

# **Automotive Body Repair and Paint Work**

## **Level –III**

**Based on October 2023, Curriculum Version 2**



**Module Title: Applying Retrofitting**

**Module Code: EIS BRP3 M09 1023**

**Nominal Duration: 40 Hours**

**Prepared by: Ministry of Labor and Skill**

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## **Acknowledgment**

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## Acronym

VFPS .....	Vehicle Frontal Protection Systems
SUV .....	Sport Utility Vehicle
GVM .....	Gross Vehicle Mass

## Introduction to Module

Retrofitting is nothing more than the addition of new technology or features to older systems in order to improve efficiency, add more functionality or be compatible with the latest environmental demands. Here's how automotive can benefit from that process.

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This module covers competence to determine for refitting and retrofitting and for installation of accessories in considering of the technical specifications, requirements and statutory regulations.

**This module covers the units:**

- Introduction to Retrofitting
- Fitting Accessories and Components
- Advise Customer

**Learning Objective of the Module**

- Understand Introduction to Retrofitting
- Fit Accessories and Components
- Apply Advise Customer

**Module Instruction**

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the “LAP test” giver at the end of each unit and
5. Read the identify reference book for Examples and exercise

**Unit one: - Introduction to Retrofitting**

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This unit is developed to provide you the necessary information regarding the following content coverage and topics

- Characteristics of retrofitting
- Source equipment and information

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Understand the Characteristics of retrofitting
- Accesses Source of equipment and information

### 1.1 Characteristics of retrofitting

**Retrofitting** refers to the addition of new technology or features to older systems. In the context of buildings, this could mean upgrading insulation, installing energy-efficient windows, or integrating smart home technology.

New and existing adaptive technologies continue to broaden opportunities for people with disabilities to drive both comfortably and safely. Some of these adaptive technologies are as simple as swivel seats for more convenient access. Others, such as hand controls, may be necessary for a driver to safely operate a vehicle. Whatever customer requirements, chances are good that adaptive equipment is available to support the customer special driving needs and allow them to maintain the freedom offered by the open road.

Generally speaking, to qualify for retrofitting, a vehicle must be in a good state of repair. For instance, this includes a corrosion-free body and chassis, a properly maintained gearbox, and the vehicle's original wiring harnesses and configuration.

Retrofitting is nothing more than the addition of new technology or features to older systems in order to improve efficiency, add more functionality or be compatible with the latest environmental demands. Here's how automotive can benefit from that process.

To modify equipment in automobiles, that is already in service using parts developed or made available after the time of original manufacture. To install, fit, or adapt (a device or system) for use with something older. Related word to retrofit is modified, reconstruct, recycle, tweak, furnish, render, modernize, overhaul and install.

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The retrofit of oxidation catalysts on diesel engines has been taking place for well over twenty years in the off-road vehicle sector. Over 300,000 oxidation catalysts have been installed in underground mining and materials handling equipment. With nearly universal application, oxidation catalysts have been retrofitted on millions of on-road and off-road vehicles worldwide. And tens of millions of these devices are operating as first-fit, original equipment (OE) on new vehicles. Oxidation catalysts installed on engines running 500 ppm or less sulfur fuel have achieved total particulate matter reductions of 20 to 50%, hydrocarbon reductions of 60 to 90% (including those HC species considered toxic), and significant reductions of carbon monoxide, smoke, and odor.

The number of vehicles retrofitted with high efficiency, wall-flow diesel particulate filters (DPF) has grown significantly over the past few years. Over 300,000 on-road and off-road heavy-duty engines worldwide have been retrofitted with passively or actively regenerated DPFs, with more than 100,000 DPF retrofits installed on diesel engines in the U.S. since 2001. In addition, millions of new passenger cars have been equipped with DPFs in Europe since mid-2000.

Significant investments in DPF production capacity have been made and will be expanded in the future to ensure that DPF demands for both new vehicles and retrofit applications in North America can be met. The operating and durability performance of DPFs has been very impressive. For example, a growing number of on-road DPF-equipped heavy-duty vehicles have been successfully operating for millions of miles.

Today, second and third generation retrofit filter systems can reduce PM emissions from 85% to more than 90%. The majority of these installed retrofit DPF systems make use of high efficiency, ceramic wall-flow filters. Since 2007, every new diesel vehicle sold in the U.S. or Canada has been equipped with a high efficiency DPF as required by the U.S. EPA's 2007/2010 highway heavy-duty emission regulation. This represents more than three million new trucks operating on DPFs mostly in the U.S. In 2010, new highway trucks were required to reduce NOx emissions by 90% relative to pre-2007 requirements and have been equipped with NOx control technologies such as lean NOx trap catalysts, urea SCR, and high-flow EGR systems. Urea SCR has established itself as the preferred NOx reduction technology for on-road and off-road vehicles and engines.

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**Here are a few examples of current regulations:**

- As of 2023, the United States, the United Kingdom, some South American countries and Africa have no regulations on electric retrofitting.
- In Europe\*, some countries, such as Germany, are adopting regulations known as R.T.I. (Receipt on Isolated Basis), but other countries have no regulatory framework at all.
- In France, your vehicle must have undergone a valid roadworthiness test less than six months earlier and equally fulfil our “eReady For Retrofit” programme requirements, which involves checking a number of key points (corrosion-free bodywork, transmission, original wiring harnesses, vehicle in original configuration, state of preservation). Thereafter, the conversion must be performed by a REV Mobility’s-accredited installer.

**1.2 Source equipment and information**

Equipment installation is a skill that involves planning, designing, installing, testing, and maintaining various types of equipment and systems. Whether you are working on a residential, commercial, or industrial project, you need to select and source the appropriate equipment and materials for your installation. In this article, we will cover some of the key steps and factors to consider when choosing and obtaining the equipment and materials for your equipment installation project

Company Resources are all assets a company controls and can use to achieve its goals. Company resources include the following: Human Resources. Material Resources, Financial Resources.

The first step in selecting and sourcing the equipment and materials is to assess the project requirements. You need to understand the scope, specifications, objectives, and constraints of the project, as well as the expectations and needs of the client or end-user. You also need to identify the applicable codes, standards, regulations, and best practices that govern the equipment installation. Based on these factors, you can determine the type, size, capacity, functionality, quality, and compatibility of the equipment and materials that you need for the installation.

**Research the equipment and materials options**

The next step is to research the equipment and materials options that are available in the market. You can use various sources of information, such as catalogs, websites, reviews, brochures,

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manuals, and technical data sheets, to compare and evaluate the features, benefits, drawbacks, and costs of different equipment and materials. You can also consult with experts, suppliers, manufacturers, or peers to get their recommendations, feedback, or advice on the equipment and materials that suit your project. You should also consider the availability, delivery time, warranty, and support of the equipment and materials.

### **Select the equipment and materials**

The third step is to select the equipment and materials that best meet your project requirements and budget. You should weigh the pros and cons of each option and make a rational and informed decision based on your research and analysis. You should also document your selection process and criteria, as well as the reasons for choosing or rejecting certain equipment and materials. You should also communicate your selection to the relevant stakeholders, such as the client, the project manager, or the installation team, and get their approval or feedback.

### **Equipment and materials**

The final step is to source the equipment and materials from reliable and reputable suppliers or vendors. You should negotiate the terms and conditions of the purchase, such as the price, quantity, quality, delivery date, payment method, and warranty. You should also review and verify the invoices, receipts, contracts, and other documents related to the purchase. You should also inspect and test the equipment and materials upon delivery to ensure that they are in good condition and match your specifications. You should also store and handle the equipment and materials properly to avoid damage or loss.

By following these steps, you can select and source the appropriate equipment and materials for your equipment installation project. This will help you ensure the quality, safety, efficiency, and effectiveness of your installation, as well as the satisfaction of your client or end-user.

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## Drilling and boring tools



Figure1- 1 Drilling machine

A varied terminology is related to making holes with revolving tools. A hole may be drilled or bored; awls, gimlets, and augers also produce holes. An awl is the simplest hole maker, for, like a needle, it simply pushes material to one side without removing it. Drills, gimlets, and augers, however, have cutting edges that detach material to leave a hole. A

drilled hole is ordinarily small and usually made in metal; a bored hole is large and in wood or, if in metal, is usually made by enlarging a small hole. Drilling usually requires high speed and low torque (turning force), with little material being removed during each revolution of the tool. Low speed but high torque are characteristic of boring because the boring tool has a larger radius than a drill.

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## Terminals and Connectors

Terminals and connectors are any of the various types of electrical wire connectors used to end a wire or cable and connect it to an electrical system or terminate it completely. They can be anything from ring terminals, butt splices, wire caps, ferrules, fork terminals, pin terminals, or a host of other styles which are available in a variety of insulation styles. We employ crimp connectors, as well as other forms of electrical connectors. Pacer carries everything from waterproof connectors to battery posts and everything between. When selecting wire terminals, you need, the first thing to do is consider what requirements you're looking for. Do

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you need waterproof terminals? Is vibration resistance important? What kind of temperatures will the wire terminals need to handle? Questions like these will help you isolate the type and style of wire connector to crimp that will work best for your particular application.

### Delphi Connectors

Delphi connectors which are now called Automotive connectors are a series of environmentally sealed connectors designed and manufactured to handle exposure to moisture and extreme temperatures. It is those resistances we mentioned that make them so popular. These connectors are common to the automotive industry. They are useful for much more than that though. The sealed connection that they create is essential in harsh marine conditions. Delphi connectors are designed to create dis-connectable, environmentally sealed connections. This is achieved by placing a seal over a stripped wire before the terminal is added. Now, when the terminal is crimped to the wire, the seal is slid into the correct position. Finally, this wire is inserted in the Delphi connector making sure that both the terminal and seal go easily into place. The terminal locks into position holding the seal with it. This process creates an environmentally sealed connection.



Figure1- 2 Delphi Connector

### Ring Terminals

Ring Terminals are the most secure type of tongue-style wire terminals. That fit cleanly over a stud and are held in place by the locking nut. The advantage of ring terminals is that they remove the possibility of terminal slippage you may find with other types of terminals. These are a common choice due to their durability and ease of installation. They are easy wire connectors to crimp. Depending on the application, you can connect multiple wires to a single ring terminal or connect multiple ring terminals to a single stud

## Battery Posts



Figure1-3 Battery Posts

This type of electrical wire connectors are used to connect a load to a battery. In order to give the highest level of conductivity, all Pacer battery posts are made from 131 contact copper. We use this type of copper as it is 95% pure making it highly conductive. Specialized tools may be needed to work with these wire connectors to crimp them correctly. One issue that plagues a lot of battery posts is that they can get corroded over time which causes a

range of problems. To prevent this, each post is electro-plated with a bright tin finish. For an added layer of protection, you can add a boot covering to your post. This will help to extend the life of the connection.

## Special tools

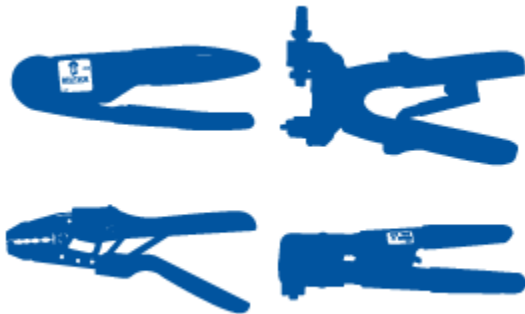


Figure1- 4 Special tools

When dealing with your electrical wire connectors, the electrical system, or its components, the correct tools are an absolute must. Without the proper tools, you run the risk of improper usage and eventually malfunction. Knowing this, Pacer takes steps to carry the tools for all the wire terminals or connectors we offer. This way you're never left wondering how to use a particular item. Find the tool you're looking for here. Of course, with such a variety of terminals

and connectors, there is going to be a variety of tools to accompany them. We have taken steps to make the selection process as easy as possible so you can get the parts and tools you need and get your project completed. When looking at the right wire connectors to crimp for your project, always consider the proper tools.

## Terminals & connectors meet

Pacer strives to offer the greatest amount of solutions possible. To offer solid solutions, they have to be backed up with evidence. That is why we put so much effort into carrying products that meet or exceed industry compliances. Below you will find a blanket list of compliances for

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each type of the connector or wire terminal we offer. You have to understand that compliances and standards can vary greatly from one type of wire terminal to another type of wire terminal even in the same group. All the electrical wire connectors we carry are built to last. We are confident of our products and stand behind the compliances they carry. Feel free to contact a Pacer expert with any specific questions you have about the compliances and standards our parts meet.

### Ring terminals

Ring terminals are used to connect wires to a connection point by fitting the open face of the terminal over a stud. These wire connectors create a solid connection as the ring that is fitted over the stud cannot come loose or fall off. These types of crimp connectors are built for long-term use. This removes the possibility of the ring terminal disconnecting. They are widely known for the semi-permanent connections that they create. To make ring terminals even better, they can easily be used with two or more wires depending on the application. Ring terminals are the most secure type of crimp connectors available and are commonly chosen for their durability, ease of use, and longevity in tough conditions.



Figure1- 5 Ring terminals

### Keyhole saw



Figure1- 6 Keyhole saw

A keyhole saw (also called a pad saw, alligator saw, jab saw or drywall saw) is a long, narrow saw used for cutting small, often awkward features in various building materials. There are typically two

varieties of keyhole saw: the fixed blade type and the retractable blade type.

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The retractable-blade variety is usually found to have either a cast-iron handle or, less commonly, a wooden handle. The facility to retract the blade to an optimum length serves to prevent unwanted flex to the blade should the full length of the blade be obstructed in some way. In both types, the blade is typically secured by one or two holding/thumb screws.

The cheaper, fixed-blade type is more commonly used in the modern construction trade. With the advance of certain building methods and materials, designs specific to these trades have been developed. One such modification being a sharpened point at the tip of the blade which can be pushed or jabbed through soft materials such as drywall without drilling a hole for the blade.

Compass saws typically feature a larger, coarser blade, and are designed to cut through tougher materials.

Two power tools serving largely the same function but which work more quickly and with less effort are the jigsaw and spiral saw.

### Self-check 1.1

**Directions:** Answer all the questions listed below.

#### Part I: Fill in the blank space

1. \_\_\_\_\_ refers to the addition of new technology or features to older systems.
2. \_\_\_\_\_ a skill that involves planning, designing, installing, testing, and maintaining various types of equipment and systems.
3. Delphi connectors which are now called \_\_\_\_\_ connectors.
4. \_\_\_\_\_ used to connect wires to a connection point by fitting the open face of the terminal over a stud.
5. \_\_\_\_\_ is used to making holes with revolving tools.

#### Part-II: Choose the correct answer from the given alternatives

1. Ring Terminals are the most secure type of tongue-style wire terminals.
  - A. True
  - B. False
2. Which one is from the following decorative metal or plastic disk that snaps or bolts onto and covers the entire face of the wheel.
  - A. Roof rack
  - B. wheel cover
  - C. Stripe
  - D. A & B
3. \_\_\_\_\_ is nothing more than the addition of new technology or features to older systems in order to improve efficiency?
  - A. Foot step
  - B. Bull bar
  - C. Retrofitting
  - D. assess requirements
4. The first step in selecting and sourcing the equipment and materials is \_\_\_\_\_.
  - A. Hood height adjustments
  - B. Repairing
  - C. Replacing
  - D. assess requirements
5. In third step to meet requirements of project and budget is \_\_\_\_\_.
  - A. select the equipment and materials?
  - B. Retrofitting Fender
  - C. assess requirements
  - D. All

**Part-III: Answer the following questions accordingly.**

1. What is the other name for a keyhole saw ?
2. What are the options of researching equipment and materials ?
3. Write is the characteristics of retrofitting?



## Unit Two: - Fitting Accessories and Components

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying information
- Disassembling and relocating accessories
- Deploying specific testing procedures

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify information
- Perform Disassembling and relocating accessories
- Apply Deploying specific testing procedures

### 2.1 Identifying information

#### Steering wheel cover

Applying a cover helps to reduce wear and tear to your steering wheel from natural, sustained use (better for the cover to wear out than the wheel itself). Steering wheel covers have potential benefits of increasing palm grip, regulating surface temperature and adding character to your car's interior.

These days, steering wheels come in all kinds of materials and textures. As the person at the helm, perhaps you want a wheel that feels more ergonomic, comfortable, or sporty. If your vehicle's steering wheel isn't quite doing the trick, you're in luck after market steering wheel covers are easy to find.

Once you measure and make sure your cover will fit, they're easy enough to slip over your existing steering wheel and can quickly add a new look to your interior. Whether you want something sleek or outrageous like the fluffy pink cover below we have 15 examples from

Amazon to choose from. Slap one on and enjoy the feel of your new steering wheel, captain!



### Door handles

The car door handles are the hardware used for opening and closing of doors. Doors are used for security purposes of our goods. There are many kinds of doors like passage, closet, dummy doors etc. similarly there are various kinds of door handles used for variety of doors and their functionality. Door handles are installed on doors to simply open and close the door with minimum effort. As the name suggest, handle is used to open and close car doors. The handle is found on both the Inside and outside of automobile doors, so they are used differently on each panel. The one on the outside is dragged to open the vehicle door, while the inside handle is used to release the door latch before you can push the door to let yourself out



Figure 2- 2 car door handles

### Door Handle retrofit

The Door Handle Cover is designed to fit most vehicles with a door handle that curves outward from the door and has an opening in between the handle and door. The length of the door handle cover should cover most door handles on large trucks, SUVs, and cars.

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Figure 2- 3 Door Handle

### Seat cover

Seat covers help protect seats from daily abuse- kids, dogs, dirt, spills, weekend adventures.

When we say size matters, were talking specifically about the fit. There are a lot of generic, one-size –fits –all car seat cover options out there. Our car seat covers .are customized for every make, model. Year and car seat type. Essentially, our neoprene car seat covers are like a skin for your cars seats.

It’s always necessary to have car seat covers because if your seat covers would be comfortable than your driver would become more reliable. Fabric seat covers .This kind of seat covers are very easy to maintain. The material which is used in these seat covers is high quality products.



Figure 2- 4 Seat covers

### Bull bar

A bull bar or push bumper is a device installed on the front of a vehicle to protect its front from collisions, whether an accidental collision with a large animal in rural roads, or an intentional collision by police with another. Vehicle frontal protection systems (VFPS)



Figure 2- 5 Examples of acceptable additional lighting on a VFPS

## Requirements

All bull bars fitted to vehicles manufactured on or after 1 July 2013 with a GVM of not more than 3.5 tonnes, must comply with the design and installation requirements of Australian Standard AS4876.1-2002 'Motor Vehicle Frontal Protection Systems Part 1- Road User Protection' (except clause 3.2).

## Foot step

Foot step also provides comfort for the vehicle. Footsteps are located on the bottom of the car (on one or both sides), usually at the foot of the car door. The installation of the footstep itself is not too difficult; the important thing is to know which part of the chassis will be used as a footstep when installed.

The automatic footstep feature is a side step or step that can lower itself when the door is opened or closed. It works by using a motor mounted on the side of the stairs. They fulfill two main functions. The most obvious function is to function as a step. Without the extra effort to get into some taller cars, getting into them will be like climbing a mountain. Car passengers, especially the elderly and children, have difficulty getting in and out of the vehicle; besides, this car's ground clearance is relatively high compared to the sedan-type vehicle . Protecting the car from various forms of road debris is the second function of the footstep.

As the vehicle moves, its wheels kick up all kinds of waste, from rocks and dirt to other, more destructive things. A running board can prevent some debris from being thrown high enough to scratch and damage doors and side panels. In addition, footsteps can help keep the interior of the vehicle clean. In this way, the running board or footsteps can act like a doormat, where passengers can wipe dirt off their feet before entering the vehicle.

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Figure 2- 6 Foot step

Footstep and sidebar are two different things that are sometimes used interchangeably by some manufacturers, as shown in Figure 1. Like a sidebar, a footstep provides a stepping surface into the vehicle. Sidebars usually have individual step pads to correspond to each door on the vehicle, and they are generally narrower than footsteps. The sidebar is more suitable to be applied to cars that have lower ground clearance. The footstep is also usually more comprehensive than the side rails and has an even better profile. Instead of individually placed stair treads pads, flat stair treads usually have treads that run the length of the plank.

### **Roof rack**

A roof rack is a set of bars secured to the roof of a automobile. It is used to carry bulky items such as luggage, bicycles, canoes, kayaks, skis, or various carriers and containers.

They allow users of an automobile to transport objects on the roof of the vehicle without reducing interior space for occupants, or the cargo area volume limits such as in the typical car's trunk design. These include car top weatherproof containers, some designed for specific cargo such as skis or luggage

The most common components of a roof rack system are: towers, fitting pieces (for attaching towers to a specific vehicle), crossbars, and gear mounts.

Automobile roof racks are split into different types, depending on the vehicle roof:

- Rain Gutter - older roof racks were usually mounted directly to the gutter surrounding the roof line.
- Bare Roof - many modern vehicles, which do not have gutters, can have a roof rack installed by attaching hooks to the top of the door frames.





Figure 2- 8 Examples of truck bed rack

### Wheel cover

Wheel cover is a decorative metal or plastic disk that snaps or bolts onto and covers the entire face of the wheel.

Cars with stamped steel wheels often use a full-wheel cover that conceals the entire wheel. Cars with alloy wheels or styled steel wheels generally use smaller hubcaps, sometimes called center caps. Alternatively, a wheel cover or spare tire cover can be an accessory that covers an external rear-mounted spare tire found on some automobiles.



Figure 2- 9 wheel cover

Wheel covers are an important part of the construction – when driving there are many factors that affect their functioning. They are increasingly used when you want to improve the comfort of your car while increasing safety. The wheel cover is exposed, among other things, to the

negative influence of chemicals and surface elements. For this reason, it is important to manufacture it from suitable materials which will easily stand up to un favorable conditions.

### Purpose of wheel cover

Car aerodynamics has become significant in the automotive industry development as it can crucially influence vehicle performance, comfort, safety, stability, cooling and visibility. Aerodynamic drag can be defined as the fluid drag force that occurs on a moving car with the direction of the fluid free stream flow. The total drag force occurs due to both the forces that produced by pressure distributions over the body surface and forces that are originating from skin friction. Typically, 75-80 percent of the total driving resistance on today’s cars occurs when the speed is at 80 km/h, coming from the aerodynamic drag force .

Reducing the drag that is caused by wheels and wheelhouses is an interesting solution to increase the range of car and to improve vehicle’s road behavior. However, knowledge and prediction of underbody flow is quite restricted because of the complexity of the geometry

The wheel cover also acts as an additional support in providing sound insulation. The noise level in the cabin is one of the most important aspects the buyer takes into account. Without a soundproof wheel cover, there are significantly more unwanted sounds inside the cabin.

Sound proof the wheel covers in order to improve the driving experience and how to respond to our customers' flexible reactions to changes in the automotive sector by providing the latest technology and maintaining a stable supply chain.

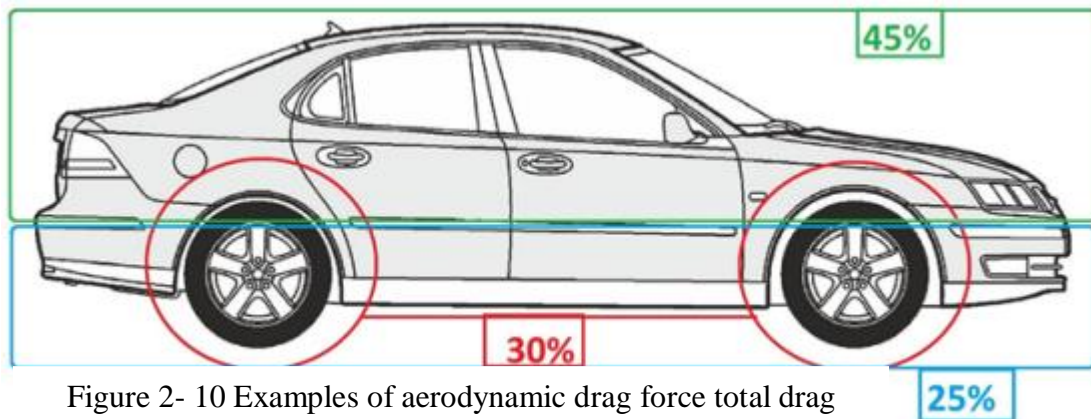


Figure 2- 10 Examples of aerodynamic drag force total drag



## Stripe

A stripe is a line or band that differs in color or tone from an adjacent area. Stripes are a group of such lines. As a pattern (more than one stripe together), stripes are commonly seen in nature, food, emblems, clothing, and elsewhere.

Two-toned stripes inherently draw one's attention, and as such are used to signal hazards. They are used in road signs, barricade tape, and thresholds.



Figure 2- 11 Different colors stripe

In nature, as with the zebra, stripes may have developed through natural selection to produce motion dazzle. Stripes may give appeal to certain sweets like the candy cane. For hundreds of years, stripes have been used in clothing. Striped clothing has frequently had negative symbolism in Western cultures.

In addition to looking really cool did you know that racing stripes actually had a very important job back in the day? They were used to separate one car from another during auto races. The stripes were about the only way to tell the cars apart as they went whizzing around the track. There are people who are convinced that these stripes actually help the car go faster. Alright, Susan. If you think that vinyl racing stripes is going to soup up your mom-mobile you go ahead and think that. We will apply them and then you race to your heart's content.

There are several types of vinyl racing stripes to choose from with different colors, widths and even patterns. Some are two stripes, some are three. Some have stripes of all the same width while others have a thick one surrounded by thinner ones. Most of the 3M vinyl stripes can be cut to fit your vehicle's needs.



Figure 2- 12 vinyl racing car stripes in different colors

### Carry boy

ECARRYBOY” has undergone technological development in production of Fiberglass Canopy and Pickup & 4×4 Accessories of perfect quality and design. “CARRYBOY” believes in the meticulousness in every process of production. Each department has its own specialist to closely supervise its operation. The factory has been invested into the largest and the most modern factory by introducing the latest technology to help reinforcing the production standard. The production line is divided into several departments to create a standard skilled workmanship in every function. Selective quality materials and special designed equipment are intensively acquired with the aim to produce the best fiberglass canopy and pickup & 4×4 accessories for the World.



Figure 2- 13 Examples Pickup 4×4 fitted with Carry boy

## 2.1 Disassembling and relocating accessories

The seat reference point is to be determined using the template shown in Figure 2. The template is to be positioned on the centre line of the seat with the point D located at the contact point of the template and the seat back. The seating reference point is located at point C.

The above displacements allow for:

- I. The 36 mm difference in the 'H-point to back of body' location for a child torso reference line relative to an adult torso reference line;
- II. A nominal compression of the seat back upholstery under a body form 'displaced torso reference line' test of 20 mm; and
- III. Displacements of the head form for Category 2 and Category 3 head restraints, relative to the 102 mm displacement of the head form for adult head restraints, of:

Category 2 seats - 86 mm;

Category 3 seats - 74 mm.

The nominal displaced torso reference line from which the head form displacement is measured is the torso reference line parallel to the uncompressed seat back cushion location when the specified moment about the seating reference point for the particular category of seat is applied to the seat back frame.

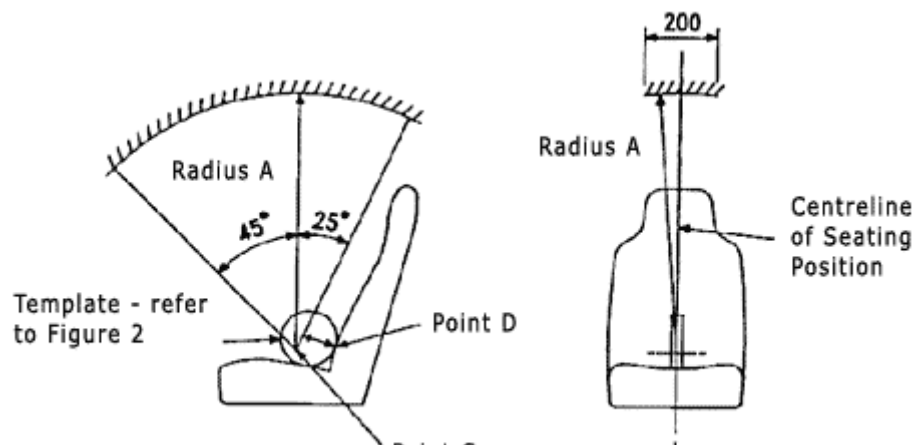


Figure 2- 14 seating reference point

## Initial point of contact VFPS

The initial point of contact between the bull bar and the pedestrian in the event of a collision should be as low as possible.

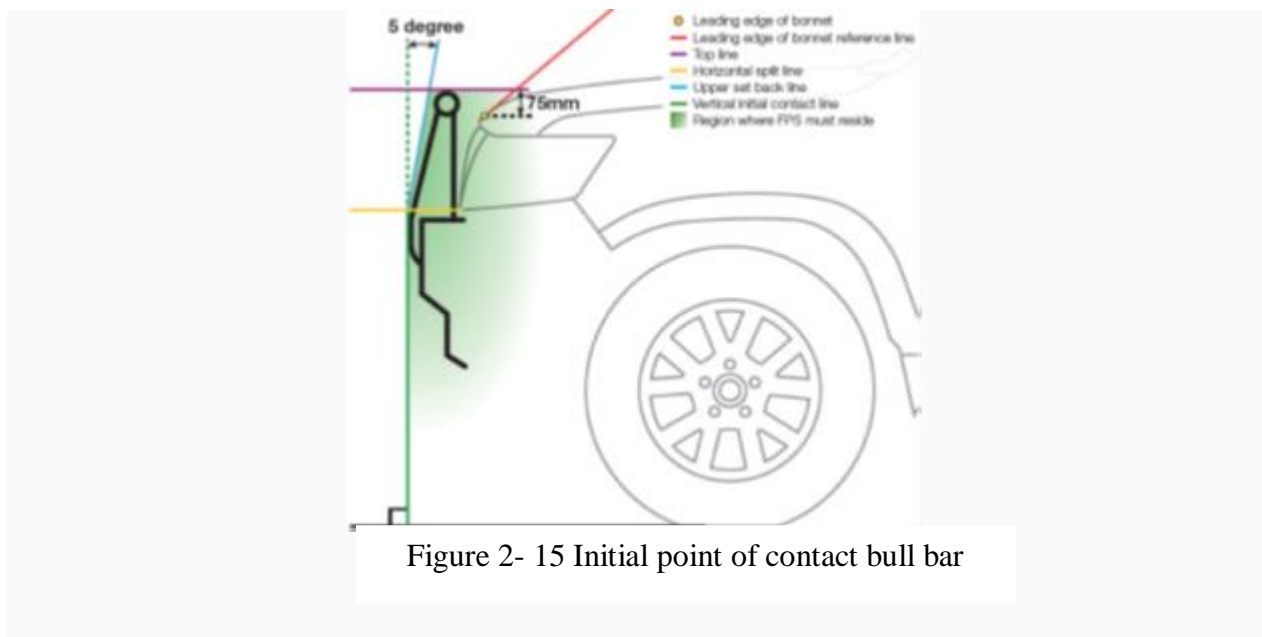
## Design and construction

The purpose of this guide is to inform manufacturers and retailers about the safety requirements applying to the design, specification, and fitting of vehicle frontal protection systems (VFPS) to light vehicles on South Australian roads. VFPS includes bull bars, roo bars, and nudge bars.

It provides an appropriate balance between the protection of vehicles from animal strikes and the safety of pedestrians, and other unprotected road users by offering clear guidance to help ensure that the VFPS complies with rule 29A of the Road Traffic (Light Vehicle Standards) Rules—the Light

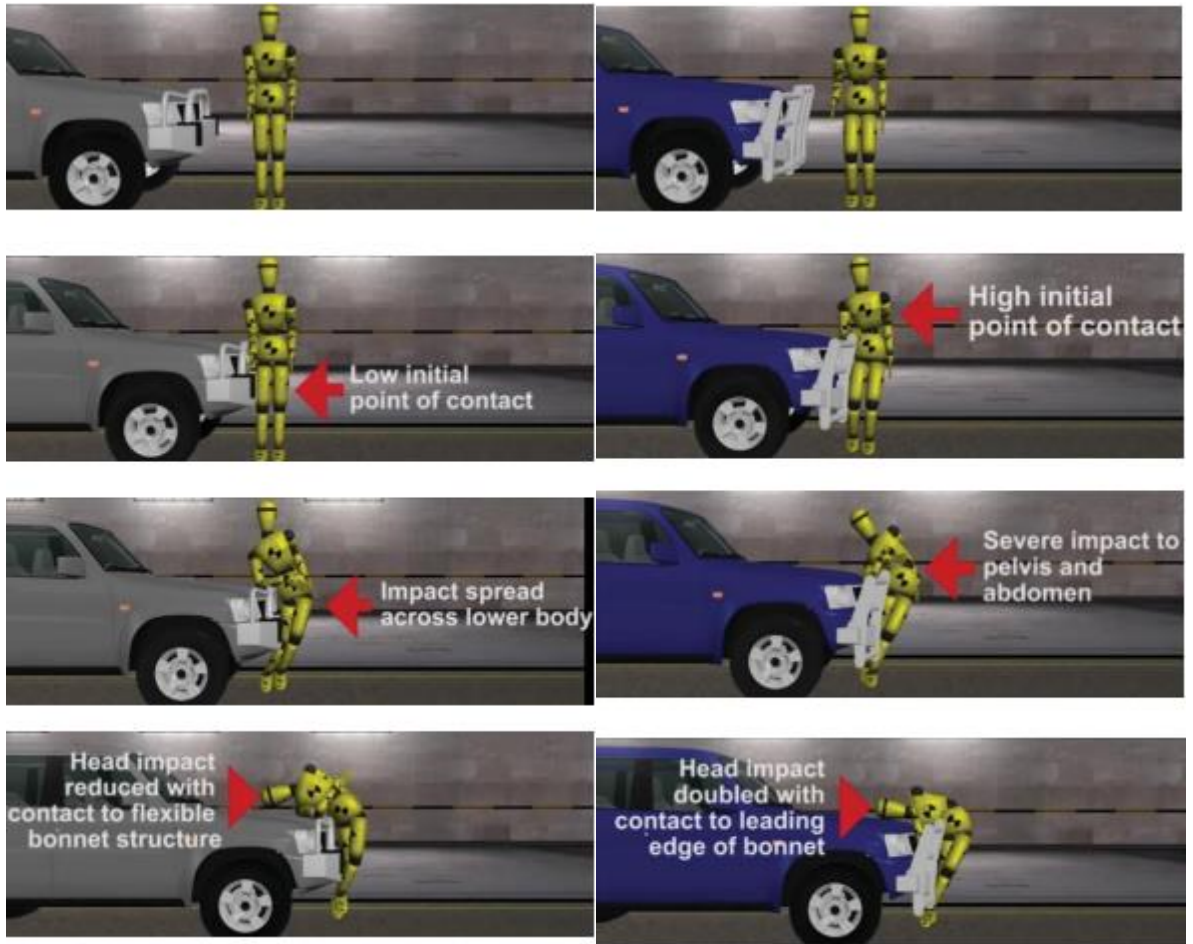
## Initial point of contact

The initial point of contact between the bull bar and the pedestrian in the event of a collision should be as low as possible.



### Determination of the leading edge of the bonnet

ANCAP Test Protocol Pedestrian Protection v8.5 (Jan. 2019, p.15) defines the 'Bonnet Leading Edge Reference Line' as shown in Diagram 3.



**Noncompliant bull bar**

**Compliant bull bar**

Figure 2- 16 VFPS has an unacceptable upright profile, the VFPS is too high

### Determination of the leading edge of the bonnet

ANCAP Test Protocol Pedestrian Protection v8.5 (Jan. 2019, p.15) defines the 'Bonnet Leading Edge Reference Line' as shown in Diagram 3.

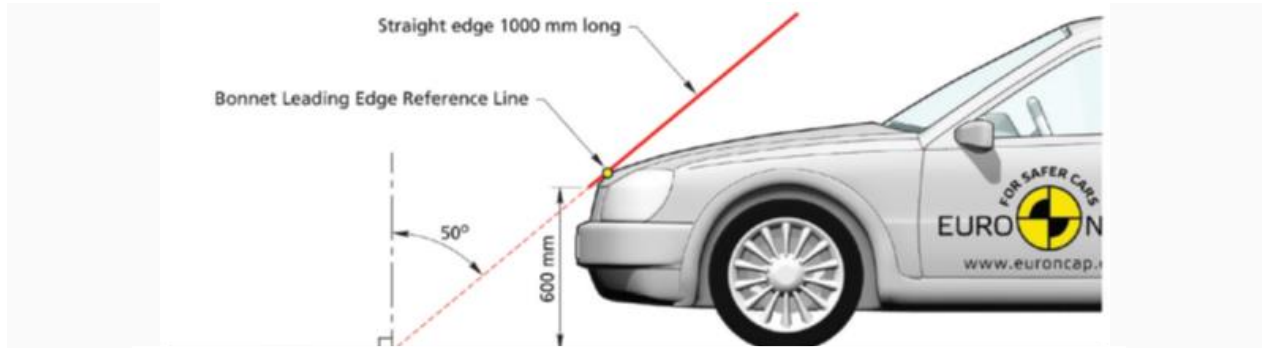


Figure 2- 17 Determination of the bonnet leading edge reference line

The definition, which can be used as a guide to determine the leading edge of the bonnet, is as provided in UN Regulation No. 127 Pedestrian Safety Performance which lays down requirements for the construction and functioning of motor vehicles and frontal protection systems in order to reduce the number and severity of injuries to pedestrians and other vulnerable road users.

Driving lights and other accessories that will obscure the driver's field of view must not be attached to the top rail of a VFPS.

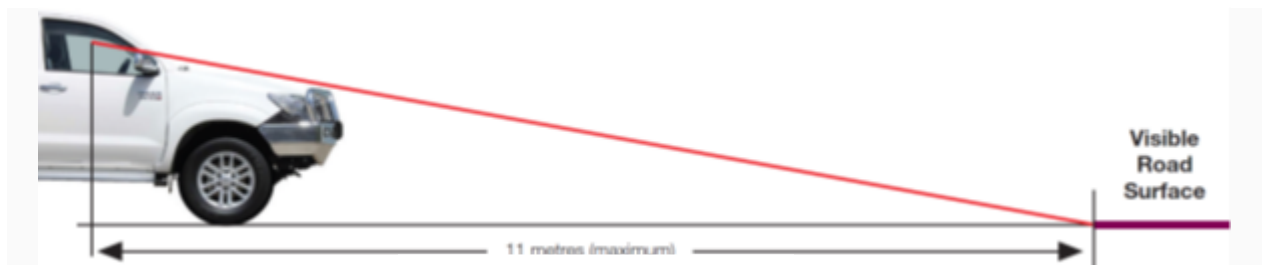


Figure 2- 18 Field of view

## Roof Rack Cross Rails

If something is carried on top of the vehicle that is longer or wider than the roof rack like paneling, plywood, or a mattress the wind can catch it while the vehicle is being driven. The item being carried could be violently torn off, and this could cause a collision, and damage the vehicle. Never carry something longer or wider than the roof rack on top of the vehicle unless using GM Certified accessory carrier. For vehicles with a roof rack, the rack can be used to load items. For roof racks that do not have cross rails included, GM Certified cross rails can be purchased as an accessory. See your dealer/retailer for additional information. Loading cargo on the roof rack that weighs more than 100 kg (220 lbs) or hangs over the rear or sides of the vehicle may damage the vehicle. Load cargo so that it rests evenly between the cross rails, making sure to fasten cargo securely. Typical cross rail spacing for most roof top accessories is 700mm (27.5 inches).

**Total load = cargo weight plus weight of accessories used to carry cargo.**

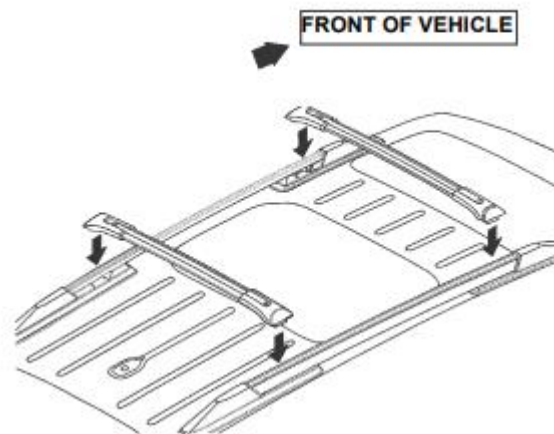


Figure 2- 19 Roof Rack Cross Rails

Both the lateral bars and the loading crossbars are equipped with 6mm slots in which any standard M6 fixing systems can be used.

The loading crossbars can also be positioned as desired according to your specific needs.

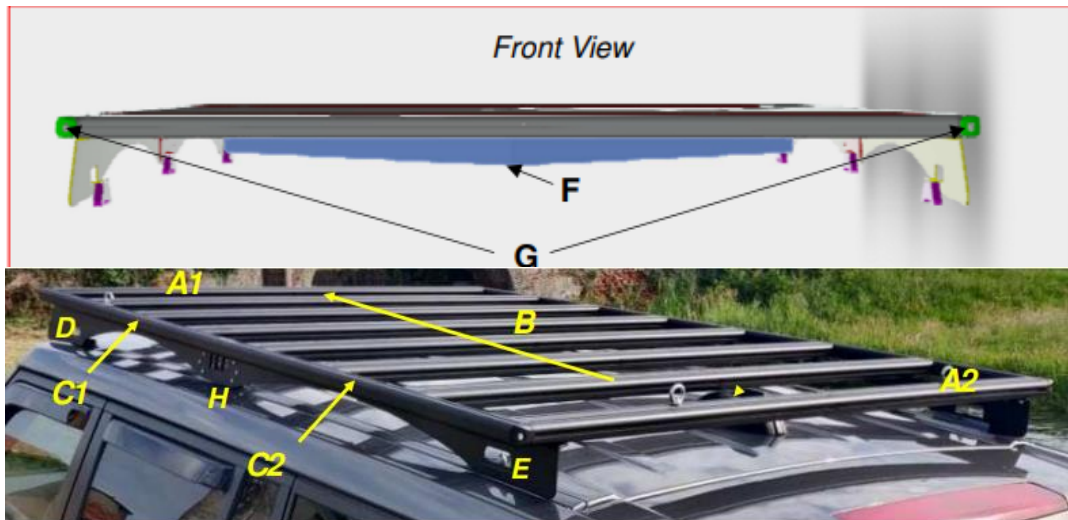


Figure 2- 20 position of crossbars

Nr.1 front crossbar - A1, Nr. 6 loading crossbars – B, Nr. 2 short side perimeter bars – C1

Nr. 1 rear crossbar - A2, Nr. 2 long side perimeter bars – C2, Nr. 2 front brackets – D

Nr. 2 middle brackets - H, Nr. 2 rear brackets – E, Nr. 1 wind deflector – F, Nr. 4 corner plates - G



## Operation Sheet 2.1

**Operation Title:** Cover door handle

**Purpose:** To installed door handle Cover

### Conditions or situations for the operations:

- ✓ Safe working area
- ✓ Properly operated tools and equipment
- ✓ Appropriate working cloths fit with the body

**Quality Criteria:** Assured performing of all the activities according to the procedures

### Precautions:

- Wearing proper clothes, eye glass
- Make working area hazard free
- Read and interpret manual which guide you how to use tools and equipment.

### Steps in doing the task

Step 1. Place the cover over vehicle door handle by inserting the hook located on the backside of the cover behind the door handle.

Step 2. Ensure the door handle cover is pressed firmly in place and as straight as possible for a tight seal against the vehicle door.

Step 3. Repeat steps 1 & 2 on the other door handles.



Width: 12"

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## Operation Sheet 2.2

**Operation Title:** Roof Rack Installation

**Purpose:** To installed over the bed

**Conditions or situations for the operations:**

- ✓ Safe working area
- ✓ Properly operated tools and equipment
- ✓ Appropriate working cloths fit with the body

**Equipment Tools and Materials:**

- Allen wrenches
- Stool or ladder
- Microfiber cloth and cleaning solution

**Quality Criteria:** Assured performing of all the activities according to the procedures

**Steps in doing the task**

Step 1. Asses and prepare vehicle

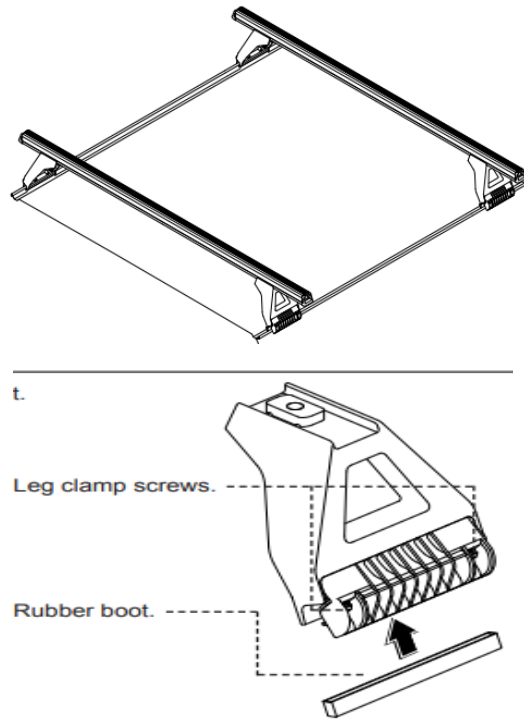
Step 2. Install crossbars (if necessary)

Step 3. Assemble roof rack

Step 4. Hoist roof rack above vehicle

Step 4. Attach roof rack

Step 5. Check stability



### Operation Sheet 2.3

**Operation Title:** Fitting carry boy

**Purpose:** To install carry boy

#### Conditions or situations for the operations:

- ✓ Safe working area
- ✓ Appropriate working cloths fit with the body

#### Equipment Tools and Materials:

- Pliers
- Socket wrench
- Combination wrench

**Quality Criteria:** Assured performing of all the activities according to the procedures

#### Steps in doing the task

Step 1. Install rubber truck on the truck bed

Step 2. Place hardtop on the truck bed and adjust alignment between left and right

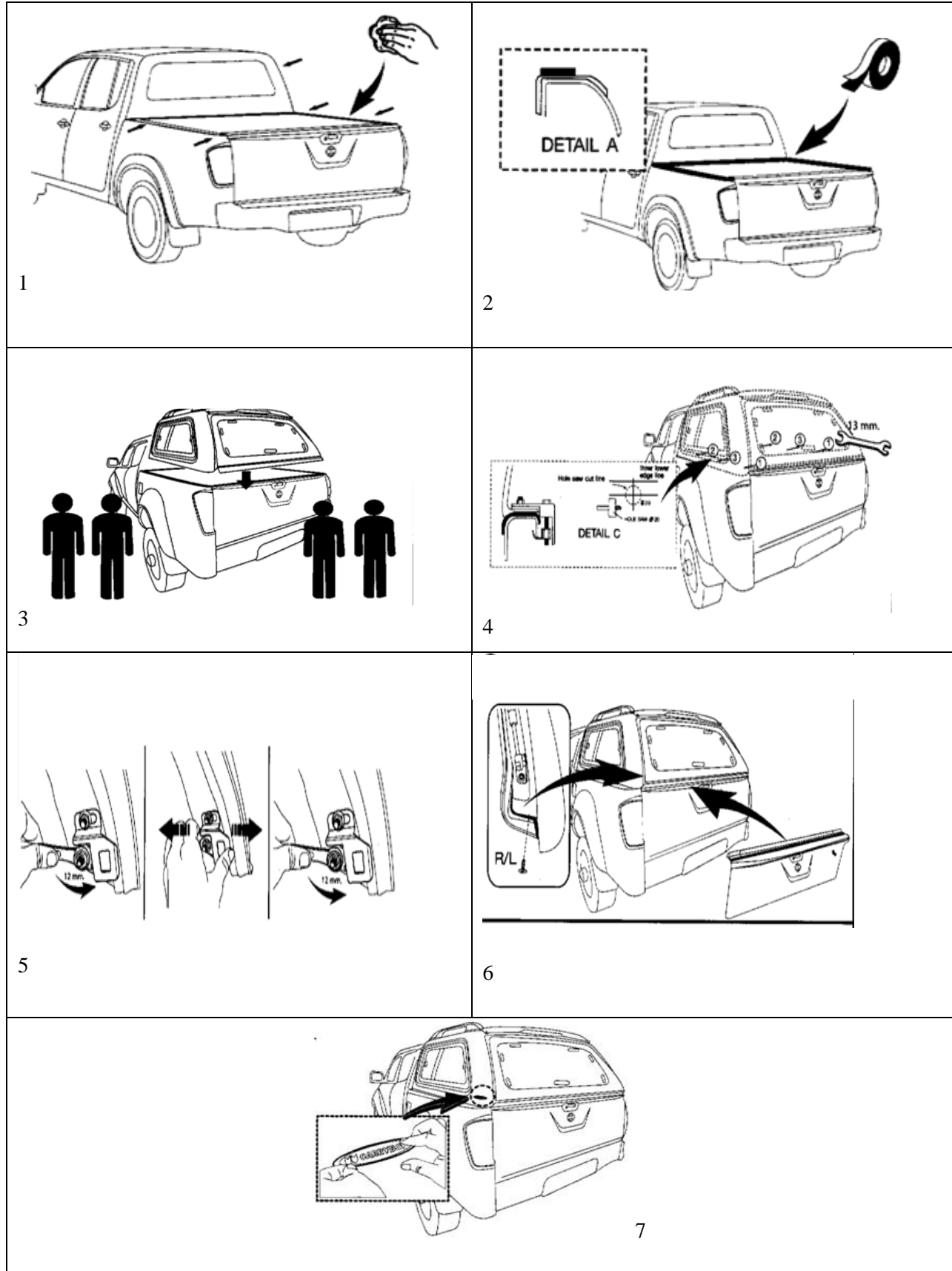
Step 3. Install kick clamp at 6 position

Step 4. Adjust a latch R/L for matching with the rotary lock on the rear door

Step 5. Seal silicon glue between aluminum truck bed of the weather.

Step 5. Strip to protect water leaking.

Step 7. Roof logo L/R carry boy emblem final check the appearance



## Operation Sheet 2.4

**Operation Title:** Bull Bar Installation

**Purpose:** To minimize the risk to pedestrian

**Conditions or situations for the operations:**



- ✓ Safe working area
- ✓ Properly operated tools and equipment
- ✓ Appropriate working cloths fit with the body

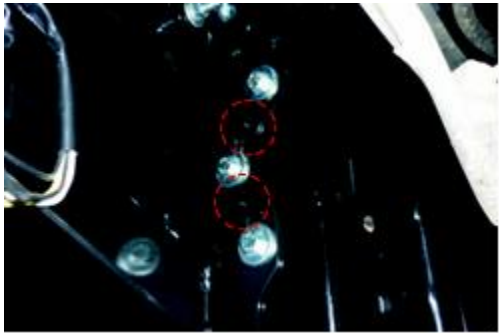
**Equipment Tools and Materials:**

- Allen wrenches
- Socket wrench

**Quality Criteria:** Assured performing of all the activities according to the procedures

**Steps in doing the task**

<p>Step 1. Before installation check bull bar application  is compatible with your vehicle.</p>	
<p>Step 2. Remove bumper bar, grill, factory crush cans,  tie down points and recovery hook.</p>	
<p>Step 3. Fit chassis bracket to chassis using M10 bolts, flat washers and spring washers into original bumper bolt holes. Refit original recovery hook on right hand side and tie down point on left hand side using original bolts.</p>	
<p>Step 4. Mask and paint lower lips of front mud guards  and panel under headlights satin black.</p>	
<p>Step 5. If winch is being installed, refer to winch installation instructions</p>	

<p>Step 6. Unwrap bull bar. Check over riders and light assemblies are tight in bull bar before installation</p>	
<p>Step 7. Fit bull bar to chassis brackets using M12 bolts, flat washers, spring washers and nuts provided. Align bull bar with vehicle leaving a 10mm gap between bull bar wing and mudguard flare to allow for movement between body and chassis.</p>	
<p>Step 8. Once bar is aligned with vehicle and tightened, drill through pinning holes between bull bar and chassis bracket and secure with bolts, washers and nuts provided.</p>	
<p>Step 9. Connect park lights, indicators and fog lights as per wiring diagrams at the back of instruction manual.</p>	
<p>Step 10. Trim guard liners as required.</p>	
<p>Step 11. Fit protection plate to underneath of bull bar using M8 bolts, spring washers and flat washers.</p>	

### Self-check 2.1

**Directions:** Answer all the questions listed below.

#### Part I: Fill in the blank space

1. \_\_\_\_\_ it is used to carry bulky items such as luggage, bicycles, canoes, kayaks, skis, or various carriers and containers.
2. \_\_\_\_\_ is a line or band that differs in color or tone from an adjacent area.
3. \_\_\_\_\_ are located on the bottom of the car (on one or both sides), usually at the foot of the car door..
4. \_\_\_\_\_ is a set of bars secured to the roof of a automobile.
5. \_\_\_\_\_ is a device installed on the front of a vehicle to protect its front from collisions.

#### Part-II: Choose the correct answer from the given alternatives

1. The Door Handle Cover is designed to fit most vehicles with a door handle that curves outward
  - A. True
  - B. False
2. Which one is from the following decorative metal or plastic disk that snaps or bolts onto and covers the entire face of the wheel?
  - C. Roof rack
  - C. Stripe
  - D. wheel cover
  - D. A & B
3. Which one is from the following help to protect the seats from daily abuse- kids, dogs, dirt, spills, weekend adventures?
  - A. Foot step
  - C. Retrofitting
  - B. Bull bar
  - D. assess requirements
4. Which one is from the following decorative metal or plastic disk that snaps or bolts onto and covers the entire face of the wheel?
  - A. Roof rack
  - C. Stripe
  - B. Wheel cover
  - D. A & B
5. \_\_\_\_\_ is located on the bottom of the car (on one or both sides), usually at the foot of the car door?
  - C. Foot step
  - C. Seat cover
  - D. Bull bar
  - D. A & B

**Part-III: Answer the following questions accordingly.**

1. Write types of automobile roof racks, depending up on the vehicle roof?
2. What is the purpose of wheel cover?



## Unit Three: - Advise Customer

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Providing information

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Provide information

### 3.1 Providing information

Vehicle regulations are requirements that automobiles must satisfy in automotive standards. Regulation, vehicle law, regulation of technologies.

### Using a Net Promoter Score

A quick and easy way to measure customer service is to use a Net Promoter Score – a simple system that at a basic level gives your business a score out of ten. It’s a score given by customers in response to the question: “How likely is it that you would recommend our company to a friend or colleague?” Customers scoring 9-10 are called promoters – they tend to buy more products from you and remain longer as customers. Those scoring 7-8 are known as passives and can be developed into promoters. A score of 0-6 is given by customers who are detractors – they are less likely to continue being valuable customers.

The trick to measuring your customer service is to understand what makes the promoters happy with your customer service and where it’s going wrong for the detractors. A NPS score helps you identify promoters and detractors and adjust your communications and relationship with them accordingly.

### Cost Accounting

In cost accounting, a cost object is anything (a product line, a unit, a batch) that’s used to accumulate costs. A customer can also be a cost object. Looking at costs and profit per customer helps you make good decisions about your limited capacity and customer profit.

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Technology allows companies to analyze data for many customers. Computer programs can easily separate and review lots of customer data on costs and profits.

Small companies may not have the technology for complex analysis. If that's the case, customer analysis applies best to companies with a limited number of customers or those who have excellent homogeneous customer data.

### **Prepare vehicle component part for delivery to customer or installation**

These general terms and conditions are applicable to all agreements with regard to purchase and Performance of work, concluded between customers and vehicle component part companies and Buyers/customers operating a business or exercising a profession.

### **In these terms and conditions the terms below have the following meaning:**

- **Vehicle component Part Company:** the vehicle component partcompany allied with customers and vehicle component partcompanies whom sells/supplies goods and/or performs work directly or indirectly for buyer/customer.
- **Buyer:** the person, operating a business or exercising a profession, who purchases goods from the vehicle component partcompany.
- **Customer:** the person, operating a business or exercising a profession, who gives the vehicle component partcompany an assignment to perform work (or have it performed).
- **'Goods'** shall mean inter (vital parts/separate components of) trade-in engines/completely overhauled engines and/or (vital parts/separate components of) trade-in technical Components/completely overhauled technical components, pertaining to vehicles/vessels or stationary installations.

### Self-check 3.1

**Directions:** Answer all the questions listed below.

**Part-I: Answer the following questions accordingly.**

1. Discuss the following for written below?
  - A. Vehicle component Part Company
  - B. Buyer
  - C. Customer
  - D. Goods
  - E. Vehicle regulations

**LAP Test**  
**Practical Demonstration**

**Name:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Time started:** \_\_\_\_\_

**Time**

**finished:**

\_\_\_\_\_

**Instruction:** Perform the following tasks

Task 1: Fit the following accessories and components

- I. Bull bar
- II. Roof racks
- III. CARRY boy

Task 2: Relocating the following accessories

- I. Seat cover
- II. Bull bar
- III. Steps

## Reference

1. The Clean Vehicle Retrofit Technology Guide, Daniel Hayes, Zemo.org.uk
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3. Roof Rack Cross Rails Manual, Service part operation
4. Roof rack Range rover L322 Fitting Guide
5. Rhino heavy duty gutter mount guide
6. AERO WHEEL COVER CATA LOG
7. SJS 2018 wheel covers custom design
8. CUSTOMER INSTRUCTIONS FOR RETROFIT ZIP CLEAN SEAT

### Web cite:

URL: <https://www.britannica.com/technology/drill-tool>

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