. When this occurs, it is possible to extend the longitudinal members of the body to act as a subframe for the crane, providing subframe-attaching methods are used.

In cases where frame reinforcements are not required, the upper flange of the frame must be protected by a wear plate. The flat-bars or angle-iron would serve this purpose *(see Figure 56, Figure 57, Figure 58 and Figure 59).*

Subframe

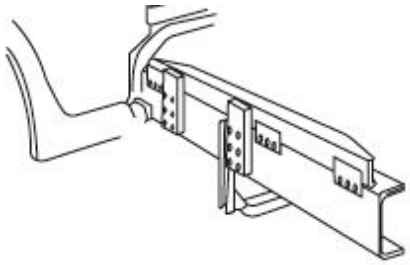


Figure 56

Inverted "L"

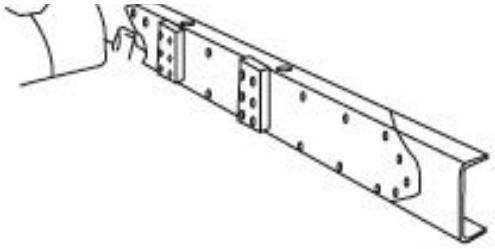


Figure 57

Inverted "L" with Flat Bar

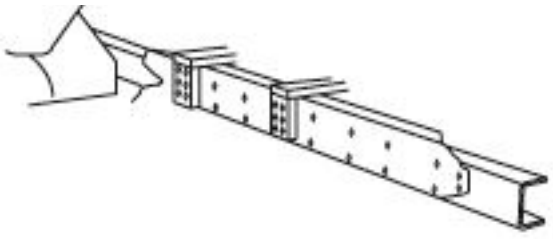


Figure 58

Angle Wear Plate

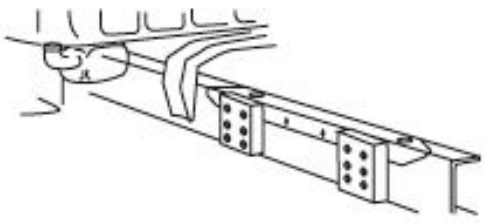


Figure 59

Rear-mounted cranes, such as those used in the logging and building materials industries, are normally installed with a subframe that is an integral part of the body. The crane must be rigidly attached to the rear of the frame and subframe. The subframe must be installed with rigid mountings at the center and rear end. The front mounts must permit longitudinal movement between the frame and subframe.

Rear Bumpers and Towing Hitches

When required, rear bumpers and towing hitches can be fabricated and installed on Autocar trucks, provided the rated GVWR of the truck is not exceeded. Figure 60, Figure 61 and Figure 62 show examples of rear crossmembers that can be used for towing hitches. The crossmember and hitch must be carefully designed to handle the train weight involved. Rear towing members must be bolted in place, not welded. Underslung towing members can be web or flange-mounted as shown. There must always be a rear crossmember in the truck frame.

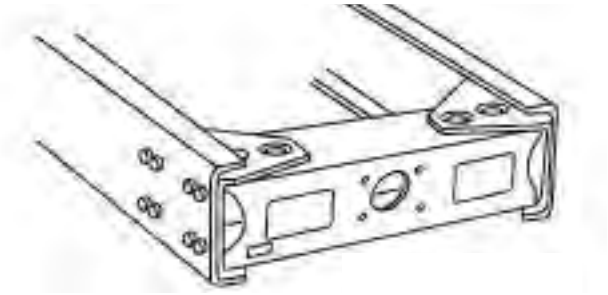


Figure 60

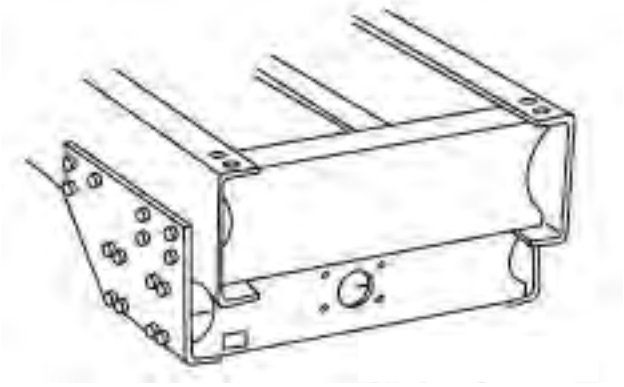


Figure 61

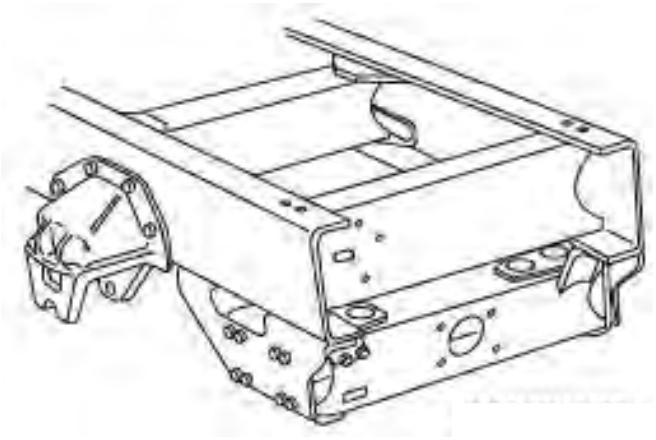


Figure 62

Rear steps and bumpers can be flanged or web-mounted as shown in Figure 63 and Figure 64. Bolting is preferred, however, since the loadings imposed are relatively small, steps and bumpers can be welded to the rear of the frame if desired.

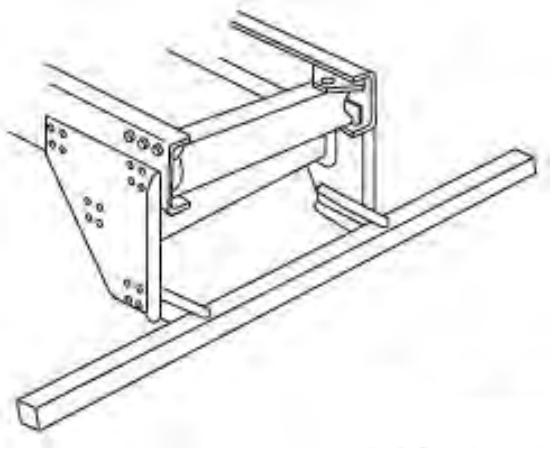


Figure 63

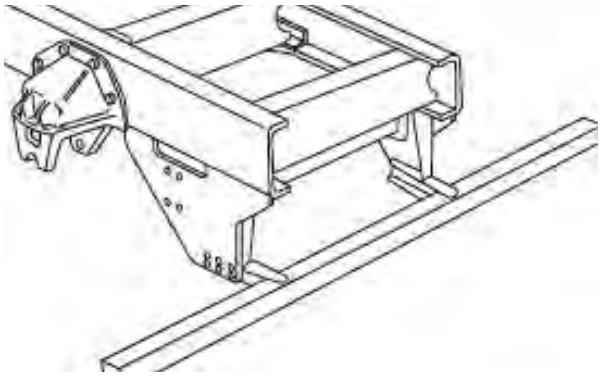


Figure 64

Front Bumper Mountings

Consult Autocar Engineering at 877-973-3486 prior to mounting hose reels or other objects to the front bumper/crossmember as a heavy duty front end option may be required. Front end loader cradles for the arms are acceptable if the arm travel is restricted by hydraulic controls and not the cradles.

Auxiliary Axle Installation

Tag or pusher axles can only be installed on trucks with proper frame reinforcement to accommodate the expected axle loads imposed with a full load and the tag or pusher axle raised.

The tag or pusher axle installation should be done according to the instructions furnished by the axle manufacturer, providing that these instructions do not violate any recommendations made elsewhere in this Manual. If there is a contradiction between the axle manufacturer's instructions and this Manual, call Autocar Engineering at 877-973-3486.

Note: *Additional air capacity must be provided in accordance with axle manufacturer recommendations.*

The tag or pusher axle should be checked to ensure that when installed it is parallel to the drive axle. Welding of any suspension component, crossmembers or other components to the chassis frame rails is forbidden.

Brake System

Autocar chassis are equipped with FMVSS-121 air brake systems. The installation of tag or pusher axles must be done in such a way to ensure compliance with FMVSS-121. Criteria that must be met include, but are not limited to, the following:

- Reservoirs must meet FMVSS-121 requirements.
- Brakes must meet the actuation and release times of FMVSS-121.
- Foundation brakes must meet FMVSS-121 dynamometer requirements.
- Compressor capacity must meet FMVSS-121 requirements.
- Service, emergency and parking brake capabilities must meet FMVSS-121 requirements.
- Anti-lock braking system must meet FMVSS-121 requirements.

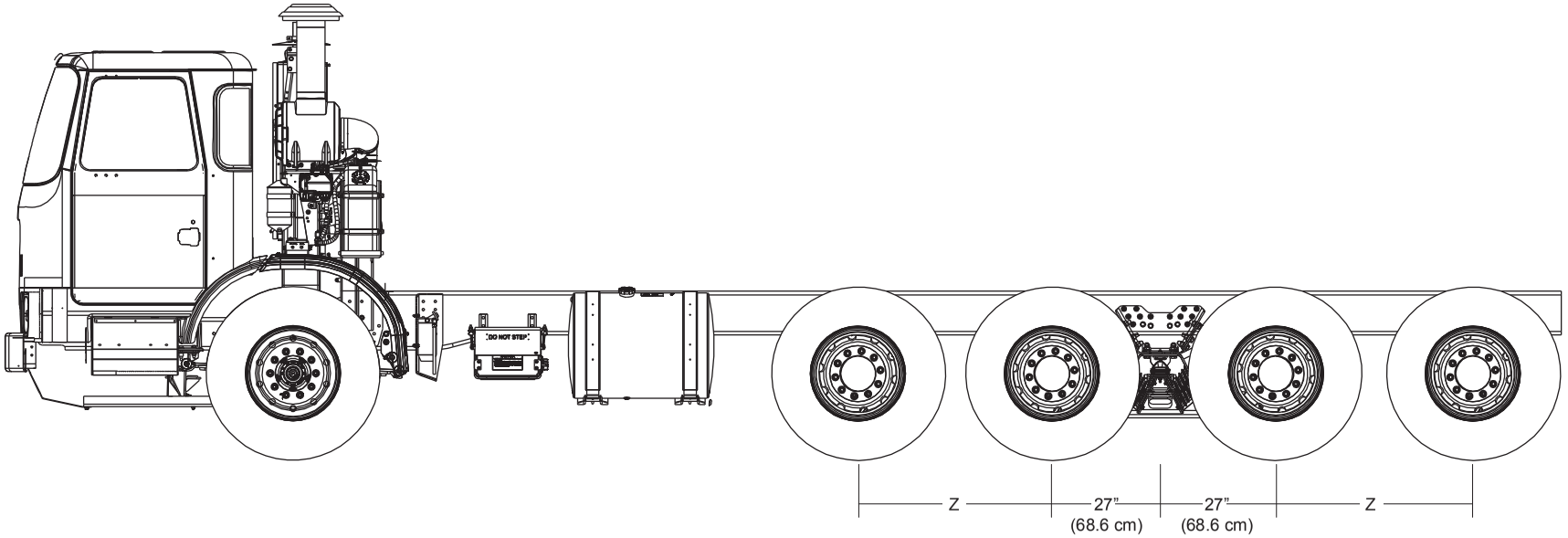
Connection of the tag or pusher axle's brake system to the truck brake system should be done according to the following recommendations:

- Use an additional relay valve for the tag or pusher axle brake circuit. Relay valve should have its own dedicated, protected supply circuit. Do not splice into existing brake circuit supply or delivery lines.
- Connect the added reservoir (if needed to ensure compliance to the above reservoir volume requirement) to secondary air system.
- Connect the signal line for the added axle relay valve to the "T" signal line from the front modulator valves.
- Pressure protect the added axle lift and load bag circuits from the rest of the secondary system.
- Refer the chassis schematics in the Air System Section of this Manual.

Tire and Wheel Equipment

Tires, rims, wheels, hubs and associated equipment must be chosen to handle the intended loading of the axle. The manufacturer's ratings of these components must be used in calculating the GVWR for certification.

Auxiliary Axle Spacing



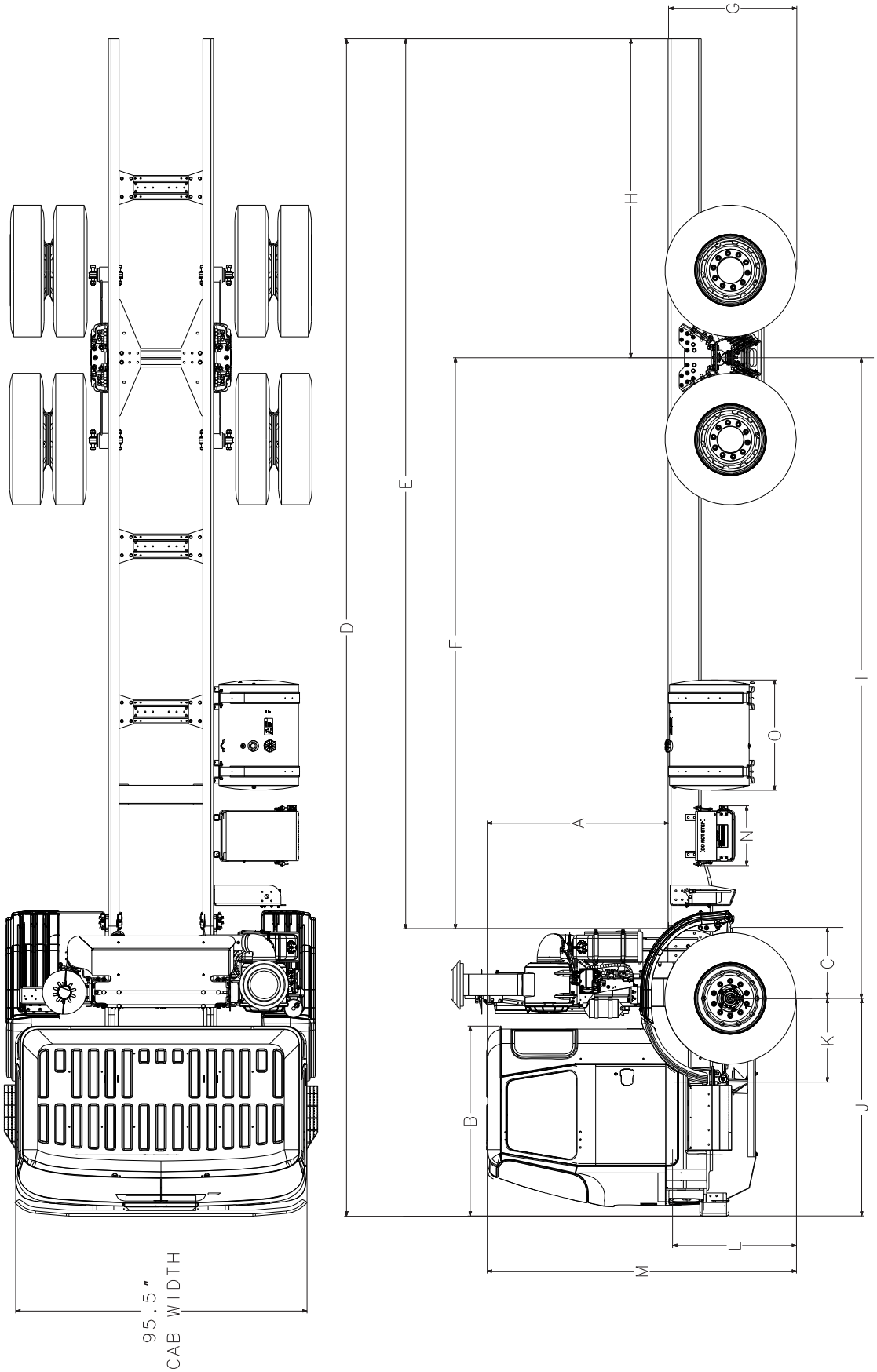
(Diagram Shows a 54 in. Rear Axle Spacing)

Figure 65

Auxiliary Axle Spacing

Sales Code	Z
335T048	48.00
335T049	49.00
335T050	50.00
335T051	51.00
355T052	52.00
335T053	53.00
335T054	54.00
335T000	Customer Specific*

**All dimensions must be specified as inch increments per layout.*



This Chassis Diagram Shows a 53.5 in. Front Axle Position (FAP), a 209 in. Wheel Base (WB), And a 104 in. Overhang (OH).

Figure 66

ACX Truck Dimensions

Description		Dimensions (in)	
		ACX42 & ACX64 Front Spring Susp	ACX64 & ACX84 Front Air Susp
A	Cab Height	59.30	64.90
B	Bumper To Back Of Cab	62.00	62.00
C	FAP to Effective Back Of Cab*	23.00	23.00
D	Overall Length	384.00	485.00
E	Effective Cab To End Of Frame	290.50	391.50
F	Effective Cab To Rear Axle	186.50	287.50
G	Unladen Frame Height	TABLE A	TABLE A
H	Overhang	104.00	104.00
I	Wheelbase	209.00	310.00
J	Bumper To Front Axle Centerline*	71.00	71.00
K	Driver Center Of Gravity*	25.80	25.80
L	Floor Height	TABLE C	TABLE B
M	Ground To Top Of Cab	TABLE C	TABLE B
N	Battery Box Width	TABLE D	TABLE D
O	Fuel Tank Length	TABLE E	TABLE E

**Denotes a 53.5 in. Front Axle Position (FAP).*
These dimensions will change ± 1 in. for chassis with a 52.5 in. Front Axle Position (FAP).

See Figure 66

Table A – Rear Frame Height
(ACX64 and ACX84 W/Front Air Suspension)

Description	Sales Code	Loaded (in)*	Light (in)*
11 Leaf 25,000 lbs.	350-005	35.01	38.19
11 Leaf w/Helper 31,500 lbs.	350-006	35.01	38.19
Reyco 102CC 31,000 lbs.	350-338	41.11	42.26
Hendrickson PAX-230 23,000 lbs.	350-0009	40.26	40.26
Hendrickson PAX-460 46,000 lbs.	350-0008	40.26	40.26
Hendrickson HMX-400 40,000 lbs.	350-0003	39.01	40.01
Hendrickson HMX-460 46,000 lbs.	350-0004	39.01	40.01
Hendrickson HN-522	350-0001	39.01	40.01
Hendrickson RT650 65,000 lbs.	350-257	44.13	45.13
Hendrickson RT460 46,000 lbs.	350-247	43.32	44.26
Chalmers 860-70 70,000 lbs.	350-0011	45.03	47.83

**Heights based on 11R22.5 16-ply Continental HDR1 (formerly HDL).*

Table B – Cab Floor Height and Ground to Roof Height

Axle	Spring	Cab Floor Height L				Ground To Roof Height L			
		ACX42 & ACX64 Front Spring Susp	ACX64* Front Air Susp	ACX84* Front Air Susp	ACX84** Front Air Susp	ACX42 & ACX64 Front Spring Susp	ACX64* Front Air Susp	ACX84* Front Air Susp	ACX84** Front Air Susp
MFS 20	20K Hendrickson Single Front Air Susp		42.79				102.59		
MFS 20 DUAL AXLE	40K Hendrickson Parasteer, 7.5 in. Ride Height			42.79	43.39			102.59	103.19
MFS 20 DUAL AXLE	40K Hendrickson Parasteer, 9.5 in. Ride Height			44.79	45.39			104.59	105.19

* *Dimensions shown are expressed in inches. Dimensions are based on 11R22.5 16-ply Continental HDR1 (formerly HDL).*

** *Dimensions shown are expressed in inches. Dimensions are based on 315/80R22.5 20-ply Continental HSU and Accuride 22.5 in. x 9.0 in. steel disc wheels.*

Table C – Cab Floor Height and Ground to Roof Height

Axle	Springs	Cab Floor Height *	Ground to Roof Height *
MFS 12	12,500 lbs. Flat Leaf	40.90	100.70
MFS 14	12,500 lbs. Flat Leaf	40.90	100.70
	14,500 lbs. Flat Leaf	41.27	101.07
	16,500 lbs. Flat Leaf	41.27	101.07
MFS 16	12,500 lbs. Flat Leaf	40.90	100.70
	14,500 lbs. Flat Leaf	41.27	101.07
	16,500 lbs. Flat Leaf	41.27	101.07
	20,800 lbs. Flat Leaf	41.02	100.82
MFS 18	16,500 lbs. Flat Leaf	40.27	101.07
	18,800 lbs. Flat Leaf	40.87	100.67
	20,800 lbs. Flat Leaf	41.02	100.82
	20,800 lbs. Low Camber Flat Leaf	41.00	100.80
	22,000 lbs. Flat Leaf	40.91	100.71
MFS 20	18,800 lbs. Flat Leaf	40.87	100.67
	20,800 lbs. Flat Leaf	41.02	100.82
	20,800 lbs. Low Camber Flat Leaf	41.00	100.80
	22,000 lbs. Flat Leaf	40.91	100.71
	22,000 lbs. Taper Leaf	40.91	100.71
DANA D-2200W	22,000 lbs. Taper Leaf **	39.45	99.25

* *Dimensions shown are expressed in inches. With 315/80R22.5 20-ply Continental and HSU and Accuride 22.5 in. x 9.0 in. steel disc wheels.*

** *Dimensions shown are expressed in inches. With Stand-up Cab and 315/80R22.5 L Continental and HSU and Accuride 22.5 in. x 9.0 in. wheels.*

Table D – Battery Box Dimensions

Sales Code	Sales Code	Width (in) N*	Length (in) N*
812-0001	Lh Painted Steel, 4 Batt Cap.	20.00	32.50
812-0002	Rh Painted Steel, 4 Batt Cap.	20.00	32.50
812-0003	Rh Mtd Parallel to Frame, 3 Batt Capacity	54.00	10.00
812-0004	Lh Mtd Parallel to Frame, 3 Batt Capacity	54.00	10.00
812-0005	Steel Box, 3 Battery, Lhs	20.00	25.50
812-0006	Steel Box, 3 Battery, Rhs	20.00	25.50
812-0007	Steel Box w/ Alum Lid, 3 Battery, Lhs	20.00	25.50
812-0008	Steel Box w/ Alum Lid, 3 Battery, Rhs	20.00	25.50
812-0009	Steel Box w/ Alum Lid, 4 Battery, L	20.00	32.50
812-0010	Steel Box w/ Alum Lid, 4 Battery, Rhs	20.00	32.50
812-063	Rh Mtd Parallel to Frame, 4 Batt Capacity	67.00	10.00
812-0012	City of Chicago Box, 4 Battery Capacity	32.00	20.00

* *"N" is the total installed battery box envelope including battery disconnect switch.*

Table E – Fuel Tanks

Capacity (gal)	Diameter (in)	Material	Thickness (in)	J-Brkt Qty.	Tank Weight (lbs)	J-Brkt Weight (lbs)	Install Weight (lbs)	Length (in)
45	22	Alum	0.125	2	34	20	74	30
45	22	Steel	0.105	2	84	20	124	30
45	26	Alum	0.125	2	36	20	76	24
45	26	Steel	0.105	2	89	20	129	24
75	26	Alum	0.125	2	48	20	88	36
75	26	Steel	0.105	2	118	20	158	36
85	22	Alum	0.125	3	57	20	117	58
85	22	Steel	0.105	3	141	20	201	58
100	22	Alum	0.125	3	64	20	124	67
100	22	Steel	0.105	3	160	20	220	67
100	26	Alum	0.125	2	57	20	97	46
100	26	Steel	0.105	2	143	20	183	46

Cab Measurements

Measurement Specifics*	Location	ACX (in)
Back of seat to front of dashboard	Bottom of dashboard	33.25
	Top of dashboard	38.50
Rear window to windshield	At centerline	54.25
	In front of driver	52.50
Floor to bottom of steering wheel		29.50
Floor to top of cab		59.00
Door to door inside	To side window glass	90.50
	To side upholstery	83.75
Rear window opening		57x14.25
Total square inches of glass**		5076

* *All measurements in this table are subject to slight variations from vehicle to vehicle.*

** *The dimensions shown under "Total square inches of glass" do not include measurements from models equipped with the lower cab door mounted visibility windows.*

Frame Widths for ACX Drop Frame

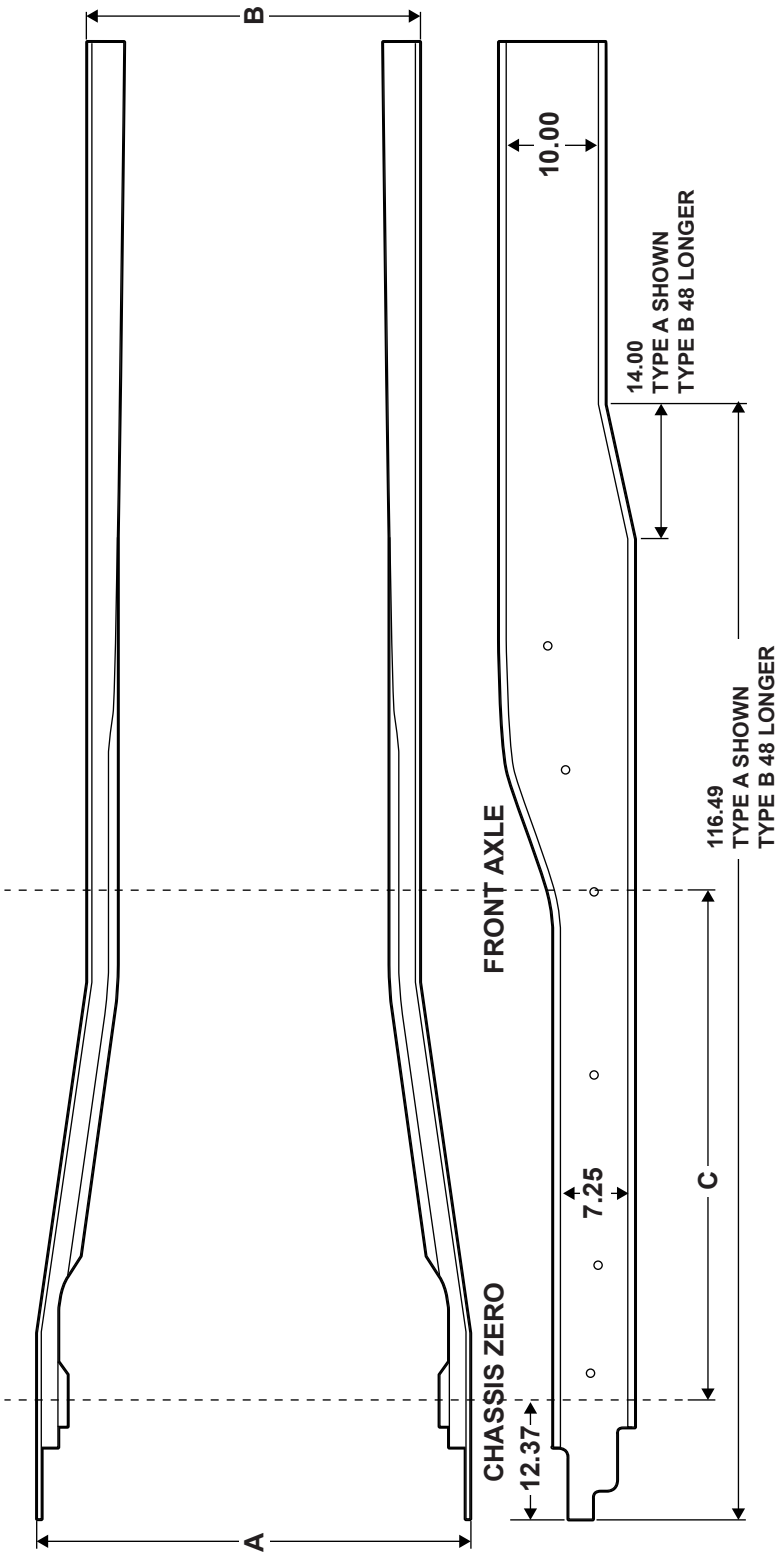


Figure 67

Frame Widths for ACX Dimension Chart

Main Frame Rail Size	Inner Reinf.	Section Modulus Main	Section Modulus Rear	RBM Main	RMB Rear	A (in)	A mm	B (in)	B mm	C (in)	C mm	WEIGHT /FOOT OF RAIL* lbs	WEIGHT /FOOT OF RAIL* kg
10.76 x 3.50 x 0.375	None	29.41	18.96	3,529,000	2,275,000	44.37	1,127	34.37	873.00	52.5/53.5	1,333.5 / 1,358.9	43.2	19.6
10.76 x 3.50 x 0.375	.25 x 10	35.17	28.92	4,220,000	3,470,000	44.37	1,127	34.37	873.00	52.5/53.5	1,333.5 / 1,358.9	69.6	31.6

Dimensions shown are expressed in inches.

***** *Divide by 2 for weight per foot of frame for each individual rail (main section).*

Notes

ELECTRICAL SYSTEM

General Information

NOTICE

Wires 406 and 407 carry the high-speed communications between the electronic systems in the vehicle. Wire 408 is an uninsulated wire that wraps around 406 and 407. It absorbs RFI that is produced from the communication circuits 406 and 407.

Two termination resistors are used on all Autocar products. They each have a resistance value of 120 ohms. The second resistor is located in the Autocar harness near the engine ECM. These two resistors are in parallel, so the total resistance value measured across the Data Link should be 60 Ohms.

NOTICE

Vehicles with electronically controlled engines use the J1939 Control Link.

Follow the same guidelines and precautions for the J1939/J1922 Control Link wiring. No connections may be made to wires 406 (yellow), 407 (green) and 408 (shield). These circuits are used for control of the vehicle. Accelerator pedal, engine brake\ and traction control are examples of functions controlled by these circuits.

NOTICE

All wiring connections to components of the factory-installed system must be accomplished by using the proper mating wire termination (connections on studs and ground connections must use eyelet terminations, connections to female bullets must terminate in male bullets, etc).

CAUTION

Do not modify or make connections to wires 406 (yellow), 407 (green) or 408 (shield). Any modifications, connections, or damage to these wires can result in the failure of the vehicle's electronic systems.

Warning

Devices that emit radio frequency (RF) energy, such as AM/FM radios, mobile communication systems (two-way radios, telephones) and radio-controlled security systems, are subject to the rules and regulations of the Federal Communications Commission (FCC) 47 C.F.R. Parts 2 and 15. Any such system installed in your vehicle should comply with those rules and should be installed only by a qualified technician.

Mobile communication systems, specifically systems not designed for automotive use, or not properly installed, may adversely affect the operation of the vehicle. For example, such systems, when operated, may cause the engine to stumble or stall. In addition, such systems may themselves be damaged or their operations electrical system affected by the operation of the vehicle. Citizens Band (CB) transceivers, garage door openers and other transmitters which have power output of 5 watts or less, ordinarily will NOT affect vehicle operation.

Because Autocar has no control over the design or manufacture of such systems or their installation, Autocar cannot assume responsibility for any such adverse effects or damage.

Repair and Splicing

DO NOT splice electronic circuits such as the speedometer, tachometer, coolant levels, etc. In all cases, replace the damaged wire. If this is not possible, solder the wires and use heat shrink tubing over the splice. Do not use mechanical

type splice joints (such as butt-end splices or wire nuts). Should splicing be necessary, follow these guidelines:

- The end of the wire should be stripped and the ends inspected to be sure that the wire strands are in good condition.
- Solder the wire ends together with a Rosin core solder (DO NOT USE acid core).
- The joint should be a solid mechanical joint before the solder is applied.
- The use of heat-shrink tubing is recommended for covering crimp joints, splicing and metal barrel type joints.
- All joints must be sealed and adequately insulated.
- Heat the splice connector to activate the heat shrink. Look for sealant at each end of the connector as evidence of a good application. Do not use an open flame to apply heat shrink.
- Be sure that all joints are free of sharp edges that may work through the insulation.

Routing and Clipping

A truck chassis must sometimes undergo a great amount of rework to suit various body applications. In such cases, welding and movement of components may be necessary. With this in mind, removal of wiring and wiring hazards must be done prior to the rework operation and reinstalled when the work is completed. However, if this is not practical, the electrical wires, harnesses, and components must be shielded from the rework and welding process. When finished, all wiring and components must be re-installed as closely as possible to how they were before removal.

Avoid routing of wire through areas which are exposed to wheel splash or other such exposed areas. When this is not possible, adequate protection of the wire must be provided by way of shielding and proper clipping procedures in order to avoid damage from ice, stones and other road debris. In addition, to the above, any routing of wires and harness assembly under the frame side members (or frame flange) should be discouraged. Damage to wires, etc., from miscellaneous off-road material can be very severe and dangerous.

All wires should be routed through the holes provided in sheet metal, castings and frame brackets. These holes should always be provided with some sort of protective material—such as nylon conduit, grommets, etc. Clearance of at least 76.1 mm (3 in.) should be provided for wire routing near any moving parts. These wires should be secured tightly and covered with conduit.

Any wire connected to circuit components such as switches and relays (in exposed locations) must be provided with a drip loop to prevent moisture from running down the wire to the device.

When wiring is routed between two parts that may experience movement, the wiring should be secured to each part with enough slack to allow the wire to flex. In all cases, avoid routing wire close sharp edges, screws, fasteners, etc. If this cannot be avoided, various types of protective devices should be used (these can include conduit, shields, caps, grommets, etc.). Wire should never pass through or over a metal edge without a protective shield and fastener within 76.1 mm to 127 mm (3 in. to 5 in.) on each side of the edge. Avoid areas where temperature exceeds +180F (+83C). In areas around the exhaust system, wire should be routed and fastened no closer than 150 mm (6 in.). In addition, high temperature type insulation should be installed.

All wiring tie downs, grommets and retainers on chassis are designed and fitted for material installed by Autocar. Any new or additional wires and harness assemblies require additional tie downs or fasteners. Do not force additional wire through factory-installed tie downs, etc.

Routing/Clipping Guidelines

- Electrical cables cannot be bundled with fuel or hydraulic lines. However, they may be routed parallel but separate, provided they are routed above the fuel or hydraulic lines.
- Excess cable must fold back *(see Figure 68).*
- Minimum bend radii of electrical cables is 1.5 times the cable diameter.
- Electrical cable and wiring harnesses that are protected by plastic conduit must not be bundled with coolant hoses.
- Overlay or option high current electrical cables must be routed independent of all other routings.
- Where cables must flex between moving parts, the last supporting clip must be securely mounted so that relative movement does not promote chafing.
- Clipping brackets should be designed and mounted to adequately support the bundle. Clips should be mounted in a hanging position or supported along three quarters of the horizontal mounting surface. Bundles must be supported at 457.2 mm (18 in.) maximum intervals. A cable tie may be used between clip points.
- Electrical cables or wiring harnesses that route along or through abrasive surfaces must not touch these surfaces. Additionally, there must be a protective covering suitable to withstand chafing.
- The edges of all members through which unprotected cable passes must be bushed with suitable grommets.
- Electrical cables and wiring harnesses must not support any mechanical loads other than their own mass.
- Electrical cables and wiring harnesses are prohibited from being located in areas that experience routine exposure to diesel fuel, hydraulic fluid or oil spillage (i.e. under filters, below overflow vents, etc.).

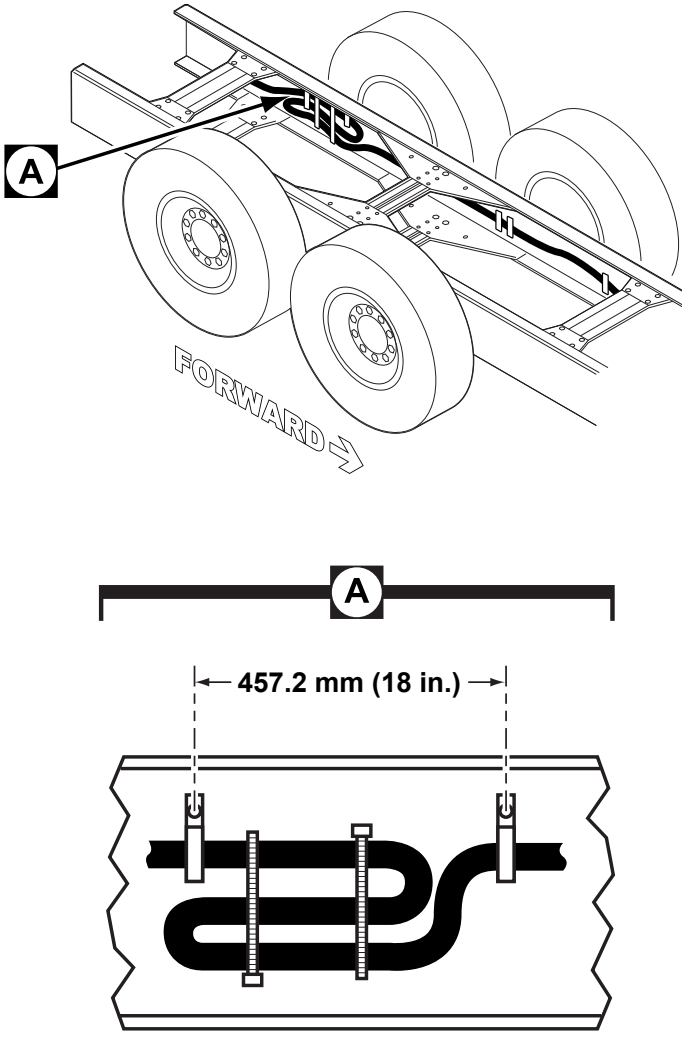


Figure 68

Circuit Protection

1. Modification to existing vehicle wiring should be done only with extreme caution and consideration of effects on the completed vehicle electrical system. Circuitry changes should be studied to ensure that adequate circuit protection will exist and that undesirable current paths are not created.
2. Any added circuitry must be protected either by a base vehicle fuse or breaker, or by a similar device provided by the body builder.
3. When adding loads to a base vehicle protected circuit, make sure that the total current draw on the base vehicle protected circuit is less than 80% of the base vehicle fuse rating or less than 100% of the base vehicle circuit breaker rating.
   - Total current draw is the sum of the base vehicle circuit current requirement (measured with an ammeter) and the add-on component's current requirements.
   - Never increase the rating of a factory installed fuse or circuit breaker.
   - If the total electrical load on the circuit (after the addition of electrical equipment) is less than 80% of the fuse or 100% of the circuit breaker protection rating in that circuit, and less than the capacity of any limiting components (switches, relays, etc.), the items to be added can be connected directly to that circuit. If the total electrical load to be imposed on a circuit exceeds the value of the circuit protection, or the value of some limiting component, the items to be added cannot be added directly to the circuit.

Circuit Protection Guidelines

The Wire Size and Fuse Selection Table (see next page) indicates the smallest recommended wire that should be used when splicing or connecting into an existing circuit. It also indicates the maximum recommended current for each fuse.

If a smaller wire is to be used, or if the circuit being spliced into is not protected by a fuse or a circuit breaker, then a fuse or circuit breaker consistent with the Wire Size and Fuse Selection Table, MUST be installed within 6 inches of the splice or connection point. Added devices should be powered from a relay if the operating current exceeds the maximum recommended current or nuisance fuse failures may occur. The operating current includes the current requirements of all devices added to the circuit, plus the current requirements of devices already serviced by the circuit.

Relays should be installed in accordance with the following:

- The existing circuit can be spliced or connected to a new wire that powers one side of the relay coil. The size and insulation of this new (relay coil) circuit MUST be selected consistent with the Wire Size and Fuse Selection Table.
- The other side of the relay coil should be connected to a good ground. Never splice or connect to an existing ground wire.
- Power for the relay can be taken from any recommended power source. The size and insulation material of the wire that powers the relay and the wire that delivers power from the relay to the added device(s) MUST be selected consistent with the Wire Size and Fuse Selection Table. Note that in most cases, the relay will be powered from a circuit that has no fuse or circuit breaker, and will therefore require a new fuse within 152.4 mm (6 in.) of the splice or connection.

- Added devices, exceeding the current capabilities of the factory installed system, are best controlled through the use of a relay or hand-on switch. The coil of the relay can be fed from the circuit in the factory harness (now acting as a signal circuit) with added wiring providing feeds to the added electrical device. The relay selection is important and depends on current requirements, number of cycles expected in the relay lifetime, whether the relay is to be operated intermittently or for long periods of time, and whether the relay is exposed to weather conditions or is installed in a protected area. When the current requirements of a circuit exceed the capacity of an available relay, more than one relay can be used if the circuit is wired to split the load.
- Added wire feeds to the switch or relay power contacts should not be tapped into basic vehicle wiring. Draw power as close to the battery as possible (i.e., the starter motor relay, etc.).

Circuit protection (fuses or circuit breakers) must be provided for all added wiring and should be installed as close to the point of tapped power as possible. The protection device rating should be greater than the combined current requirements of the add-on components: The combined current requirements should be less than 80% of the rating for a fuse and less than 100% of the rating for a circuit breaker.

Wire Size and Fuse Selection Table

Fuse or CB Rating (AMPS)	Maximum Fuse* Operating Current (AMPS)	Smallest Wire Gauge For Various Ambients				
		120 °F MAX		150 °F MAX		200 °F MAX
		PVC**	XLPE***	PVC**	XLPE***	XLPE***
10	8	18	22	16	20	18
15	12	16	18	14	18	16
20	16	14	16	12	16	14
25	20	12	14	10	14	12
30	24	10	14	8	12	10

* *Circuit breakers can be operated at currents up to the circuit breaker rating.*

** *Polyvinyl Chloride insulation (SAE J1128 GPT): Not recommended near engine.*

*** *Cross-linked Polyethylene insulation (SAE J1128 SXL): Recommended near engine.*

General Safety Guidelines

⚠ WARNING

Failure to repair a malfunction in the electrical system can result in serious damage due to vehicle fire. Always let an experienced electrical technician perform repairs. Always determine the source of the fault. Do not just treat the symptoms.

⚠ WARNING

Always wear eye protection when working around batteries to prevent the risk of injury due to an explosion or contact with sulfuric acid.

⚠ NOTICE

Electronic circuits and components are designed to sense voltage differences smaller than one volt. While static electricity is not normally dangerous to humans, it can seriously damage electronic circuits and components. Circuit boards mounted in the instrument cluster, for example, may not fail immediately after being hit with a static discharge. Rather, they may work for a while and then fail for no apparent reason. Always work with proper grounding straps and antistatic mats around electric components.

Exercise caution when working on an electrical system, charging batteries or jump-starting the engine. Attempting to work on electronic components without proper equipment can damage internal parts with static electricity. Do not work on the electric system without proper tools and training. Repair work on the electrical system must be done by trained professionals. Your authorized Autocar parts and service location has the right tools and trained technicians to handle such repairs.

Charging System

An alternator with an integrated voltage regulator is used to supply power to the vehicle electrical system. The charging system voltage should be checked periodically to prevent overcharging or undercharging the batteries, and to detect any voltage drop in the wiring. If the R terminal is used as a signal for body control function, this lead should be shielded within the cab to isolate RFI from existing circuits.

Battery Box

⚠ DANGER

When inspecting or cleaning batteries, never smoke or expose batteries (or the area around them) to sparks or flames. The battery area may contain an explosive gas mixture that can ignite causing an explosion leading to serious personal injury.

Each chassis should have 3 to 4 batteries installed. Always make sure the batteries are fastened properly in the box *(see Figure 69)*.

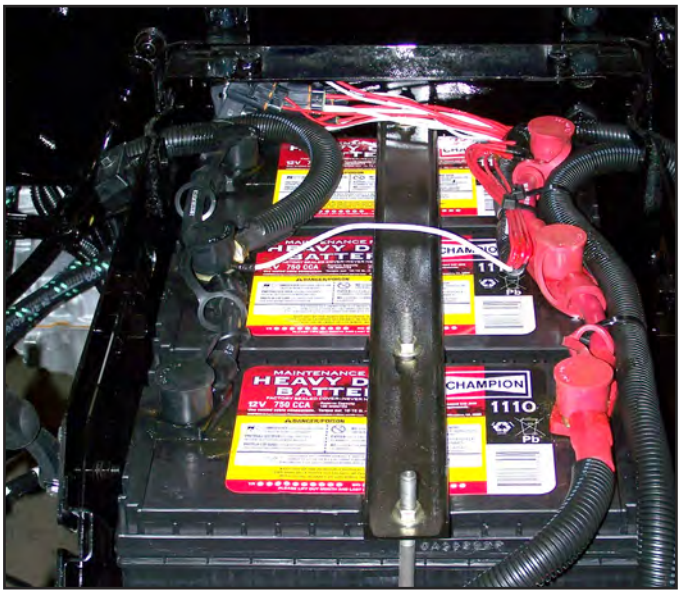


Figure 69

Body Builder Wiring

Each chassis come pre-wired with essential body builder interface circuits. Connectors ROPT, POPT1 and ROPT2 are located on the primary drive side of the center console, underneath the rear body builder panel and are labeled accordingly. Connectors POPT3, ROPT4 and ROPT5 are located on the secondary side of the center console, underneath the rear body builder panel and are labeled accordingly. There are also two chassis mounted body builder connectors for outside wiring requirements. These connectors are located by the cab to chassis "hotplate" connection point on the forward left side of the cab with an option for an extension harness to a chassis mounted body builder control box. Each body builder connection comes with the mating connector pre-installed.

The chart below references each of the body builder connections and what mating terminal is required to plug in to the existing connector.

Please note that the Allison transmission wiring functionality can differ depending on which vocational package the transmission control module is calibrated to. Please refer to your nearest Allison dealer for information on which wires will perform which functions for the selected calibration on the vehicle. All wires to the Allison transmission control module begin with the letter A1. The next two digits are the respective pin on the transmission control module and the letter extension refers to a continued chain of wires. For example, A103-C connects to Allison transmission control module pin 3 and has multiple connections to this circuit. Due to variances in wire harnesses for different applications, the letter extension at the end of the circuit may differ on your vehicle from what is listed in the chart below.

In-Cab Connectors

Note: The below list of circuit numbers are the only acceptable wires in the cab for the body builder to plug into. No other connections are allowed to be made to any other wires without written approval from Autocar (Contact Autocar Engineering at 877-973-3486).

Circuit #	Description	Location	Mating Information
0C-CA	Ground (High Current)	ROPT, Cavity A	Delphi Terminal 15304712
0C-CB	Ground (High Current)	ROPT, Cavity B	Delphi Terminal 15304712
0C-CC	Ground (Low Current)	ROPT, Cavity C	Delphi Terminal 15304711
0C-CD	Ground (Low Current)	ROPT, Cavity D	Delphi Terminal 15304711
141-LA	Backlighting	ROPT, Cavity E	Delphi Terminal 15304711
141-LB	Backlighting	ROPT, Cavity F	Delphi Terminal 15304711
141-LC	Backlighting	ROPT, Cavity G	Delphi Terminal 15304711
141-LD	Backlighting	ROPT, Cavity H	Delphi Terminal 15304711
ACC1-A	Accessory Power	ROPT, Cavity J	Delphi Terminal 15304712
ACC1-B	Accessory Power	ROPT, Cavity K	Delphi Terminal 15304712
IGN1-A	Ignition Power	ROPT, Cavity L	Delphi Terminal 15304712
IGN1-B	Ignition Power	ROPT, Cavity M	Delphi Terminal 15304712
A105	Allison Overspeed Set Point	POPT1, Cavity A	Delphi Terminal 15304723
A122	Allison Kickdown/Secondary Shift	POPT1, Cavity B	Delphi Terminal 15304723
A121	Allison ABS Response	POPT1, Cavity C	Delphi Terminal 15304723
A104	Allison Engine Brake Enable	POPT1, Cavity D	Delphi Terminal 15304723
A125-A	Vehicle Speed	POPT1, Cavity E	Delphi Terminal 15304723
A101-A	Allison Shift Select/Secondary Shift	POPT1, Cavity F	Delphi Terminal 15304723
A117-A	Allison Auto Neutral Pack Enable	POPT1, Cavity G	Delphi Terminal 15304723
A113	Allison Secondary Mode Indicator	POPT1, Cavity H	Delphi Terminal 15304723
604S-A	Secondary Drive Active (Dual Drive Only)	POPT1, Cavity J	Delphi Terminal 15304723
772-A	ABS Retarder Event	POPT1, Cavity K	Delphi Terminal 15304723

In-Cab Connectors *(continued)*

***Note:** The below list of circuit numbers are the only acceptable wires in the cab for the body builder to plug into. No other connections are allowed to be made to any other wires without written approval from Autocar (Contact Autocar Engineering at 877-973-3486).*

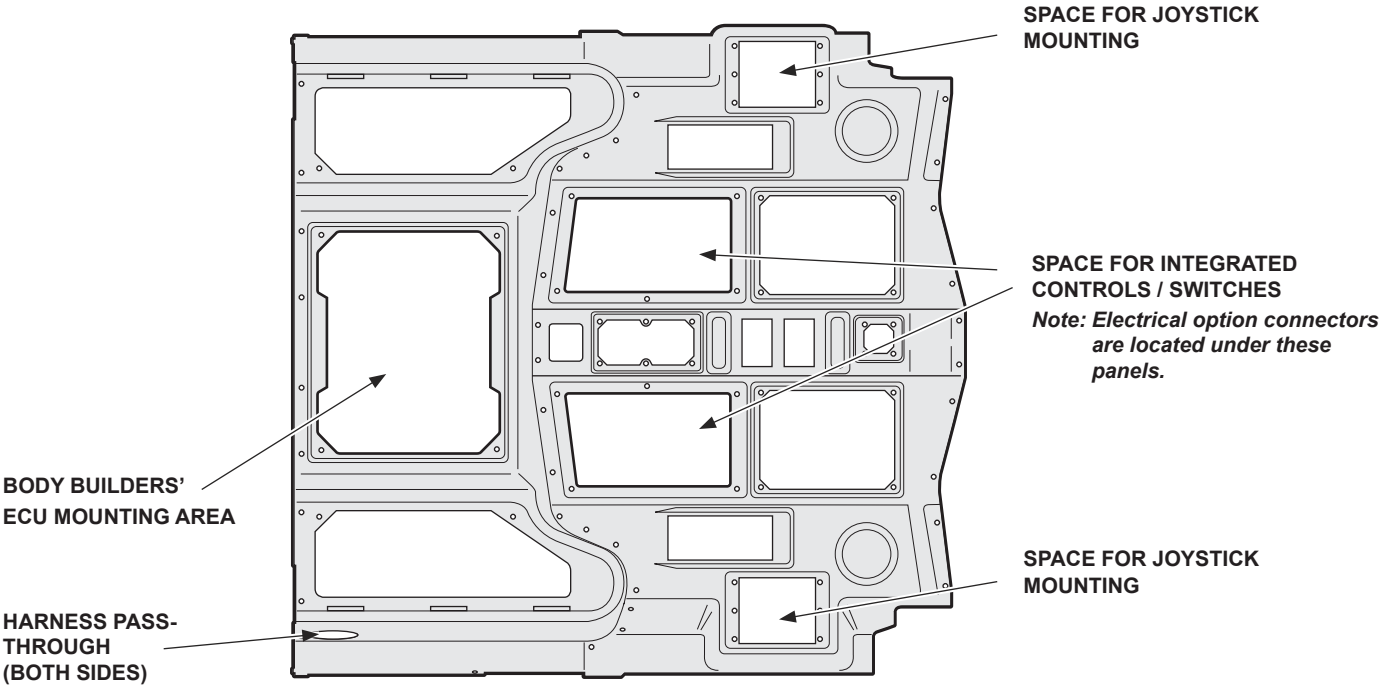
Circuit #	Description	Location	Mating Information
573-A	Remote PTO (Engine)	ROPT2, Cavity A	Delphi Terminal 15304711
A145-B	Allison PTO Enable In (to Mux system)	ROPT2, Cavity B	Delphi Terminal 15304711
960	Body Active Input (to Mux System)	ROPT2, Cavity D	Delphi Terminal 15304711
A163-C	Transmission Ignition Power	ROPT2, Cavity F	Delphi Terminal 15304711
559-M	Engine Ground	ROPT2, Cavity G	Delphi Terminal 15304711
636M-A	Throttle Limit	ROPT2, Cavity H	Delphi Terminal 15304711
A164	Transmission Sump Temp	ROPT2, Cavity J	Delphi Terminal 15304711
A103-C	Transmission Digital Ground	ROPT2, Cavity K	Delphi Terminal 15304711
A142-B	Allison Auto Neutral/Pack Input	POPT3, Cavity A	Delphi Terminal 15304723
597	PTO Enable Output (from Mux system)	POPT3, Cavity B	Delphi Terminal 15304723
A143-A	Allison PTO Enable Input (to Mux system)	POPT3, Cavity C	Delphi Terminal 15304723
A114C-A	Allison Auto Neutral Indicator Output	POPT3, Cavity D	Delphi Terminal 15304723
401-A	J1587 Negative	POPT3, Cavity E	Delphi Terminal 15304723
400-A	J1587 Positive	POPT3, Cavity F	Delphi Terminal 15304723
599-A	Reverse	POPT3, Cavity G	Delphi Terminal 15304724
19-A	Alternator R Terminal	POPT3, Cavity H	Delphi Terminal 15304723
840	Reverse	ROPT4, Cavity A	Delphi Terminal 15304712
841	Neutral	ROPT4, Cavity B	Delphi Terminal 15304712
842	Battery Power	ROPT4, Cavity C	Delphi Terminal 15304712
843	Battery Power	ROPT4, Cavity D	Delphi Terminal 15304712
844	Ignition Power	ROPT4, Cavity E	Delphi Terminal 15304712
845	Ignition Power	ROPT4, Cavity F	Delphi Terminal 15304712
0C-HC	Cab Ground	ROPT4, Cavity G	Delphi Terminal 15304712
0C-HB	Cab Ground	ROPT4, Cavity H	Delphi Terminal 15304712
0C-HA	Cab Ground	ROPT5, Cavity A	Delphi Terminal 15304712
113-C	Right Turn	ROPT5, Cavity B	Delphi Terminal 15304712
112-C	Left Turn	ROPT5, Cavity C	Delphi Terminal 15304712
53	Marker Lights	ROPT5, Cavity D	Delphi Terminal 15304712
52-C	Park Lights	ROPT5, Cavity E	Delphi Terminal 15304712
71-G	Stop Light	ROPT5, Cavity F	Delphi Terminal 15304712

Chassis Connectors

***Note:** The below list of circuit numbers are the only acceptable wires on the chassis for the body builder to plug into. No other connections are allowed to be made to any other wires without written approval from Autocar. (Contact Autocar Engineering at 877-973-3486).*

Circuit #	Description	Location	Mating Information
782	Trailer ABS Ignition Power	Body 1, Cavity A	Delphi Terminal 12064735, Seal 15324995
52-J	Tail Lamp Power	Body 1, Cavity B	Delphi Terminal 12064735, Seal 15324995
53-C	Marker Lamp Power	Body 1, Cavity C	Delphi Terminal 12064735, Seal 15324995
112	Left Turn Power	Body 2, Cavity A	Delphi Terminal 12052455, Seal 15324995
113	Right Turn Power	Body 2, Cavity B	Delphi Terminal 12052455, Seal 15324995
71	Stop Lamp Power	Body 2, Cavity C	Delphi Terminal 12052455, Seal 15324995

Body Builders Integrated Controls



Note: *Should a body builder need to pass through the cab with wiring, the preferred method is to use a bulkhead connector with a flange instead of using a hole with a grommet. Treat the hole with epoxy primer sealer after drilling.*

Figure 70

Camera Mounting and Prep Options

Autocar offers Third Eye camera prep and Intec camera prep factory installed. External cab mounted cameras should utilize existing holes and fastener locations to mount camera brackets.

Cab Monitors

The mounting bracket is located inside the overhead console and can be used for mounting monitors *(see Figure 71)*.

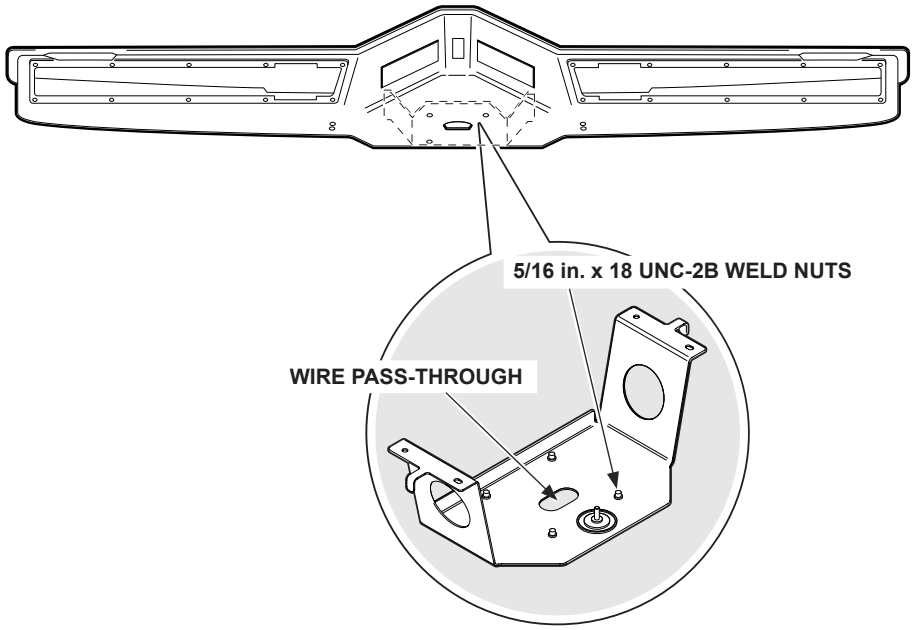


Figure 71

Monitor Connection

Note: The below list of circuit numbers are available in the overhead console for a monitor connection and may be used by the body builder. The mating connector is Delphi 15326886.

Circuit #	Description	Location	Mating Information
490-B	Accessory Power	Overhead Console: RRC, Cavity A	Delphi Terminal 15304711
492-C	Battery Power	Overhead Console: RRC, Cavity B	Delphi Terminal 15304711
0C-DD	Ground	Overhead Console: RRC, Cavity C	Delphi Terminal 15304711
599-F	Reverse Signal	Overhead Console: RRC, Cavity D	Delphi Terminal 15304711

Rear Lighting Connection

Note: The below list of circuit numbers are available at the end of the chassis for the rear lighting connection. The body builder may use these connections if the rear turn signals are not used or supplied by Autocar. The mating connector is Deutsch DT06-08S.

Circuit #	Description	Location	Mating Information
90	Park Lights	End of Frame, RRTLP, Cavity 1	Deutsch Terminal 1060-14-0122
116-B	Left Rear Turn Signal	End of Frame, RRTLP, Cavity 2	Deutsch Terminal 1060-14-0122
115-B	Right Rear Turn Signal	End of Frame, RRTLP, Cavity 3	Deutsch Terminal 1060-14-0122
412	Reverse	End of Frame, RRTLP, Cavity 4	Deutsch Terminal 1060-14-0122
0W-C	Ground	End of Frame, RRTLP, Cavity 5	Deutsch Terminal 1060-14-0122
71-E	Stop Lamps	End of Frame, RRTLP, Cavity 6	Deutsch Terminal 1060-14-0122

Circuit Number Index Chart

(for reference only)

Circuits	Circuit #
Ground	0
Primary Power	1-19
Polarity Reversing Circuits	20-29
Headlamps and Fog Lamps	30-49
Marker and Clearance Lamps	50-69
Stop Lamps	70-74
Tail and Parking Lamps	90-109
Turn Signal Lamps	110-129
Dome Lamps	130-139
Instrument Lamps	140-149
Heater. Defroster, Air Conditioner	150-179
Instruments	180-219
Cab Hoist	220-239
Ignition	240-259
Horns	260-279
Starter	280-299
Compressor Clutch	300-309
Transmission	310-329
Power Seat	330-339
Power Vent	340-349
Power Window	350-359
Starting Aids	360-369
Cigar Lighter	370-379
Windshield Wiper	380-389
Electric Fuel Pump	390-399

Circuits	Circuit #
Diagnostics and Control	400-409
Back-up Lamps	410-419
Indicator Lamps	420-459
Rear Axle	460-489
Radio	490-499
Miscellaneous Lamps	500-549
Engine Electronics	550-599
Engine Controls	600-639
Anti-lock Brake System Controls	640-679
Air Conditioning Controls	680-699
Heated Mirrors	700-709
Anti-lock Brake System Controls	730-799
Automatic Transmission (A101-A180)	800-819
VECU Wiring	820-830
Hybrid Electronics	830-839
High Current Body Builder	840-849
Camera Wiring	850-860
SCR Electronics 2010	870-899
Secondary Databus	906-908
Protected "Branch Connector" Circuit Feeds	950-959
Auxiliary Circuits	990-999

Autocar Vehicle Electronic Control Unit

All ACX 2010 vehicles are equipped with a Vehicle Electronic Control Unit (VECU). The VECU is located under the primary driver side armrest with a secondary read-only power ECU, Multiplex Vehicle Electrical Center (mVEC), located under the secondary side arm rest.

The VECU receives both hard wired inputs and J1939 data and uses that information to power hard wired outputs as well as send J1939 data out on the primary vehicle data bus. The VECU also has a secondary vehicle data bus that it uses to send data to the Multiplex Vehicle Electrical Center (mVEC) as well as body mounted controllers.

Each VECU has several input and output pins that are standard in every vehicle as well as several that are programmed specifically for different vehicle options. It is not possible to exchange one VECU for another from another vehicle unless it can be verified that they are of the exact same logic revision level.

The VECU has two connectors that are color coded and keyed differently to ensure proper installation. The following charts *(on page 73 and 74)* details each pin function.

VECU Pin Function Chart – Black

VECU Black Connector			
Pin	Wire	Function	Usage
1	30S-C	Secondary Headlight Output 1	Standard
2	820A-A	VECU Battery Feed	Standard
3	820A-B	VECU Battery Feed	Standard
4	820A-C	VECU Battery Feed	Standard
5	820A-D	VECU Battery Feed	Standard
6	820A-E	VECU Battery Feed	Standard
7	553-C	Primary Accelerator Signal	Standard
8	113-J	Right Turn Input	Standard
9	112-J	Left Turn Input	Standard
10	71-H	Stop Lamp Input	Standard
11	IGNA-A	Ignition power (System Wake Up)	Standard
12	N/A	Spare	Option
13	30S-D	Secondary Headlight Output 2	Standard
14	0Y-L	VECU Ground Feed	Standard
15	0Y-H	VECU Ground Feed	Standard
16	0Y-J	VECU Ground Feed	Standard
17	0Y-R	VECU Ground Feed	Standard
18	553-B	Secondary Accelerator Signal	Option
19	555-C	Secondary Accelerator Idle Signal	Option
20	960	Body Builder Input	Standard
21	N/A	Spare	Option
22	92-A	Park Light Input	Standard
23	408-A	Primary J1939 Ground Pin	Standard
24	30P-A	Primary Headlight Output 1	Standard
25	30P-B	Primary Headlight Output 2	Standard
26	30P-C	Primary Headlight Output 3	Standard
27	30P-D	Primary Headlight Output 4	Standard
28	552	5 Volt Sensor Supply	Standard
29	N/A	No Use	N/A
30	N/A	No Use	N/A
31	555-B	Primary Accelerator Idle Signal	Standard
32	287	Keyswitch	Standard
33	407-P	Primary J1939 Negative Pin	Standard
34	406-P	Primary J1939 Positive Pin	Standard
35	116C	Left Rear Turn Output	Standard

VECU Pin Function Chart – White

VECU White Connector			
Pin	Wire	Function	Usage
1	A113	Secondary Mode Indicator	Standard
2	A143-C	Allison PTO Input	Standard
3	474	Dual Tag/Pusher Input	Option
4	115C	Right Rear Turn Output	Standard
5	474-A	Dual Tag/Pusher Output	Option
6	A114C-A	Allison Neutral Indicator Output	Standard
7	597	PTO Enabled Output	Standard
8	284-A	Neutral Start Solenoid Output	Standard
9	822	mVEC Wake Up Output	Standard
10	472	Lift Axle Solenoid Output 1	Standard
11	472-A	Lift Axle Solenoid Output 2	Standard
12	30S-C	Secondary Headlight Output 3	Standard
13	472-E	Lift Axle Request Input	Standard
14	907-D	Secondary J1939 Negative Pin	Standard
15	906-D	Secondary J1939 Positive Pin	Standard
16	59	Marker Interrupt Input	Option
17	42N	Park Brake Released Input	Standard
18	A124-E	Allison Retarder Input	Option
19	A141-A	Allison Neutral Start Input	Standard
20	624	Engine Brake On/Off Input	Standard
21	628	Engine Brake Hi/Lo Input	Standard
22	554	5 Volt Sensor Return	Standard
23	30S-B	Secondary Headlight Output 4	Standard
24	A104	Allison Engine Brake Enable Output	Standard
25	33	Hi Beam Input	Standard
26	39-A	Fog/Drive Lamp Input	Option
27	30	Headlight Input	Standard
28	A101-C	Right/Left Control Input	Option
29	A145-A	Allison PTO Neutral Input	Standard
30	636L	Engine Regeneration Switch Input	Standard
31	565-A	Cruise Control Resume/Coast input	Standard
32	563-A	Cruse Control Set/Accelerate Input	Standard
33	562-A	Cruise Control On/Off Input	Standard
34	N/A	No Use	N/A
35	N/A	No Use	N/A

Fuses

There are three primary locations for fuses on the chassis. Fuse boxes FB1 and FB2 are located under the steering wheel on the main drive side of the vehicle. There are also some fuse only slots in the mVEC controller located under the secondary side arm rest. Each chassis also has a fuse box (FB3) located outside on the chassis, mounted to the back of cab upright on the left side of the vehicle *(see Fuse Population Chart below).*

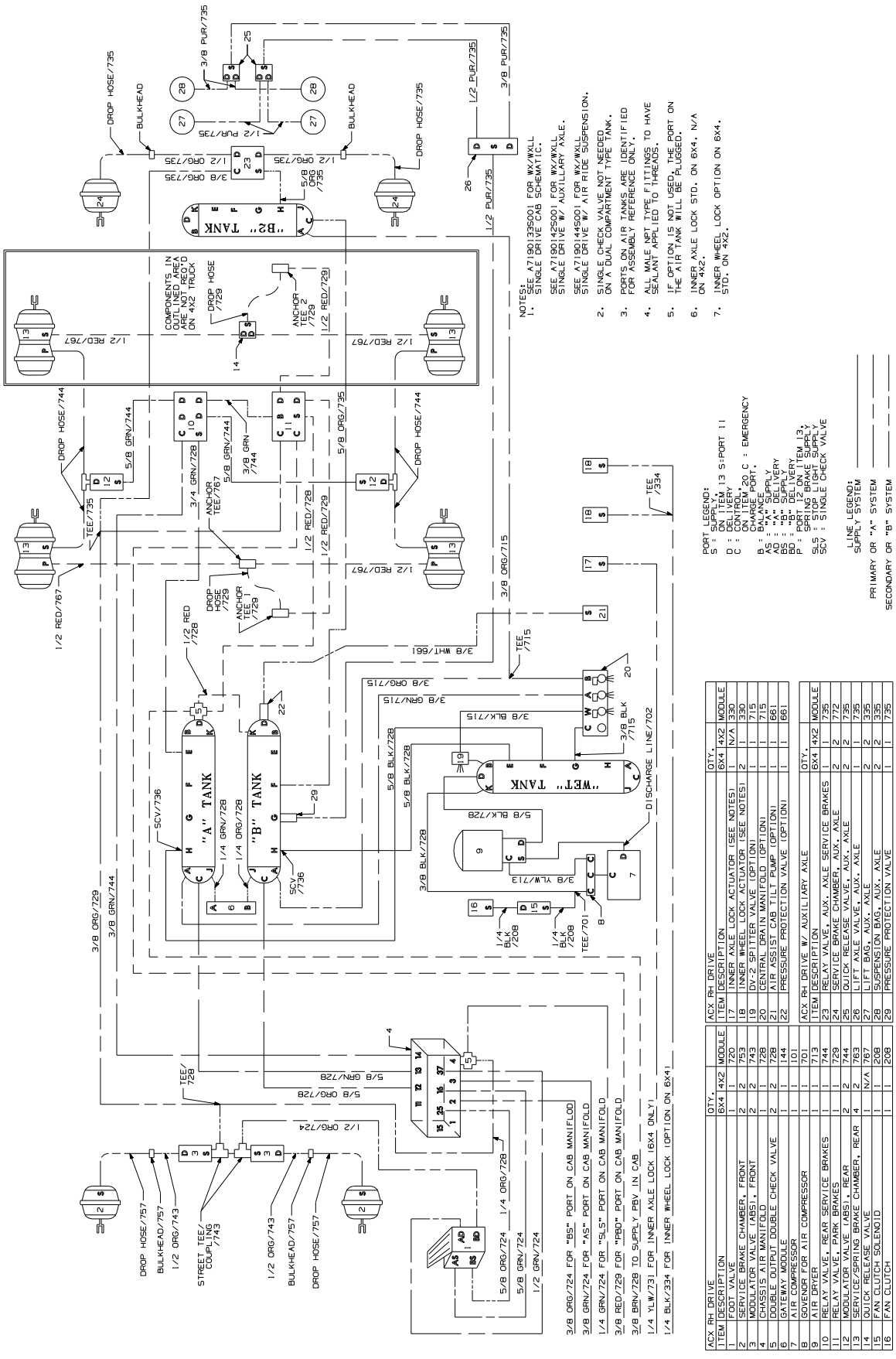
Fuse Population Chart

Fuse Box FB 1 - Located under main drive station				
Location	**Size**	**Type**	**Function**	**Usage**
C1 (F11)	30A	Auto	Wipers	Standard
C2 (F12)	25A	Auto	Blower Motor	Standard
C3 (F13)	20A	Auto	Accessory Power	Standard
C4 (F14)	15A	Auto	Radio Accessory	Standard
C5 (F15)	15A	Auto	Heated Mirror	Option
C6 (F16)	25A	Auto	CB Radio	Option
C7 (F17)	15A	Auto	Power Windows	Option
C8 (F18)	15A	Auto	Motor Mirrors	Option
C9	N/A	N/A	Spare Accessory	N/A
C10	N/A	N/A	Spare Accessory	N/A
A1	N/A	Manual	Spare Battery	N/A
A2 (F2)	15A	Manual	Body Builder Battery	Option
A3 (F3)	25A	Manual	Body Builder Battery	Option
A4 (F4)	15A	Manual	Park Lights	Standard
A5 (F5)	20A	Manual	Back of Cab Lights	Option
A6 (F6)	20A	Manual	Beacon	Option
A7 (F7)	20A	Manual	Accessory Lights	Option
A8 (F8)	10A	Manual	Horn	Standard
A9 (F9)	20A	Manual	Rear Turn Signals	Standard
A10	N/A	Manual	Spare Battery	N/A
Fuse Box FB 2 - Located under main drive station				
Location	**Size**	**Type**	**Function**	**Usage**
A3	10A	Auto	Transmission Ignition	Standard
A4	10A	Auto	Telma Ignition	Standard
E3	10A	Auto	Instrument Cluster Ignition	Standard
E4	20A	Auto	Ignition Power	Standard
E5	15A	Auto	Body Builder Ignition	Option
E6	15A	Auto	Body Builder Ignition	Option
E1	30A	Manual	VECU Power	Standard

Fuse Population Chart *(continued)*

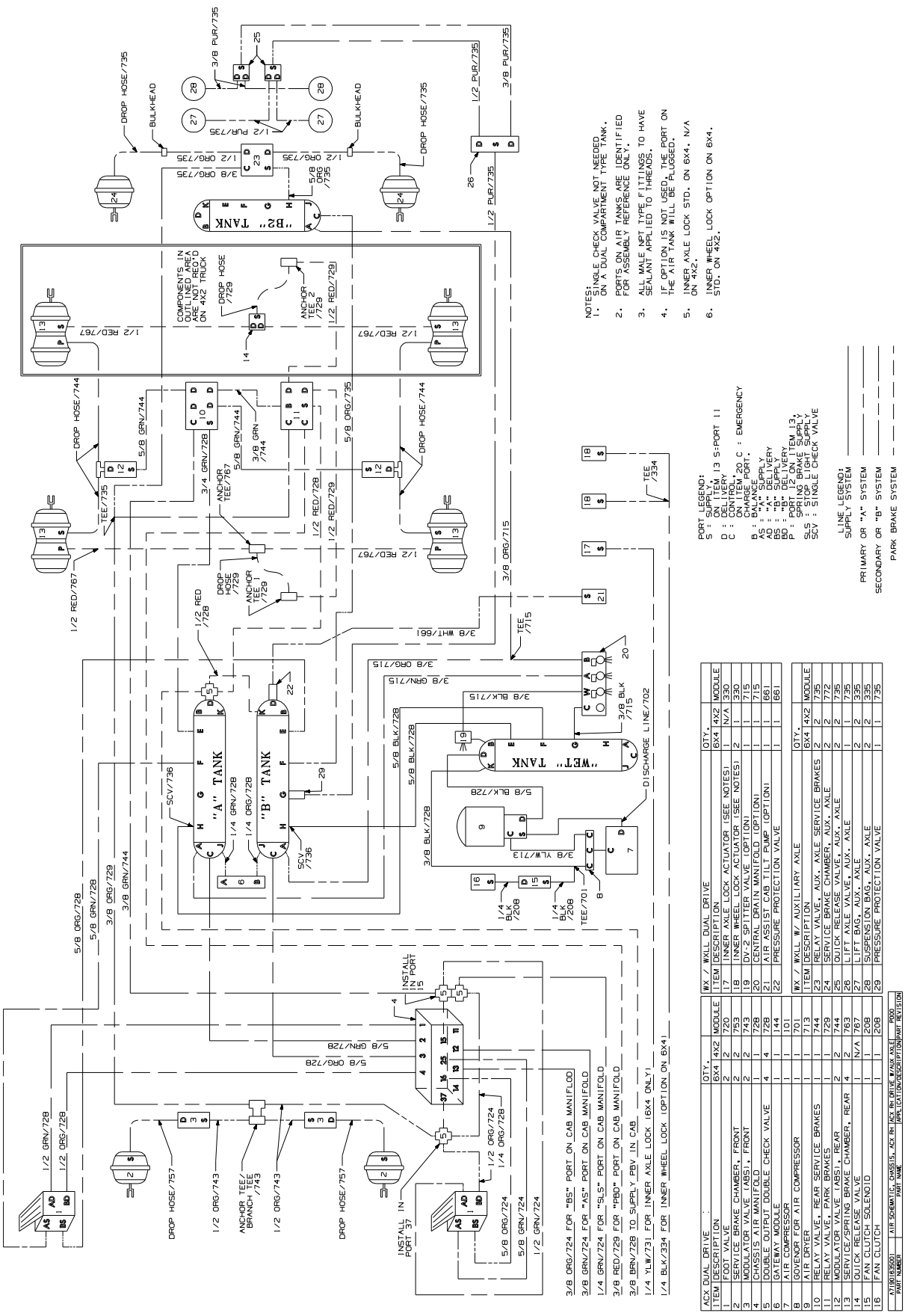
Fuse Box FB 3 - Located on outside Engine upright, Left side				
Location	**Size**	**Type**	**Function**	**Usage**
C1	15A	Manual	A/C Clutch	Standard
C2	10A	Manual	Urea Level Sensor	Standard
C3	30A	Manual	ABS Battery	Standard
C4	N/A	N/A	Spare Battery	N/A
C5	10A	Manual	Motion Sensor	Option
C6	N/A	N/A	Spare Battery	N/A
C7	N/A	N/A	Spare Battery	N/A
C8	N/A	N/A	Spare Battery	N/A
A1	25A	Auto	Trailer ABS Ignition	Standard
A2	7.5A	Auto	ABS Ignition	Standard
A3	25A	Auto	Chassis Option Ignition (Diesel Eng Only)	Option
A3	5A	Auto	Engine Ignition Power (Gas Eng Only)	Standard
A4	25A	Auto	Chassis Option Ignition (Diesel Eng Only)	Option
A4	15A	Auto	Engine Ignition Power (Gas Eng Only)	Standard
A5	10A	Auto	NOX SCR Sensor	Standard
A6	25A	Auto	Spitter	Standard
A7	25A	Auto	Fuel Heater (Diesel Engine Only)	Option
A7	15A	Auto	Fuel Shutoff (Gas Engine Only)	Standard
A8	10A	Auto	NOX Engine Sensor	Standard
A9	5A	Auto	Engine Ignition	Standard
A10	5A	Auto	DCU Ignition	Standard
mVEC - Located under secondary arm rest				
Location	**Size**	**Type**	**Function**	**Usage**
F9	10A	Auto	Keyswitch	Standard
F10	10A	Auto	Instruent Cluster Battery	Standard
F11	10A	Auto	Dome Lamp	Standard
F12	10A	Auto	Diagnostic Connector	Standard
F13	15A	Manual	Radio Battery	Standard
F14	30A	Manual	Power Port 2	Standard
F15	30A	Manual	Cigar Lighter (Power Port)	Standard
F16	30A	Manual	Stop Lights	Standard

AIR SYSTEM



AIR SCHEMATIC, CHASSIS ACX RH A7190183

This schematic is for reference only. Details are subject to change without notice. For the latest schematics contact Autocar Technical Support with the truck serial number.



ACX DUAL DRIVE :	QTY.		
ITEM	DESCRIPTION	6X4	4X2	MODULE
1	FOOT VALVE	2	2	720
2	SERVICE BRAKE CHAMBER, FRONT	2	2	753
3	MODULATOR VALVE (ABS), FRONT	2	2	743
4	CHASSIS AIR MANIFOLD	1	1	728
5	DOUBLE OUTPUT DOUBLE CHECK VALVE	4	4	728
6	GATEWAY MODULE	1	1	144
7	AIR COMPRESSOR	1	1	101
8	GOVENOR FOR AIR COMPRESSOR	1	1	701
9	AIR DRYER	1	1	713
10	RELAY VALVE, REAR SERVICE BRAKES	1	1	744
11	RELAY VALVE, PARK BRAKES	1	1	729
12	SERVICE/SPRING BRAKE CHAMBER, REAR	2	2	763
13	QUICK RELEASE VALVE	4	N/A	767
15	FAN CLUTCH SOLENOID	1	1	209
16	FAN CLUTCH	1	1	208

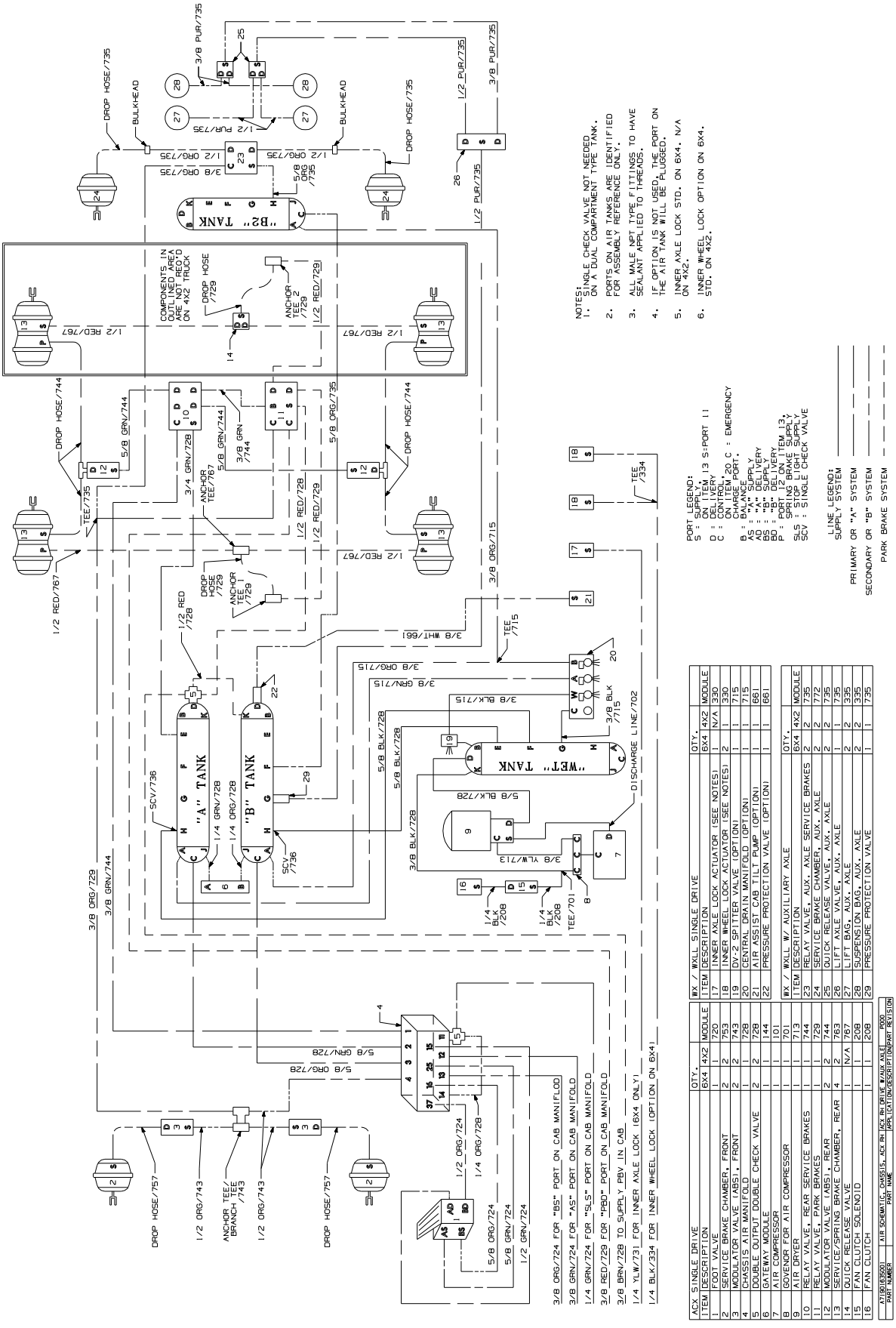
WX / WXLL DUAL DRIVE	QTY.		
ITEM	DESCRIPTION	6X4	4X2	MODULE
17	INNER AXLE LOCK ACTUATOR (SEE NOTES)	1	N/A	330
18	INNER WHEEL LOCK ACTUATOR (SEE NOTES)	2	1	330
19	DV-2 SPITTER VALVE (OPTION)	1	1	715
20	CENTRAL DRAIN MANIFOLD (OPTION)	1	1	715
21	AIR ASSIST CAB TILT PUMP (OPTION)	1	1	661
22	PRESSURE PROTECTION VALVE	1	1	661

WX / WXLL W/ AUXILIARY AXLE	QTY.		
ITEM	DESCRIPTION	6X4	4X2	MODULE
23	RELAY VALVE, AUX. AXLE SERVICE BRAKES	2	2	735
24	SERVICE BRAKE CHAMBER, AUX. AXLE	2	2	772
25	QUICK RELEASE VALVE, AUX. AXLE	2	2	735
27	LIFT BAG, AUX. AXLE	2	2	335
28	SUSPENSION BAG, AUX. AXLE	2	2	335
29	PRESSURE PROTECTION VALVE	1	1	735

X7190165001	AIR SCHEMATIC, CHASSIS, ACX RH DRIVE #/AUX AXLE	P000
PART NUMBER	PART NAME	APPLICATION DESCRIPTION/COMPANY REVISION

AIR SCHEMATIC, CHASSIS DD, AUX A7190165

This schematic is for reference only. Details are subject to change without notice. For the latest schematics contact Autocar Technical Support with the truck serial number.



ACX SINGLE DRIVE	QTY.		
ITEM DESCRIPTION	6X4	4X2	MODULE
1 FOOT VALVE	1	1	720
2 SERVICE BRAKE CHAMBER, FRONT	2	2	753
3 MODULATOR VALVE (ABS), FRONT	2	2	743
4 CHASSIS AIR MANIFOLD	1	1	728
5 DOUBLE OUTPUT DOUBLE CHECK VALVE	2	2	728
6 GATEWAY MODULE	1	1	144
7 AIR COMPRESSOR	1	1	701
8 GOVENOR FOR AIR COMPRESSOR	1	1	701
9 RELAY DRIVER, REAR SERVICE BRAKES	1	1	744
10 RELAY VALVE, PARK BRAKES	1	1	729
12 MODULATOR VALVE (ABS), REAR	2	2	744
13 SERVICE/SPRING BRAKE CHAMBER, REAR	4	2	763
14 QUICK RELEASE VALVE	1	N/A	767
15 FAN CLUTCH SOLENOID	1	1	208
16 FAN CLUTCH	1	1	208

WX / WKLL SINGLE DRIVE	QTY.		
ITEM DESCRIPTION	6X4	4X2	MODULE
17 INNER AXLE LOCK ACTUATOR (SEE NOTES)	1	N/A	330
18 INNER WHEEL LOCK ACTUATOR (SEE NOTES)	2	1	330
19 DV-2 SPITTER VALVE (OPTION)	1	1	715
20 CENTRAL DRAIN MANIFOLD (OPTION)	1	1	715
21 AIR ASSIST CAB TILT PUMP (OPTION)	1	1	661
22 PRESSURE PROTECTION VALVE (OPTION)	1	1	661

WX / WKLL W/ AUXILIARY AXLE	QTY.		
ITEM DESCRIPTION	6X4	4X2	MODULE
23 RELAY VALVE, AUX. AXLE SERVICE BRAKES	2	2	775
24 SERVICE BRAKE CHAMBER, AUX. AXLE	2	2	772
25 QUICK RELEASE VALVE, AUX. AXLE	2	2	735
26 LIFT AXLE VALVE, AUX. AXLE	1	1	735
27 LIFT BAG, AUX. AXLE	2	2	335
28 SUSPENSION BAG, AUX. AXLE	2	2	335
29 PRESSURE PROTECTION VALVE	1	1	735

AIR DIAGRAM	AIR SCHEMATIC, CHASSIS, ACX RH DRIVE W/AUX AXLE, RDO
PART NUMBER	APPLICATION DESCRIPTION/PART REVISION

AIR SCHEMATIC, CHASSIS SD, AUX A7190166

This schematic is for reference only. Details are subject to change without notice. For the latest schematics contact Autocar Technical Support with the truck serial number.

Appendix A

Cummins Requirements For A Natural Gas Engine Installation

Cummins AFB		Automotive IQA documents
IQA - Gas	11/28/2006	IQA - Gas - Automotive - ISL G
3.03	5/21/2007	Application Type Naming Convention Master (for internal use only)
10	**ENGINE TECHNICAL PACKAGES**	
10.142	11/24/2008	2007 ISL G Mechanical Technical Package
15.65	4/2/2009	J1939 Multiplexing of Inputs and Outputs
15.67	5/27/2009	Electronic Accelerator Pedal Position Performance Specification (Interface)
15.68	2/27/2009	Vehicle Speed Input Electronic Interface
15.78	8/25/2009	CM2180A Electronic Subsystem Technical Package - OEM Interfaces
15.82	8/25/2009	CM2180A Electronic Subsystem Technical Package - OEM Components
15.84	8/25/2009	CM2180A Electronic Subsystem Technical Package - Serial Communications
15.88	8/23/2006	Electronic Throttle Control Performance Specification (Interface)
20.08	5/1/1989	Crankshaft Power Take-off Recommendations
20.11	2/23/2010	Air Compressor Systems-Automotive & Industrial Installation Requirement
20.12	12/11/2009	Installation Quality Assurance (IQA)
20.12-approval	2/16/2007	Automotive IQA Approval Document
20.12 DOEM	2/15/2008	Automotive IQA Approval Document for DOEM
20.12-Portugese	12/14/2005	Garantia de qualidade da instalação (IQA)
20.12 Chinese	3/7/2008	安装质量保证 (IQA)
20.14	8/9/2004	Engine Specification Requirement - "Tracking" Options
20.17	3/16/2010	Lubrication System - Installation Requirements
20.22	11/13/2009	Post IQA OEM Product Change Control Proces (Non OBD/Emissions Related)
21.10	2/18/2010	Air Intake Systems - Automotive/Bus Installation Requirements
21.17	1/26/2009	LNG Fuel Systems - Automotive/Bus Installation Requirements
21.19	3/2/2007	Service Accessibility - Automotive Installation Requirements
21.20	7/17/2009	Natural Gas and LPG/Propane Catalysts - Automotive and Bus Installation Requirements
21.25	1/26/2009	CNG Fuel Systems - Automotive/Bus Installation Requirements
21.35	12/7/2009	Starting & Electrical Systems - Automotive/Bus Installation Requirements
21.36	2/18/2009	Engine Mounting - Installation Requirements
21.37	6/5/2009	Powertrain & Driven Accessories - Installation Requirements
21.46	9/8/2009	Guidelines For OEM Installed Hardware - Installation Requirements
21.47	8/11/2009	Engine Certification/Market/Region Application Requirements
21.50	1/25/2010	Post-2001 Cooling System Fill & Deaeration - Auto & Bus Install. Req
21.52	10/13/2009	Cooling System Heat Transfer (post-2001) - Auto & Bus Installation Requirements
21.52 Attachment	4/20/2010	Charge Air System Pipe Cleanliness and Inspection Equipment
21.54	4/17/2003	Cooling System Testing - Tow Dyno Testing at Low Ambient Test Conditions (Pre-EGR)
21.55	3/23/2009	Body Builder IQA - Installation Requirement
21.55 worksheet	6/14/2006	Body Builder IQA Worksheet - Installation Requirement
21.57	5/21/2004	Keyswitch Input Signal Installation Requirements for Engine Shutdown
21.74	2/2/2010	Powertrains - Automotive Hybrid Bus Installation Requirements

Appendix A *(continued)*

Cummins AFB		Automotive IQA documents
21.75	7/1/2009	ISLG - Auto & Bus Installation Requirements
21.99	3/12/2009	Automotive IQA Checklist - CM2180A Electrical & Electronics
21.100	11/19/2009	Automotive IQA Mechanical Checklist
21.100-Workbook	3/8/2010	Automotive IQA Mechanical Checklist-Workbook Submit Issue
24.41	10/31/2005	OEM Installed Air Shutdown Systems Installation Requirements
40	**LUBRICATION SYSTEMS**	
46.02	8/12/2005	Angularity Limits for Cummins Engines
48.02	6/4/2004	Alternative Fueled Engine Closed Crankcase Ventilation Systems
70	**FUEL SYSTEMS**	
74.17	8/29/2008	Fleetguard Composite Fuel and Lubrication Filters
79.05	8/31/2007	Natural Gas Fuel Performance Specification (Wide Range Fuel Capable)
90	**COOLING SYSTEMS**	
99.01	4/9/2008	Engine Coolant Performance Specifications
110	**ELECTRICAL SYSTEMS**	
111.13	11/24/2003	Oil Cooled Alternator Plumbing (50DN)
111.18	3/17/2006	Delco 11SI Alternator Transition
111.19	8/18/2009	Cummins 24SI Alternator Transition
120	**STARTING SYSTEMS**	
121.12	6/23/2005	Cummins 39MT-HD Starter
121.14	1/3/2003	Cummins Denso Midrange Starter Transition
121.15	6/27/2003	Cummins Delco 38MT-HD Starter Transition
121.17	4/27/2009	Cummins Branded Electric Starter Performance Curves
140	**POWER TRAIN COMPONENTS**	
140.08	11/5/2007	Rear Engine Power Takeoff (REPTO) for 8.3, 8.9 and 10.8 Litre Engines
140.16	6/18/2009	Axle Ratio Recommendations with Overdrive Transmissions
141.09	3/12/2007	Mid Range Flywheel Assembly Reduction Technical Package
141.10	2/5/2007	Midrange SAE#2 Flywheel Housing Starter Bore Standardization Technical Package
170	**CLIMATIZATION COMPONENTS**	
174.04	3/11/2009	Preparation for Cold Weather Engine Operation
190.04	4/20/2010	Emissions Related OEM Product Change Control Process and EPA Defect Reporting Process
191.14	11/4/2005	2007 EPA After treatment OEM Serialization Guidelines
191.24	4/20/2010	OEM Regulatory Agreement Support Information
	SUPPORT INFORMATION	
191.25	4/20/2010	OEM Serialization Requirements
191.28	1/18/2010	Warranty Reporting of OEM Components
191.29	4/20/2010	OEM Regulatory Compliance Documentation Schedule
191.32	4/20/2010	Reporting First Point of Retail Sale

Please note the most accurate listing should be acquired from the Cummins website or the local Cummins distributor.

Autocar, LLC
551 South Washington Street
Hagerstown, IN 47346
www.autocartruck.com

ASE 00001 Rev. 000

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