INEOS

GRENADIER

Body Builders Guide


INEOS
GRENADIER

TABLE OF CONTENTS

INTRODUCTION

1.0 Introduction

These guidelines provide body manufacturers (legal entities) and conversion engineers (natural persons), hereinafter collectively referred to as "body manufacturers", with important technical information that must be considered when planning and building a body that is roadworthy and safe for traffic. The attachment, assembly, installation or conversion work required for this purpose is hereinafter referred to as "body assembly work".

This body/equipment mounting guideline is based on the development of the vehicle INEOS Grenadier - Station Wagon, Pick-up and Chassis Cab.

Due to the vast number of body manufacturers and associated companies, INEOS Automotive is not able to foresee all possible changes that may occur as a result of body mounting work, e.g. regarding handling, stability, weight distribution, centre of gravity of the vehicle and its handling characteristics. Therefore, INEOS Automotive does not accept any liability for accidents or injuries resulting from such modifications to its vehicles. The manufacturer is obligated to ensure that their body modifications are free of defects - also with regard to the vehicle as a whole - and does not result in danger to persons or property. In the event of a breach of this obligation, the body manufacturer is subject to its own product liability.

This body/equipment mounting guide is intended for professional body manufacturers. For this reason, this body manufacturer guideline assumes a corresponding level of background knowledge.

In addition, the body manufacturers must comply with the operating instructions valid for the vehicle in question. Please note that some work (e.g. welding work on load-bearing parts) may only be carried out by appropriately qualified personnel in order to avoid the risk of injury and to achieve the quality required for body mounting work.

NOTE: As a body manufacturer, you must ensure that only the body mounting work described in these guidelines is permitted. Any body/equipment mounting work not described in these guidelines is not permitted.

NOTE: It is the responsibility of the body converter to check that they are using the latest version of the INEOS Body builders guide. The latest version of the guide can be found on the INEOS Aftersales portal, local website or by contacting your vehicle supplying agent.

Additional disassembly and technical information can be found via the INEOS Aftersales portal.

For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

1.1 Concept of this body / equipment guideline

To help you find information quickly, the following build-up guideline is divided into 10 chapters:

- Chapter 1 - Introduction
- Chapter 2 - General
- Chapter 3 - Planning of bodies
- Chapter 4 - Technical limits for planning

- Chapter 5 - Damage prevention
- Chapter 6 - Modifications to the basic vehicle
- Chapter 7 - Design of bodies
- Chapter 8 - Electrics / electronics
- Chapter 9 - Calculations
- Chapter 10 - Technical Details

Appendix:

For further information, see subsection 2.2 “Product and vehicle information for body manufacturers”.

The index in PDF format is linked to help you find the information you require quickly.

The limit values specified in chapter 4 “Technical limit values during planning” must be observed and must form the basis of the planning.

The chapters "Modifications to the basic vehicle", "Design of bodies" and "Electrics / electronics" represent the main chapters for the technical content of the guideline.

In order to ensure the operational and traffic safety of the complete vehicles, the instructions given in this guideline for body / equipment mounting must be strictly observed.

Body manufacturers must design and fabricate their vehicles in a manner that ensures compliance with the laws and regulations, including safety and exhaust gas standards, applicable to the finished vehicles in their respective countries.

- When making modifications / alteration to vehicles, it is important to carefully design and fabricate them in a way that meets various relevant laws and regulations with a sufficient margin. These laws and regulations always set the minimum requirements that must be adhered to in the specific body-building or alteration work.
- Ensure that the materials used for body construction or modifications meet the necessary legal requirements, performance standards, and safety regulations, while also striving to make the resulting vehicle as lightweight as possible.
- Upon completion of the body construction or alteration work, inspect the materials and parts used to verify that they have been manufactured according to design specifications, meet predetermined performance requirements and functionality, and are free from any defects.

All body manufacturers must ensure that the original functions of the base vehicle are not compromised during the body construction or alterations. Additionally, a thorough investigation should be conducted to confirm that any modifications to standard parts do not pose any functional issues from both technical and safety perspectives.

- The visibility of the forward view must not be obstructed by the body construction or alterations.
- The chassis must remain undamaged during the body construction or alterations.

- The weight distribution between the right and left wheels should remain consistent after the body construction or alterations.
- All body construction tasks should be carried out in a way that prevents local load concentration on the chassis frame. To evenly distribute the load across the frame, all wheels should be positioned on the same plane without causing any distortion to the frame.
- The materials and components used in the body construction or modification process should be designed and manufactured in a way that allows for easy inspection and maintenance of the chassis components once they are installed on the vehicles.
- Restrictions are established for the dimensions and weight of the components installed based on the specific base vehicle. It is important to adhere to any limitations set in each country regarding the length, width, height, and weight of the parts.

NOTE: All INEOS Automotive vehicles as delivered from factory meet Global Cyber Security requirements for the markets INEOS Automotive sell within. If any part of the Electrical Harness, Modules or associated components are altered in anyway, then it is the responsibility of the Body-builder to ensure local Cyber Security requirements are still met.

NOTE: Any reference to standards, directives, or regulations in this publication was deemed correct and relevant at the time of publication. It is the converter's responsibility to verify that these standards, directives, or regulations have not been superseded and are still relevant. If any have been superseded, the most current version should be used.

NOTE: All graphics are intended for illustration purposes only, and do not faithfully reproduce all technical details.

NOTE: This publication was accurate at the time of printing. However, we reserve the right to develop, improve, and change any equipment, specifications, and information without notice or obligation. The manufacturer and agent/dealer will not be held responsible for any inaccuracies or their consequences. Software instructions and procedures in this book were correct at the time of printing, but software and information may be updated over the vehicle's lifetime. For the latest information, please refer to the online version at the INEOS Aftersales portal.

1.2 Means of representation

WARNING: The WARNING symbol, seen throughout, alerts you to particular risks that, if not avoided, could result in serious injury and death. Pay extra attention to the information and precautions that follow this symbol.

CAUTION: The CAUTION symbol, seen throughout, alerts you to particular risks that, if not avoided, could result in damage to the vehicle and/or components. Pay extra attention to the information and precautions that follow this symbol.

NOTE: The NOTE symbol alerts you to other information of particular importance.

*NOTE: **ENVIRONMENTAL NOTICE** - The ENVIRONMENTAL NOTICE with the NOTE symbol alerts you to environmental information of particular importance.*

1.3 Vehicle safety

WARNING: Before installing third-party bodies or units, it is essential to read the chapters on installation in this body builders guide, in the instructions and notes of the unit suppliers and in the detailed operating manual for the basic vehicle. Otherwise, you may fail to recognise dangers and endanger yourself or others.

Notes on vehicle safety

We recommend that you use parts, assemblies, conversion parts or accessories that are suitable for the respective vehicle type and have been tested by INEOS Automotive.

If you use non-recommended parts, units, conversions or accessories, have the vehicle safety checked immediately.

NOTE: It is essential to observe national registration regulations, as body work on the vehicle can change the vehicle type under registration law and invalidate the operating permit. This applies to:

- *Modifications that change the vehicle type approved in the type approval.*
- *Modifications that are likely to endanger road users.*
- *Modifications that worsen the exhaust or noise behaviour.*

Vehicle modifications by the body manufacturer

Before starting body mounting work, the body manufacturer must check whether:

- The vehicle is suitable for the planned body.
- The vehicle type and the equipment also comply with the operating conditions after the body has been fitted.

Approval is possible by means of an individual approval procedure (with exemptions) under the customer's own responsibility with the help of their own expert.

The body manufacturer must inform the officially recognised expert or inspector of any modifications to the basic vehicle. The inspection and testing organisations decide on compliance with laws and regulations following any modifications to the basic vehicle and thus on whether the complete vehicle can be registered.

The body manufacturer, in cooperation with its customer and in consultation with an officially recognised expert, is responsible for

approving the vehicle for the customer's purposes by means of individual approval.

Inspections by official test centres or official approvals do not necessarily guarantee compatibility with all functions and systems in the basic vehicle.

For further information, contact your INEOS service agent, use the "Contact Us" page on your local INEOS website. Alternatively, see section 2.1 "Advice for body Manufacturers".

NOTE: Observe country- specific laws, directives and registration regulations at all times.

1.4 Operating safety

WARNING: Modifications to electronic components, their software, or cabling may impair their function and that of other connected components. This can affect safety-relevant systems, causing them to malfunction and jeopardise the vehicle's operational safety. There is an increased risk of accidents and injury! Do not tamper with wiring or electronic components or their software. Always have work on electrical and electronic devices performed at a qualified specialist workshop.

Some safety systems only function while the engine is running. Therefore, do not switch off the engine while driving!

NOTE: Be aware that the chassis cab will be delivered without its rear lights mounted, and some parts are only temporary fixed for transport. This means that it is not allowed to drive the chassis cab on public roads without prior modifications.

1.5 Note on copyright protection

This body/equipment guideline and the text, images and data material it contains are protected by copyright. This also applies to the editions on other media.

If you have any questions about this body/equipment guideline, please contact your INEOS supplying agent.

1.6 Publication information

Issue 1 / Published date: 19th July 2024 / Publication No: IAL 240628

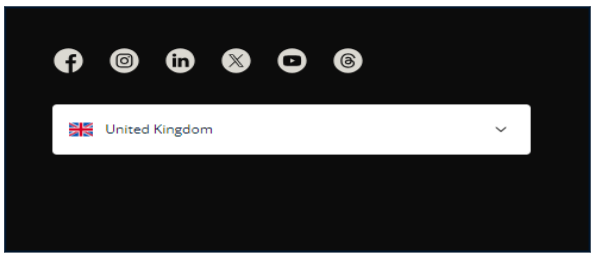
GENERAL

2.1 Advice for body Manufacturers

Technical advice for basic vehicle

Any questions or enquires can be directed via the "Contact Us" section on your local INEOS GRENADIER web page.

Make sure you use your local web page or select your Country from the drop down box to get the correct contact details for your region.



Additional information can be found on the INEOS Aftersales portal or through your INEOS Supplying agent or INEOS Aftersales centre.

2.2 Whole Vehicle Type Approval (WVTA) and EU Certificate of Conformity (CoC)

The REGULATION (EU) 2018/858 sets out the requirements for the approval of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles. In this directive, regulations were also issued for the approvals of vehicles that are manufactured in several production stages, the multi-stage type-approval procedure. As a result, each manufacturer involved in the construction of a vehicle is responsible for approving modi ied or added scopes at its stage of manufacture. The manufacturer may choose one of the four following procedures:

- EU Whole Vehicle Type Approval (WVTA)
- EU small series type approval
- National small series type approval
- Individual Vehicle Approval

CoC stands for Certi icate of Conformity. A document attesting to the conformity of certain goods - i.e. also of vehicles and bodies - to recognised (international) standards. The purpose of this EU Certi icate of Conformity is to facilitate the approval of goods on international markets. Therefore, the document is needed mainly in

import and export as a part of customs clearance. The manufacturer who holds an EU type approval or EU small series type approval is obliged to enclose a Certificate of Conformity with every vehicle that corresponds to an approved type.

Approval is possible by means of an individual approval procedure (with exemptions) under the customer's own responsibility with the help of their own expert.

The body manufacturer is responsible in cooperation with its customer - in consultation with an officially recognised expert - for approving the vehicle for the customer's purposes by means of individual approval.

2.2.1 Exhaust gas certification

Testing for the Grenadier ex-factory is only carried out on the engine test bench in accordance with Directive 715/2007/EU.

The engine test bench cycle WLTP (Worldwide Harmonised Light-Duty Vehicles Test Procedure) is applied.

2.3 Product safety and product liability

2.3.1 Product Safety

Both vehicle manufacturers and body manufacturers must ensure that the products they produce are only placed on the market in a safe condition and that they do not pose a risk to people or property. Failure to do so may result in civil, criminal and/or public prosecution.

In principle, each manufacturer is liable for the products they produce.

The body manufacturer must ensure compliance with Directive 2001/95/EC on general product safety.

The body manufacturers must also ensure compliance with standards on functional safety (preferably ISO 26262).

2.3.2 Product liability

The body manufacturer is responsible for the operational and road safety of the body mounting work carried out, in particular for:

- Checking and maintaining the operating and driving safety of the entire vehicle after body mounting work has been carried out (driving, braking and steering behaviour must not be affected by the body mounting work).
- Influences of body mounting work on the basic vehicle.
- Consequential damage caused by body mounting work.
- Consequential damage resulting from the subsequent installation of electrical and electronic systems.
- The maintenance of the functional safety and the free movement of all moving parts of the basic vehicle (e.g. axles, springs, prop shafts, steering, shift linkage, etc.) after body mounting work has been carried out, also in the case of diagonal torsion of the vehicle.

Any work carried out or modifications made to the basic vehicle or body must be entered in the maintenance booklet.

2.3.3 Safety-relevant features

Safety-relevant features are components or systems whose defectiveness or failure may result in immediate danger to life and limb of road users.

INEOS Automotive recommends assessing the safety relevance of components or functions for the following work:

- Modifications to the basic vehicle
- Vehicle installations
- The interface between vehicle and body (mechanics, electrics/electronics, power take-offs, hydraulics, pneumatics)

A component or function is to be classified as safety-relevant, if one of the ten following safety functions is affected:

- Occupant protection in the event of an accident
- Prevention of momentary loss of road view
- Avoidance of loss of steer-ability
- Avoidance of loss or partial loss of braking function
- Avoidance of the loss of driving function
- Avoidance of uncontrolled propulsion
- Avoidance of sudden loss of propulsion power
- Avoidance of leakage of operating fluids/fire hazard
- Avoidance of loosening of cargo/trailers/parts/structures/ semi-trailers
- Avoidance of injuries during operation and other handling of the vehicle.

The following customer-related influences must be considered when assessing safety relevance:

- Extreme operating conditions
- Wear and tear
- Environmental conditions
- Duty cycle of the vehicle.

Documentation

If safety relevance is identified in accordance with the ten safety aspects, these must be marked as safety-relevant in paper and data records, and the associated functions and features, as well as measures taken to avoid the hazards, must be documented.

2.4 Ensuring traceability

Hazards of the body detected after delivery may require subsequent measures on the market (customer information, warning, recall). To make these measures as efficient as possible, traceability of the product after delivery is required.

For this purpose and in order to be able to use central vehicle registers in the domestic territory or comparable registers abroad for the identification of affected keepers, we strongly recommend

that body manufacturers store the serial number/identification number of their body linked to the vehicle identification number of the basic vehicle in their databases. It is also advisable to store the addresses of customers for this purpose and to give subsequent purchasers the opportunity to register.

2.5 Trademark

2.5.1 The INEOS Automotive brand in interaction with external body manufacturers

In INEOS Automotive's relations with body manufacturers, not only the aspects of product safety and product liability are of particular importance, but also the use of the trademark.

The aim of the guideline is to present the brand-related INEOS Automotive interests for the Grenadier to the body manufacturers.

The individual provisions of the guideline do not release the body manufacturers from their liability for subsequent modifications to INEOS Automotive vehicles.

2.5.2 The function of the brand

Any company with the goal of a successful brand must consistently ensure the preservation of brand functions. This applies equally to the brands of INEOS Automotive.

The brand identifies the origin of a product and enables the recognition and recognition of a product. The brand guarantees the quality of a product and embodies its characteristic values and identity.

2.5.3 Trademark protection

Trademark protection grants INEOS Holdings Ltd. the exclusive right to use its trademarks.

2.5.4 Trademark rights

The "INEOS Logo", the INEOS badge and the word mark/lettering "INEOS" are trademarks (registered trademarks) of INEOS Holdings Ltd.

GRENADIER

Graphic of INEOS logo/trademark

2.5.5 Use of Automotive trademarks

Principle

A change of the INEOS Automotive trademarks on INEOS Automotive vehicles is not permitted.

It is not permitted to affix the INEOS Automotive trademarks to vehicles and parts other than those of the INEOS Automotive brand.

INEOS Automotive trademarks in the case of technical modifications

In the case of vehicle modifications which comply with the INEOS Automotive body builders guide, the INEOS Automotive trademarks may be left unchanged on the vehicle.

Far-reaching vehicle modifications interfere significantly with the original condition of the vehicles, e.g. by interfering with the chassis, the body structure, the engine, the braking system or the vehicle electronics. These are not covered by the body / equipment mounting directives. This can result in deteriorations and risks to the overall vehicle for which INEOS Automotive is not liable from a product liability and product safety point of view.

INEOS Automotive reserves the right to insist on the removal of trade marks from converted vehicles.

2.5.6 Brand Separation/identity

Principle

INEOS Automotive series have specific characteristics, value dimensions and a brand-specific design. Changes should be made in line with the INEOS Automotive design characteristics.

The separation of INEOS Automotive trademarks and body manufacturer trademarks ensures that a distinction can be made between the brands. This applies in particular to the origin and the responsibilities to be derived from it.

If the vehicle does not comply with the requirements set by INEOS Automotive, INEOS Automotive reserves the right to demand the immediate removal of the trademarks.

A) Trademarks at the front on the vehicle

Use of the INEOS logo

- For any vehicle modifications that are approved by INEOS Automotive Limited, INEOS logos and badges may be used on the vehicle in their base vehicle locations, or as near as possible to them
- If the Body builder wishes to apply their own trademark to the vehicle, then this must be agreed with INEOS Automotive Limited in writing. There should be an appropriate distance to the INEOS logo
- Under no circumstance should the INEOS logo or branding be modified.

Use of the INEOS badge

- The INEOS badge is a mark of original INEOS Automotive design. It may only be retained on vehicles with INEOS Automotive original cabs.
- If the vehicle BIW and/or exterior panels are modified B-Pillar forward, the modifier must apply to retain the INEOS logo on the front of the vehicle and the front wing.

Model series and vehicle type designation on the front of the vehicle

The Grenadier has no model series designations on the front of the vehicle. Vehicles modified by body manufacturers may therefore not be provided with model series designations.

B) Trademarks at the rear of the vehicle

Use of the INEOS logo

- If the rear tailgate is modified, the modifier must apply to retain the INEOS logo
- If the INEOS logo is affixed to the rear of a vehicle whose appearance has been radically altered by body manufacturing work or modification, INEOS Automotive reserves the right to demand that the INEOS logo must be removed immediately. It is recommended that the body manufacturer coordinates this with INEOS Automotive prior to attachment.

Body manufacturer trademarks in conjunction with INEOS Automotive trademarks

Body manufacturers applying their trademarks to their body must ensure that they are applied with appropriate distance to the INEOS Automotive trademarks and badges.

C) Interior branding

All interior elements (e.g. seats, interior trim, etc.) integrated by the body manufacturer must not be marked with INEOS Holdings trademarks (e.g. INEOS logo or "INEOS" lettering).

2.5.7 Communication of trademarks

The use of INEOS Automotive trademarks in communication

> The body manufacturer must be clearly identifiable as the originator of the communication in all its means and channels of communication.

> When depicting modified vehicles that comply with INEOS Automotive guidelines and bear our trademarks, care must be taken to ensure that the modification of the vehicle or the vehicle modification by the body manufacturer is visible in the depiction. Only the conspicuous display of the INEOS Automotive trademark without visible body manufacturing work, extension or modification is not permitted.

2.6 Accident Prevention

The body and the attached or installed equipment must comply with the applicable laws and regulations as well as the occupational health and safety and accident prevention regulations, safety rules and information sheets of the accident insurance institutions.

The laws, standards, guidelines, etc. on occupational safety and accident prevention in the operation of vehicles, equipment and machines (general machine guidelines) must be complied with in order to avoid operating uncertainties during vehicle use and all necessary technical precautions must be taken in accordance with the current state of the art.

It is essential to observe country-specific laws, guidelines and approval regulations.

Responsibility for compliance with these laws, directives and regulations lies with the body manufacturer and equipment manufacturer.

2.7 Recycling of components - Recycling

NOTE: ***ENVIRONMENTAL NOTICE:*** *The following principles for environmentally compatible design and choice of materials should be taken into account as early as the planning stage for body attachments and bodies, in particular with regard to the EU Directive on end-of-life vehicles 2000/53/EC.*

The body manufacturer must ensure that the attachments and bodies (or conversions) comply with applicable environmental laws and regulations, in particular EU Directive 2000/53/EC on end-of-life vehicles and EU Directive 2003/11/EC relating to restrictions on the marketing and use of certain dangerous substances and preparations (flame retardants). Also keep Directive 2005/84/EC (phthalates) in mind.

Likewise, within the framework of the European chemicals' regulation REACH (Registration, Evaluation and Authorization of Chemicals, Regulation (EC) No. 1907/2006), there is an obligation to provide information in accordance with Article 33 on substances contained in structures, products and articles that meet the criteria of Article 57

and Article 59, Paragraph 1, and whose concentration exceeds 0.1 percent by weight.

In the case of single invoice transactions with INEOS Automotive, there is an obligation to provide information on bodies, products and articles containing the substances in question.

The installation documents of the conversions must be kept by the vehicle owner and, in the event of vehicle scrapping, handed over to the dismantling company. This way, environmentally responsible recycling is ensured for retrofitted vehicles.

- Avoid materials with risk potential such as halogen additives, heavy metals, asbestos, CFC and CHC.
- Take into account EU Directive 2000/53/EC.
- Preferably use materials that allow recycling and closed material cycles.
- Select materials and manufacturing processes that produce only small quantities of easily recyclable waste during production.
- Use plastics only where they offer cost, functional or weight advantages.
- In the case of plastics, especially in the case of material composites, only mutually compatible substances of a material family may be used.
- For recycling-relevant components, keep the number of plastic types used as low as possible.
- Check whether a component can be manufactured from recycled material or with recycled additives.
- Ensure that recyclable components can be easily dismantled, e.g. by means of snap-fit connections, predetermined breaking points, good accessibility, use of standard tools.
- Ensure simple, environmentally compatible removal of operating fluids by means of drain plugs etc.
- Wherever possible, avoid painting and coating components; use coloured plastic parts instead.
- Design components in accident-prone areas to be damage-tolerant, repairable and easily replaceable.
- Mark all plastic parts in accordance with VDA Material Sheet 260 ("Components of motor vehicles; marking of materials").

2.8 Quality System

Global competition, increased customer quality requirements for the entire vehicle, national and international product liability laws, new organizational forms and increasing cost pressure call for effective quality assurance systems in all areas of the automotive industry.

The requirements for such a quality management system are described in DIN EN ISO 9001.

For the reasons stated above, INEOS Automotive strongly recommends that all body manufacturers set up and maintain a

quality management system based on the specifications of DIN EN ISO 9001, including the following requirements:

- Definition of responsibilities and authorities including an organisational chart
- Description of processes and procedures and their interactions
- Appointment of a quality management representative
- Execution of contract and build-ability inspections
- Execution of product tests based on predefined procedures in test instructions
- Regulation of the handling of defective products
- Documentation and archiving of test results
- Ensuring that employees have up-to-date qualification certificates
- Systematic monitoring of test equipment including process assurance of retrograde risk assessment
- Systematic marking of materials and parts
- Implementation of quality assurance measures at suppliers
- Ensuring the availability of the process, work and test instructions in the areas and at the workplaces and keeping them up to date
- Documentation of customer-specific requirements (AQAP, QMP, FMEA, acceptance protocols, measurement protocols of individual parts etc.)
- Data provision between the contractual partners must be ensured according to an agreed format (data format, exchange server, etc.).

PLANNING OF BODY MODIFICATIONS

3.1 General Information

When planning vehicle body work, the selection of a suitable basic vehicle depends on the operating conditions of the subsequent complete vehicle.

Please note the following:

- Design of the basic vehicle to meet requirements.
- Body variant.
- Standard and special equipment.

For orientation purposes, also use the type plate, the type designation and the vehicle identification number (VIN), see section 3.5 “Vehicle identification data”.

For more information on the vehicle and body variants offered, refer to section 3.2.3 “Model overview”. Alternatively, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

For further information,

NOTE: In addition to a user and maintenance friendly design, it is important to select the right materials and observe corrosion protection measures when planning bodies.

3.2 Selection of the basic vehicle

Careful selection of the basic vehicle is necessary for safe use of the vehicle in the desired area of application.

To meet requirements, the following points should be particularly considered during planning and adapted to the respective application:

- Wheelbase
- Engine/transmission
- Axle ratio
- Permissible total mass and axle loads
- Centre of gravity
- Standard and special equipment.

NOTE: When planning bodies, it is important not only to ensure a user and maintenance friendly design, but also to select the right materials and to observe corrosion protection measures.

NOTE: Before carrying out any body manufacturing work measures, check the delivered vehicle to ensure that it meets the necessary requirements.

For more information on the vehicle and body variants offered, refer to section 3.2.3 “Model overview” or use the "Contact Us" page on your local INEOS website.

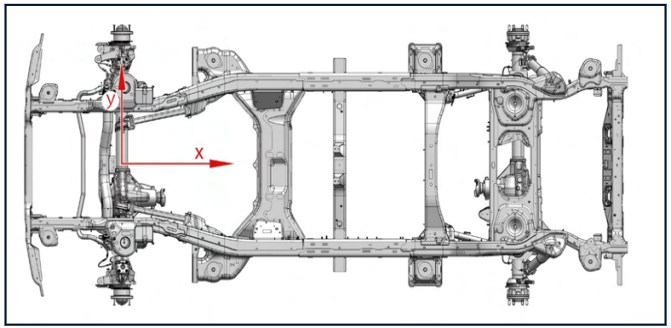
3.2.1 Coordinate systems

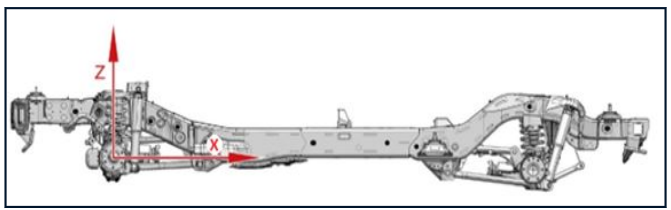
The following definition for the chassis coordinate system applies to all vehicles:

- x-axis: longitudinal axis with positive direction against the driving direction.
- y-axis: transverse axis with positive direction to the right side of the vehicle (in driving direction).
- z-axis: height axis with positive direction upwards.

The origin of the coordinate system is at the front axle.

Coordinate Origin	
X = 0	Centre of front axle
Y = 0	Centre of chassis frame
Z = 0	Centre of front axle





2.2 Schematic diagram of the coordinate system

3.2.2 Vehicle and type designation

For information on the position of the type plates, see section 3.5 “Vehicle identification data”.

For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

This body/equipment mounting guideline is valid for the following vehicle body designs of the Grenadier:

Dimensions of basic vehicle (without spare wheel):

Build version	Region	Wheelbase [mm]	Overhang at front [mm]	Overhang at rear [mm]	Overall length [mm]	Fording depth [mm]
Station Wagon	ROW/NAFTA	2922	887	874	4643	800
	EU				4683	
Pick-up	ROW/NAFTA	3227	885	1328	5400	800
	EU				5400	
Chassis Cab	ROW/NAFTA	3227	885	1328	5400	800
	EU				5400	

Observe country-specific regulations and guidelines.

3.2.3 Model overview

Kerb weight is calculated with the fuel tank 90% full, all other fluids at the correct level and **no** driver.
[T]-Trialmaster [F]-Fieldmaster

Station Wagon EU (EU6)				
Variant	Kerb weight (kg)		Total gross weight (kg)	
	Petrol	Diesel	Petrol	Diesel
UTILITY WAGON (2-seater)	2629	2704	3500	3500
UTILITY WAGON (5-seater)	2665	2740	3500	3500
STATION WAGON (BELSTAFF EDITIONS)	2736[T] 2669[F]	2811[T] 2744[F]	3500	3500
Station Wagon ROW [including New Zealand] (EU4)				
Variant	Kerb weight (kg)		Total gross weight (kg)	
	Petrol	Diesel	Petrol	Diesel
UTILITY WAGON (2-seater)	2618	2693	3500	3500
UTILITY WAGON (5-seater)	2643	2718	3500	3500
STATION WAGON	2643	2718	3500	3500
Station Wagon Australia				
Variant	Kerb weight (kg)		Total gross weight (Kg)	
	Petrol	Diesel	Petrol	Diesel
UTILITY WAGON (2-seater)	2618	2693	3550	3550
STATION WAGON	2643	2718	3550	3550
Station Wagon NAFTA				
Variant	Kerb weight (kg) [lbs]		Total gross weight (kg) [lbs]	
	Petrol	Diesel	Petrol	Diesel
STATION WAGON	2643 [5827]	N/A	3500 [7716]	N/A

Kerb weight is calculated with the fuel tank 90% full, all other fluids at the correct level and **no** driver.

Pick up EU (EU6)				
Variant	Kerb weight (kg)		Total gross weight (kg)	
	Petrol	Diesel	Petrol	Diesel
N1 Pick up	2665	2740	3500	3500
Pick up ROW (EU4)				
Variant	Kerb weight (kg)		Total gross weight (kg)	
	Petrol	Diesel	Petrol	Diesel
N1 Pick up	2643	2718	3500	3500
Pick up Australia				
Variant	Kerb weight (kg)		Total gross weight (kg)	
	Petrol	Diesel	Petrol	Diesel
N1 Pick up	2643	2718	3550	3550
Pick up NAFTA				
Variant	Kerb weight (kg)		Total gross weight (kg)	
	Petrol	Diesel	Petrol	Diesel
N1 Pick up		N/A	3500	N/A

Kerb weight is calculated with the fuel tank 90% full, all other fluids at the correct level and **no** spare wheel or driver.

Chassis Cab EU (EU6)				
Variant	**Kerb weight (kg)**		**Total gross weight (kg)**	
	Petrol	Diesel	Petrol	Diesel
N1 PU			3500	3500
Chassis Cab ROW (EU4)				
Variant	**Kerb weight (kg)**		**Total gross weight (kg)**	
	Petrol	Diesel	Petrol	Diesel
N1 PU			3500	3500
Chassis Cab Australia				
Variant	**Kerb weight (kg)**		**Total gross weight (kg)**	
	Petrol	Diesel	Petrol	Diesel
N1 PU			3550	3550
Chassis Cab NAFTA				
Variant	**Kerb weight (kg)**		**Total gross weight (kg)**	
	Petrol	Diesel	Petrol	Diesel
N1 PU		N/A	3500	N/A

Minimum **converted weight**: the weight of the vehicle post conversion plus the fuel tank 90% full, all other fluids at the correct level and with **no** spare wheel or driver.

Chassis Cab EU (EU6)				
Variant	**Minimum Converted weight (kg)**		**Total gross weight (kg)**	
	Petrol	Diesel	Petrol	Diesel
N1 PU	2665	2740	3500	3500
Chassis Cab ROW [including New Zealand] (EU4)				
Variant	**Minimum Converted weight (kg)**		**Total gross weight (kg)**	
	Petrol	Diesel	Petrol	Diesel
N1 PU	2643	2718	3500	3500
Chassis Cab Australia				
Variant	**Minimum Converted weight (kg)**		**Total gross weight (kg)**	
	Petrol	Diesel	Petrol	Diesel
N1 PU	2643	2718	3550	3550

3.2.4 Drive concept

The vehicle is equipped with permanent all-wheel drive.

3.2.5 Engine and exhaust variants

Build version	Variant	Engine	EC registration class	Emission level EU	Emission level ROW	Emission level NAFTA	Max. output [kW(hp)]
Station Wagon	**Petrol**	BMW B58	M1	EURO 6	EURO 4	LEV III	210kW @ 4750rpm, 450Nm @ 1750-4000rpm
	Diesel	BMW B57	M1	EURO 6d	EURO 4	LEV III	183kW @ 3250-4200rpm, 550Nm @ 1250-3000rpm
Pick-up	**Petrol**	BMW B58	N1	EURO 6	EURO 4	LEV III	210kW @ 4750rpm, 450Nm @ 1750-4000rpm
	Diesel	BMW B57	N1	EURO 6d	EURO 4	LEV III	183kW @ 3250-4200rpm, 550Nm @ 1250-3000rpm
Chassis Cab	**Petrol**	BMW B58	N1	EURO 6	EURO 4	LEV III	210kW @ 4750rpm, 450Nm @ 1750-4000rpm

Build version	Variant	Engine	EC registration class	Emission level EU	Emission level ROW	Emission level NAFTA	Max. output [kW(hp)]
	Diesel	BMW B57	N1	EURO 6d	EURO 4	LEV III	183kW @ 3250-4200rpm, 550Nm @ 1250-3000rpm

3.3 Vehicle modifications

Before commencing body mounting work, the body manufacturer must check whether:

- the vehicle is suitable for the planned body
- the vehicle and the equipment are still suitable for the operating conditions after the body has been fitted.

For planning bodies, INEOS may be able to supply additional information and drawings upon request.

Note also the special equipment offered at the factory.

The body manufacturer is responsible for approving the vehicle in cooperation with its customer and in consultation with an officially recognized expert for the customer's purposes by means of individual approval.

NOTE: In order to ensure the function and operational safety of major assemblies, sufficient clearances must be maintained.

WARNING: Do not make any modifications to the steering and brake system!

CAUTION: Modifications to the steering and brake systems may cause these systems to malfunction and fail. This can cause the driver to lose control of the vehicle. There is a risk of accident!

For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

Vehicle approval

The officially recognised approval authority or inspector must be informed by the body manufacturer of any modifications to the basic vehicle. The approval and testing organisations decide on compliance with laws and regulations after any modifications to the

basic vehicle, and thus on the registration capability of the complete vehicle.

NOTE: Be sure to observe country-specific laws, guidelines and registration regulations.

3.4 Dimensions and weight specifications

Do not make any changes to the vehicle width, vehicle height and vehicle length that exceed the specified limits of the current body/ equipment mounting guidelines.

Refer to section 4.1 “Technical limit values” for dimensions and weight specifications. These refer to the standard vehicle equipment; special equipment is not taken into account.

Weight tolerances in production of +/-10kg and in series weighing tolerances of 3% must be observed.

The permissible axle loads and the maximum permissible total mass must not be exceeded. For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

This also provides information on how to handle weight changes.

> Before starting the body mounting work, determine and document the actual unladen vehicle mass and the associated axle loads for unladen mass by weighing (see weighing instructions in section 9.1.1 “Determining the centre of gravity in the x-direction”) or via the vehicle identification number using the unladen mass of your vehicle ex-factory and its weight distribution via your INEOS Automotive partner.

> After completing all body mounting work, repeat the measurement of the actual unladen vehicle mass by weighing (section 9.1.1 “Determining the centre of gravity in the x-direction”). Also determine the corresponding axle loads by weighing. Document the three variables of vehicle unladen mass in the completed state, the front axle load and rear axle load in the completed state again.

WARNING: Do not exceed the tyre load capacity of the vehicle by overloading it beyond the specified total vehicle mass. The tyres may otherwise overheat and be damaged. This may cause the driver to lose control of the vehicle. There is a risk of accident!

WARNING: The braking distance may increase significantly if the vehicle is overloaded.

NOTE: Information on the permissible masses can be found on the type plate of the vehicle.

The information on vehicle unladen mass and associated axle loads before and after body mounting work, "Checking the wheel alignment" in section 9.1.1 “Determining the centre of gravity position in the x-direction”, section 3.11 “special equipment” and section 6.1.1 “General information on the suspension” must be implemented.

WARNING: If the permissible axle loads are exceeded on vehicles equipped with the ESP system, this may no longer function correctly. This can cause the driver to lose control of the vehicle. There is a risk of accident!

WARNING: The permissible axle loads must not be exceeded!

For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

NOTE: For all bodies, the individual axle loads and the permissible total mass must be observed. After modifications to the vehicle that may result in changes to the longitudinal or lateral inclination (e.g. heavy installations), the sensor cluster must be recalibrated to ensure correct functioning of the ESP.

INEOS Automotive recommends having this work performed at a qualified specialist workshop.

More detailed information on how ESP works is described in section 8.8.1 “Electronic Stability Program (ESP)”.

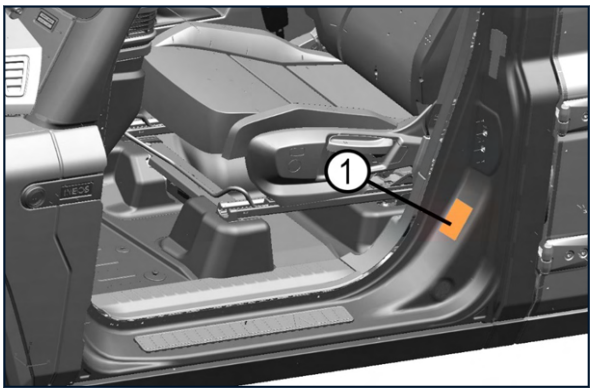
The permissible number of vehicle occupants and a sufficient margin for the payload must also be taken into account.

Take the weight of the special equipment into account in the calculation.

The country-specific regulations and guidelines apply.

3.5 Vehicle identification data

NOTE: The vehicle identification number (VIN) and type plate of the vehicle must not be changed or affixed in any other location. The type plate with the vehicle identification number is glued to the B-pillar on the driver’s side (1).

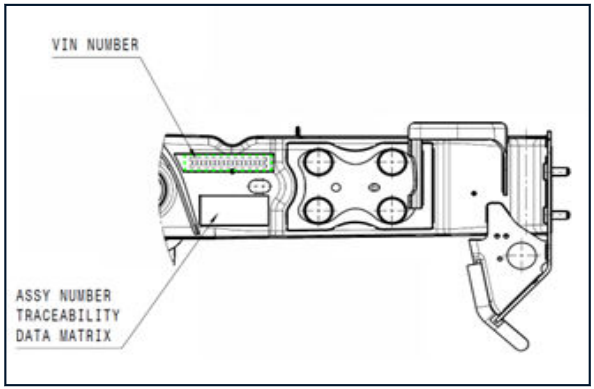


3.5 1 Vehicle type plate on the B-pillar of the driver´s side

Example of a type plate:

3.5.2 Example of a type plate (schematic representation)

1. Vehicle identification number
2. Total permissible mass
3. Total permissible combination mass
4. Permissible axle load, axle 1 (front axle)
5. Permissible axle load, axle 2 (rear axle)



3.5 3 Embossing of chassis number on right front frame

3.6 Vehicle stability

The inspection of the assembled vehicle is subject to brake regulation UN-R 13 (for vehicles in vehicle category M1: regulation UN-R 13H), and a calculated verification of the centre of gravity height on loaded vehicles must be provided. Upon acceptance of the assembled vehicle, a mathematical verification of the centre of gravity height with a loaded vehicle must be provided in accordance with the regulation Brake UN-R 13 or for vehicles of vehicle class M1 (Station Wagon) in accordance with UN-R 13H and vehicle class N1 (Pick-up) in accordance with UN-R 13.

The permissible centre of gravity heights can be found in chapter 4 “Technical limits for planning”.

INEOS Automotive does not make any statements about

- Driving behaviour
- Braking behaviour
- Steering behaviour
- ESP control response.

In the case of bodies for loads with unfavourable centre of gravity positions (e.g. rear, high and side loads), as these aspects are significantly influenced by body mounting work and can therefore be assessed exclusively by the body manufacturer.

CAUTION: If ESP has been deactivated, the driving style must be adapted accordingly (reduced cornering speed, avoidance of jerky steering movements). The permissible axle loads, total masses and centre of gravity positions must be observed.

Information on deactivating ESP can be obtained from the INEOS Aftersales portal and the owner's manual.

The permissible wheel and axle loads as well as the permissible total masses of the vehicle must not be exceeded under any circumstances, neither during conversions and installations nor when the vehicle is ready to drive.

NOTE: The permissible axle loads must be observed!

WARNING: If the permissible axle loads are exceeded, this system may no longer function as intended on vehicles with ESP. As a result, the driver may lose control of the vehicle. There is a risk of accident!

CAUTION: After modifications to the vehicle that may result in changes to the longitudinal or lateral inclination (e.g. heavy installations), the sensor cluster must be recalibrated to ensure the correct functioning of ESP.

INEOS Automotive recommends to have this work performed at a qualified specialist workshop.

More detailed information on how the ESP works is described in section 8.8.1 “Electronic Stability Program (ESP)”.

For more information on the permissible weights, refer to the vehicle identification data on the vehicle.

3.7 Tyres

The body manufacturer must ensure that

- the distance from the tyre to the mudguard or wheel housing is sufficient even with snow chains or anti-skid chains fitted and the suspension fully compressed (also with axle twist) and that the relevant data in the dimensional concepts are observed.
- only tyre sizes approved by INEOS Automotive (see section 4.2.3 “Approved tyre sizes” to be used.

Also observe the country-specific approval regulations for tyres. These regulations may specify a certain type of tyre for your vehicle or prohibit the use of certain types of tyres that are approved in other countries.

WARNING: Exceeding the specified tyre load capacity or maximum permitted tyre speed may result in tyre damage or tyre failure. As a result, you may lose control of your vehicle, cause an accident and injure yourself or others. Therefore, only use tyre types and sizes approved by INEOS Automotive for your vehicle type and observe the tyre load capacity and speed index required for your vehicle. If you have other tyres (not approved by INEOS Automotive) fitted, then:

- The wheel brakes or chassis components may be damaged.
- The clearance of the wheels and tyres is no longer guaranteed.
- The wheel brakes or chassis parts may no longer be functioning as intended.
- Driving assistance systems may react incorrectly, with delays or not at all.
- Driving assistance systems may react incorrectly, with delays or not at all.
- The values displayed in the speedometer and odometer may be distorted.
- The performance of the ESP and thus driving safety may be impaired.

For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

3.8 Threaded and welded connections

3.8.1 Threaded connections

INEOS Automotive recommends the use of flange bolts and flange nuts for threaded connections of the body perimeter to the basic vehicle or the vehicle frame.

If standard bolts/nuts have to be replaced, only bolts/nuts with

- the same diameter
- same strength grade
- same screw standard or screw type
- same surface coating (corrosion protection, coefficient of friction)
- same thread pitch

may be used.

We recommend INEOS Automotive standard parts.

WARNING: All safety-relevant threaded connections, e.g. for wheel guidance, steering and brake functions, must not be changed. Otherwise, they may no longer function as intended. This can cause the driver to lose control of the vehicle. There is a risk of accident!

CAUTION: The new installation must be carried out in accordance with INEOS Automotive customer service instructions using suitable standard parts. We recommend genuine INEOS Automotive parts.

- Implement VDI Guideline 2862 for all assembly work.
- Do not shorten the free clamping length, change to an expansion shank or use screws with a shorter free thread portion.

Observe the setting behaviour of screw connections.

- The use of INEOS Automotive tightening torques requires a total friction coefficient in the range µges = 0.08 to 0.14 for the respective bolting partners.
- If bolts at INEOS Automotive are tightened with torque and angle of rotation, a design change is not possible.
- Use the INEOS Aftersales portal to determine whether bolts and nuts of chassis components are to be tightened only when the vehicle is ready for operation.
- Components of the body that are additionally braced must have the same or higher strength as the previous bracing.

Information can be obtained from any INEOS Automotive Service Centre.

WARNING: Always replace bolts or nuts with locking teeth, micro-encapsulations and self-locking nuts after one use. Before screwing in new micro-encapsulated screws, the mating thread must be re-cut or the nut renewed to remove all residues of the old screw locking compound. It is then necessary to blow out the re-cut threads, as any remaining adhesive in the thread will prevent the screws from being tightened correctly. Failure to do so may result in bending forces acting on the bolt due to incorrect bolt pre-tensioning, causing the bolt to break. This can cause the driver to lose control of the vehicle and cause an accident.

WARNING: When loosening micro-encapsulated screws, there is a risk of injury due to the sudden loosening of the screws. Therefore, when loosening micro-encapsulated screws, make sure that there is sufficient room to move.

3.8.2 Welded connections

In order to maintain the high quality of welding work required by INEOS Automotive, the people responsible for welding must have the appropriate qualifications.

To achieve suitable and reproducible welded connections, the quality of workmanship to be achieved should be determined before welding begins in accordance with the irregularities applicable to the

welding process used, analogous to the currently valid ISO standards.

For high quality welds, the following is recommended:

- Thorough cleaning of the areas to be welded
- Several short weld beads instead of one long one
- Symmetrical beads to limit shrinkage
- Avoidance of more than 3 welds in one spot
- Avoidance of welds in strain-hardened areas.

NOTE: Disconnect battery and protect airbags, airbag control unit, airbag sensors and seat belts against weld splatter before welding work, and remove if necessary.

Selection of welding procedure

The mechanical properties of welds depend on the selection of the welding process and the geometry to be joined.

In the case of overlapping sheets, the appropriate welding process must be selected depending on the accessibility of the sides:

Accessible sides

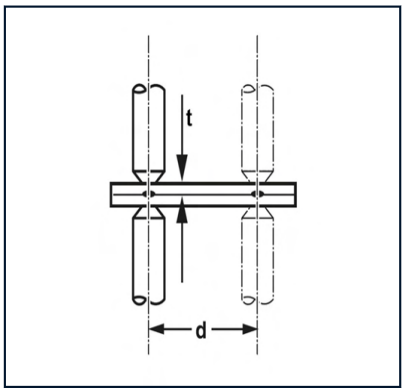
1	Gas-shielded spot welding
2	Resistance spot welding

Resistance spot welding

Resistance spot welding is used for overlapping parts with access on both sides. Avoid spot welding more than two layers of sheet metal.

Distance of spot welds

To avoid shunt effects, the specified distances between the spot welds must be maintained (d = 10t + 10 mm).

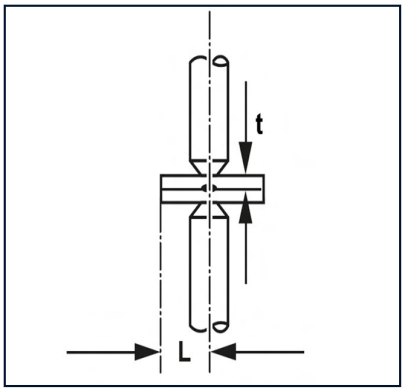


3.9 Sheet thickness

- d Distance of the spot welds
- t Sheet thickness

Distance from sheet edge

To avoid melting core damage, the specified distances to the edge of the sheet must be observed (L = 3t + 2 mm).



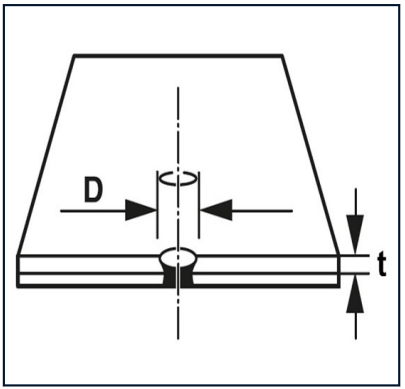
3.10 Sheet thickness

- L Distance to the edge of the sheet
- t Sheet thickness

Gas-shielded plug welding

If overlapping sheets are only accessible from one side, the welded connection must be made by gas-shielded plug welding or tack welding.

If the joint is produced by stamping or drilling followed by plug welding, the drilled area must be de-burred before welding.



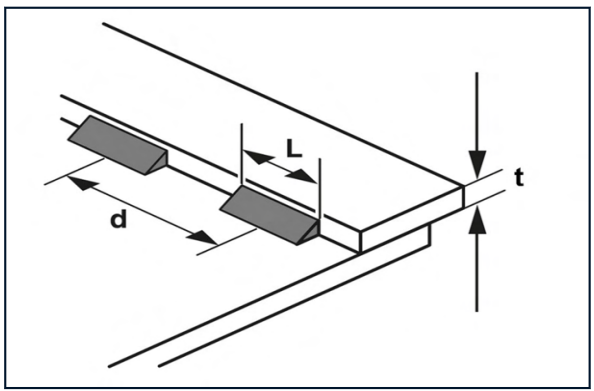
3.11 Gas-shielded plug welding

D = hole diameter [mm]	4,5	5	5,5	6	6,5	7
e = sheet thickness [mm]	0,6	0,7	1	1,25	1,5	2

The mechanical quality can be additionally increased by using "elongated holes".

Fillet welding

For sheet thickness's > 2 mm, overlapping sheets can also be joined by briefly interrupted fillet welds (30 mm < L < 40t; d > 2L).



3.13 dimensions for fillet welds

- d Distance between fillet welds
- t Plate thickness
- L Length of fillet welds

Do not weld:

- on assemblies such as engine, gearbox, axles, etc.
- on the chassis

For further information, refer to chapters 4 "Technical limits during planning", 5 "Damage prevention" as well as section 6.2 "Body-in-white/body" and the INEOS Aftersales portal.

Corrosion protection after welding

After all welding work on the vehicle, observe the specified corrosion protection measures.

NOTE: For welding work, also observe the notes listed in chapter 5 "Damage prevention" and chapter 6 "Modifications to the basic vehicle".

3.9 Noise insulation

In the case of modifications to noise-relevant parts, such as:

- Engine.
- Exhaust system.
- Intake air system.
- Tyres etc.

noise measurements must be carried out.

The country-specific regulations and directives apply.

In the EU, observe UN-R 51.

> Parts installed as standard to reduce noise must not be removed or modified.

> The interior noise situation must not deteriorate.

NOTE: All modifications to the vehicle must comply with the external noise of the vehicle prescribed by Regulation UN-R 51.

NOTE: To ensure that modifications do not affect the noise level of the vehicle, ensure that interior noise is minimized when planning bodies.

3.10 Maintenance and repair

Maintenance and repair of the vehicle must not be impeded by the body.

Observe the operating instructions.

> Maintenance points and units must remain easily accessible.

> The battery box must have adequate ventilation.

> If necessary, install battery venting.

> Check batteries for performance and condition and maintain according to manufacturer's instructions.

NOTE: Battery damage may occur due to prolonged idle times. Avoid this by disconnecting the battery and storing it accordingly.

INEOS Automotive will not pay for any additional work caused by the conversion during warranty, maintenance or repair work.

Observe the following instructions before delivery of the vehicle:

> Check the headlamp setting or have it checked by a qualified specialist workshop. We recommend an INEOS Automotive service centre.

> Tighten the wheel nuts/wheel bolts, observing the tightening torque.

INEOS Automotive recommends that maintenance scopes on the body mounting work be matched to the respective vehicle using the valid maintenance systems from INEOS Automotive. This applies both to the type and scope of maintenance and to the intervals and mileages on which maintenance should be based.

The operating manual and maintenance instructions for the body mounting work carried out and additionally installed units must be enclosed with the vehicle by the body manufacturer in the language of the country of use.

3.10.1 Storage of the vehicle

Storage in closed rooms

> Clean the entire vehicle.

> Check oil and coolant levels.

- Increase the prescribed tyre pressure by 0.5 bar.
- Release parking brake and secure vehicle against rolling away with chocks.
- Disconnect battery and lubricate cable lugs and terminals.

Observe section 9.1.1 “Determining the position of the centre of gravity in the x-direction”.

Outdoor storage (< 1 month)

- Perform the same steps as for indoors.
- Close all air inlets and set the heating to "Off".

Observe section 9.1.1 “Determining the position of the centre of gravity in the x-direction”.

Outdoor storage (> 1 month)

- Perform the same steps as for indoors.
- Fold away the windscreen wipers from the windscreen.
- Close all air inlets and set the heater to "Off".
- Remove battery and store according to manufacturer's instructions.

Observe section 9.1.1 “Determining the position of the centre of gravity in the x-direction”.

Maintenance of stored vehicles (in case of storage > 1 month)

- Monthly checking of the oil level.
- Monthly check of coolant levels.
- Monthly checking of tyre pressure.

Removing the vehicle from storage

- Check vehicle fluid levels.
- Observe manufacturer-specific instructions on operating fluids (e.g. maximum shelf life, seasonal use, etc.) and replace the respective operating fluids if necessary.
- Correct tyre pressure in accordance with regulations.
- Check the state of charge and installation of the batteries.
- Clean the entire vehicle.

3.10.2 Battery maintenance and storage

- During longer periods of standing or storage, make sure that the battery is always in a charged state.

Battery storage before vehicle assembly

Batteries age (reference DMC or post marking) may not be older than 8 weeks before vehicle assembly. Batteries older than 8 weeks should be checked by the quality department and be recharged, if necessary.

Generally, batteries must be stored in a dry and cool place. Battery self-discharge is dependent on the ambient temperature. Self-discharge decreases with lower temperatures.

Battery storage for OES

Batteries age (reference DMC or post marking) may not be older than 6 months before battery assembly to the vehicle. Batteries

older than 8 weeks should be checked and be recharged, if necessary.

During storage, the battery SoC must be monitored:

- The battery SoC must be checked once every three months. If the battery voltage drops below 12.3 V, the battery must be recharged for 24 hours at max. 14.8 V.

Battery voltage may not drop below 12.2 V at any time; otherwise, the battery must be recycled and/or disposed of following local guidelines. When the battery is transferred to the (internal) customer, the OCV must be at least 12.5 V.

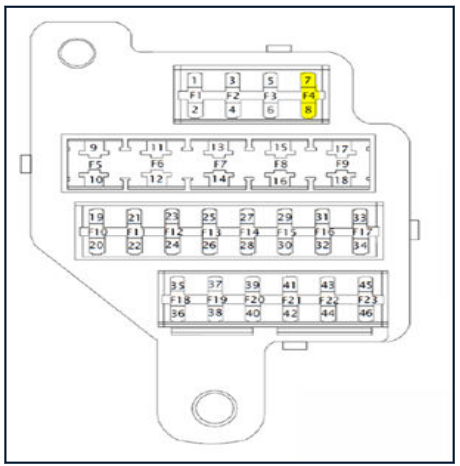
NOTE: If the battery's open-circuit voltage (when removed and unloaded for more than 4 hours) falls below 11 V, damage will occur and replacement will be necessary.

3.10.3 Transport mode

To avoid excessive discharge of the battery during longer non-operational times, the electrical system of the Grenadier can be set to transport mode. In this mode, consumers like lights and window regulators are deactivated.

Activation of transport mode

To activate the transport mode, pull the fuse **FC04 (5A)** in the Cockpit Fuse Box (located in the steering column/ignition lock area).



Deactivation of transport mode

It is possible to manoeuvre the vehicle in transport mode, only consumers such as lights and window regulators are deactivated. However, please note that transport mode must be deactivated in any case before the vehicle is put into operation on public roads.

Deactivate transport mode before starting up the vehicle. To achieve that, simply put the fuse **FC04 (5A)** back in its place, in the Cockpit Fuse Box.

3.10.4 Work before delivery of the converted vehicle

Checking the complete vehicle:

- Check the vehicle for proper condition.
- Fix any damage if necessary.

Checking the brake system:

- If stored outdoors, the brake discs may accumulate flash rust. For a good braking effect, grind the brake discs free by a short drive. If there is too much rust, the brake discs must be replaced.
- The brake fluid must be renewed regularly in accordance with INEOS Automotive regulations, but at least every 2 years.
- If the service life of the vehicle is not known, the brake fluid must be renewed.
- Check electric and hydraulic lines for damage of any kind and replace them if necessary.

Checking vehicle electrics:

- After working on the electrics or electronics, read out the fault memory of the control units and delete, if necessary.

Checking the battery:

- Before delivery of the vehicle, check the charge status of the battery. If necessary, recharge the battery.

Checking the tyres:

- Before delivery of the vehicle, check the tyres for the prescribed air pressure and for tyre damage.
- Replace damaged tyres.

Checking the wheel alignment:

- In the event of modifications by body shops, it is mandatory to check the wheel geometry (toe adjustment, etc.).

For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

3.11 Special equipment

WARNING: The use of non-approved parts, units, conversion parts or accessories can impair vehicle safety.

WARNING: Before starting work on the vehicle, read the chapters of the vehicle operating manual related to installation and the operating and installation instructions of the manufacturers of accessories and special equipment. You may otherwise fail to recognise dangers and endanger yourself or others.

You can obtain more information on special equipment here:

- INEOS Automotive service centre.
- INEOS Aftersales portal.

Special equipment or retrofitted equipment can change the unladen mass of the vehicle. In addition, special equipment can also change the centre of gravity, installation space and component clearance. Therefore, ensure that the function of the entire vehicle is maintained and that the limit values are complied with for all work to be carried out.

- Determine the actual vehicle mass and the axle loads by weighing before the body manufacturing work.
- After completion of all body manufacturing work, repeat the determination of the actual unladen vehicle mass with the associated axle loads by weighing. For this purpose, observe e.g. section 9.1.1 “Determining the position of the centre of gravity in the x-direction”.
- Document the values determined.

Then use these values to comply with or implement the specifications in the following chapters:

- "Dimensions and weight specification" on the unladen vehicle mass and associated axle loads before and after the body manufacturing work.
- "Checking the wheel setting" in accordance with section 3.10.3 “Work before delivery of the converted vehicle”.
- Section 4.2 “Chassis limit values” and section 6.1.1 “General information on the suspension”.

Not all special equipment can be installed in every vehicle without problems. This applies in particular to retrofitting, as the required installation spaces may be occupied by other components, or the special equipment may require additional components.

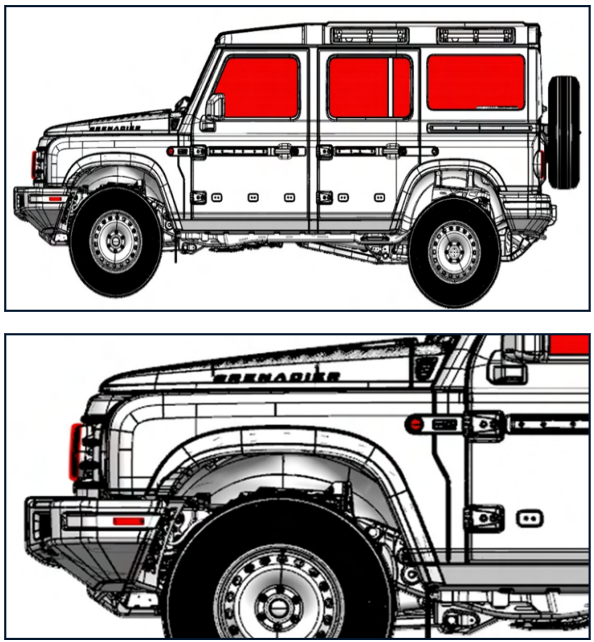
For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

3.12 Foil stickers on vehicle exteriors

Observe the following specifications for foil stickers (also known as wrapping) on the outside of the vehicle:

- Foil stickers are only permissible on vehicle exteriors that are not marked as impermissible areas in the following schematic diagrams. Exemplary illustration Station Wagon-valid for Pick-up and Chassis Cab.
- Observe and comply with country-specific legal regulations of any kind with regard to vehicle wrapping using films or similar materials. In particular consider the regulations about masking off the windscreen, windows and lighting systems.
- Do not apply foil stickers over any exterior sensors or cameras, as this would cause systems on the vehicle to operate incorrectly.

> Ensure that the removal of any foil stickers does not cause paint damage.



3.14 Foil Stickers - Side

Vehicle side - speckled areas: impermissible areas for vehicle wrapping (example Station Wagon, schematic diagram)

3.15 Foil Stickers - Front

Vehicle front - speckled areas: impermissible areas for vehicle wrapping (example Station Wagon, schematic diagram)

3.16 Foil Stickers - Back

Rear - speckled areas: impermissible areas for vehicle wrapping (example Station Wagon, schematic diagram)

TECHNICAL LIMIT VALUES

4.1 Limit values basic vehicle

NOTE: This chapter contains important technical limit values for the basic vehicle. In addition, observe the other chapters of the current body/equipment mounting guidelines.

4.1.1 Steer-ability

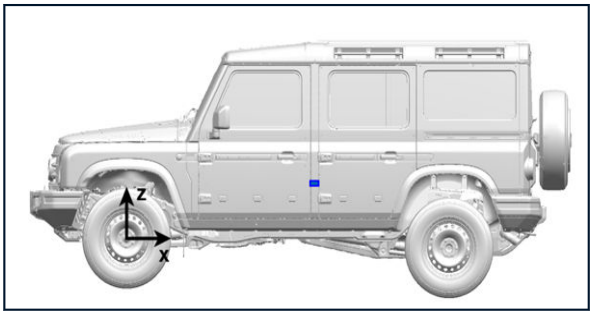
> Where the vehicle is laden to the technically permissible maximum laden mass, the mass on the front axle shall in no event be less than 30% of the technically permissible maximum laden mass of the vehicle.

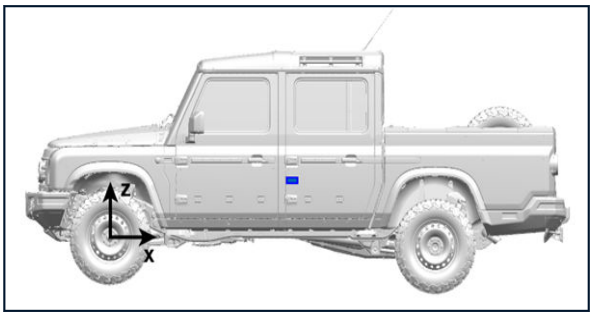
> Where the vehicle is laden to the technically permissible maximum laden mass plus the technically permissible maximum mass at the coupling point, the mass on the front axle shall in no events be less than 20% of the technically permissible maximum laden mass of the vehicle.

> Observe the permissible axle loads. (1230/2012/EU)

CAUTION: Do not make any modifications to the steering system. This includes changing and/or limiting of the steering angle. If changes are made to the steering system, the steering support may fail.

4.1.2 Centre of gravity position





	x-direction min & max value:	y-direction min & max value:	z-direction min & max value:
Station Wagon:	1668.1 mm	-13.6 mm	411.1 mm
	1752.0 mm	-13.6 mm	452.5 mm
Pick-up & Chassis Cab:	1729.2 mm	-23.6 mm	394.2 mm
	1865.1 mm	-23.6 mm	434.3 mm

The values for the y-direction refer to the Vehicle centre line.

Station Wagon = R1 wheelbase 1 (2922 mm)

Pick-up = R2 wheelbase 2 (3227 mm)

Chassis Cab = R3 wheelbase 3 (3227 mm)

All dimensions refer to the vehicle coordinate system, see section 3.2.1 “Coordinate systems”.

The body manufacturer is responsible for determining and maintaining the vehicle centres of gravity.

For more information, see section 9.1.2. “Determining the centre of gravity in the z-direction”

4.1.3 Maximum vehicle dimensions

In accordance with EU Directives 96/53/EC and VO(EU) 1230/2012, the following maximum vehicle dimensions are permissible:

Vehicle Width	Vehicle Height	Vehicle Length (without spare wheel)
2550 mm (national 2500 mm)	4000 mm	12000 mm

NOTE: The above dimensions are regulatory limits. The maximum possible vehicle dimensions are technically related to other parameters, see section 4.1.2 “Maximum permissible centre of gravity position” and section 4.2.2 “Permissible axle loads”. You can also obtain more detailed information under: “Technical advice basic vehicle”.

4.1.4 The following areas must not be welded

- Crash-relevant structural pillars of the body-in-white
- The area of safety-relevant consoles and connection points, e.g. the seat connection, seat belt anchorages, suspension mounting consoles, etc
- On the frame
- On the axles
- In bending radii
- In the area of the airbags and airbag sensors, the airbag control unit and the components of the seat belts
- In the area of the assistance systems

In case of doubt, consult the responsible specialist department before starting welding work.

For more information, see section 3.8 “Threaded and welded connections” and 5.2 “Welding work”.

4.1.5 Areas which must not be drilled

- A and B pillars
- The upper and lower chord of the frame side member
- In the area of load application points (e.g. spring brackets)
- In the area of load-bearing functions of the front or rear axle
- In the area of airbags and airbag sensors, the airbag control unit and seatbelt components
- In the area of assistance systems.

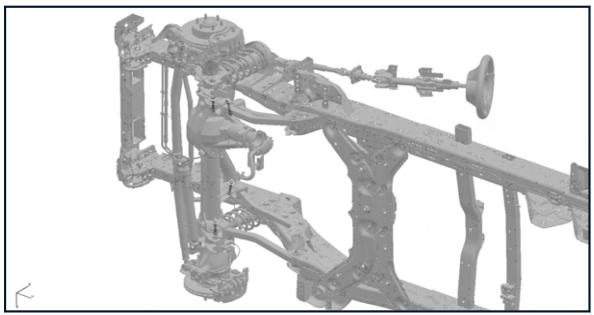
CAUTION: Holes on the frame side member resulting from the production process are not suitable for body mounting work. Do not use holes from the production process under any circumstances, otherwise damage to the frame may occur.

For more information, see 3.8 “threaded and welded connections”.

4.2 Chassis limits

4.2.1 General chassis

No additional detachable parts may be mounted to the threaded connection points on the front axle.



4.1 Important bolting points on the front axle

WARNING: Modifications to chassis components can lead to impaired and unstable handling. This may cause the driver to lose control of the vehicle and cause an accident. Therefore, do not make any modifications to chassis components.

Observe in the area of the axles:

- Transverse and longitudinal control arms: Do not make any modifications.
- Front axle: Do not make any modifications.
- Rear axle: Do not make any modifications.
- Neither the front nor the rear axle may be used for the attachment of additional units.
- Brakes: Do not make any modifications.
- Steering: Do not make any modifications.
- Devices, sensors, wiring for ABS and ESP: Do not make any modifications.
- Use new bolts when installing the front axle. Tighten all bolts and screw connections in accordance with INEOS Automotive tightening instructions. For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.
- Implement VDI Guideline 2862 for all assembly work, in particular the section "Threaded connections with special safety relevance".
- Shortening the free clamping length, changing to an expansion shank or using bolts with a shorter free thread portion cannot be approved as a matter of principle.
- Observe the setting behaviour of screw connections.

For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

Additionally tensioned components must have the same or higher strength as the previous tensioning connection.

The use of INEOS Automotive tightening torques requires screw friction coefficients in the tolerance range (= 0.08 ... 0.14).

We recommend using INEOS Automotive standard parts.

4.2.2 Permissible axle loads

WARNING: If the permissible axle loads are exceeded, the ESP of the vehicle might not be able to work as intended. Furthermore, the overload may cause damage to the chassis and load-bearing parts. As a result, the driver may lose control of the vehicle. There is a risk of accident!

CAUTION: The permissible axle loads must be observed. With fully loaded vehicles, neither the axle load nor the permissible wheel load may be exceeded. For information on axle loads and maximum permissible gross weights, can be found on the INEOS Aftersales portal. Alternatively, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

Version	Station Wagon	Pick-up	Chassis Cab
Axle Loads Front [kg]	1667	1667	1667
Axle Loads Rear [kg]	2150	2150	2150

4.2.3 Approved tyre sizes

Information on the assignment of the tyre to the vehicle model, the assigned rims and any restrictions can be obtained from the INEOS technical support team, see section 2.1 “Advice for body manufacturers”.

NOTE: We explicitly point out that the use of corresponding tyre sizes only applies in conjunction with the weight and speed indices approved and intended for this purpose.

Recommended tyres for the Grenadier:

Bridgestone Dueler:

- 265/70 R17 116S
- 255/70 R18 116S

BF Goodrich All Terrain KO2:

- L T 265/70 R17 / 121/118 S
- L T 255/70 R18 / 117/114 S

WARNING: Tyres other than those approved by INEOS Automotive may impair the performance of the ESP and thus the driving safety. In the event of a deviation from the proposed wheel/tyre combination, INEOS Automotive recommends applying for a clearance certificate from the responsible department with the existing driving control system.

Observe the associated tyre pressure, see section 6.1.4 “Wheels/ tyres”.

4.2.4 Turning circle diameter

The international and national regulations for vehicle approval and registration must be complied with. Among others these are:

- UN-R 79.
- European Union: 97/27/EC.
- European Union: VO(EU) 1230/2012.
- European Union: 96/53/EG.

The turning circle kerb to kerb for the Station Wagon is ≤ 14 m.

The turning circle kerb to kerb for the Pick-up and Chassis Cab is ≤ 15 m.

4.2.5 Modi ications Axles

Do not make any modifications to the chassis and axles, see section 6.1 “Suspension”.

4.2.6 Steering modi ications

Do not make any changes to the steering system, see section 6.1 “Suspension”.

WARNING: Modifications to the steering system are not permitted. This also includes changing and/or limiting the steering angle. If changes are made to the steering system, the steering support may fail.

4.2.7 Springs/shocks/stabilisers

Modifications to springs, dampers and stabilisers can only be made to the front and rear axles in the combinations specified by INEOS Automotive. In this case, no technical certificate is required. Modifications going beyond this must be matched to each other on the front and rear axles.

For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

If the base curb mass on the axle changes, the body-builder needs to order new springs to suit the new mass condition.

Please see table below showing the spring selection we are able to offer:

Model	Axle	Part number	Weight (kg)	Colour code
Station Wagon	Front	GRA-4C00-004550	1364-1417	
		GRA-4C00-004560	1417-1470	
		GRA-4C00-004570	1470-1523	
		GRA-4C00-004580	1523-1576	
	Rear	GRA-4D00-004590	1299-1355	
		GRA-4D00-004600	1355-1411	
		GRA-4D00-004610	1411-1467	
		GRA-4D00-031280	1467-1523	
Pick up / Chassis Cab	Front	GRA-4C00-004560	1417-1470	
		GRA-4C00-004570	1470-1523	
		GRA-4C00-004580	1523-1576	
		GRA-4C00-031940	1576-1629	
	Rear	GRA-4D00-031920	1187-1243	
		GRA-4D00-031930	1243-1299	
		GRA-4D00-004590	1299-1355	
		GRA-4D00-004600	1355-1411	
		GRA-4D00-004610	1411-1467	
		GRA-4D00-031280	1467-1523	

During installation work, ensure that the surface and corrosion protection of the springs are not damaged.

> Before welding work, springs must be covered to protect them from welding beads.

> Springs must not be touched with welding electrodes or welding guns.

WARNING: Do not use springs and dampers that do not correspond to the characteristics of the standard parts or the parts available as special equipment. Failure to do so may cause some systems to stop working as intended. This may cause the driver to lose control of the vehicle and cause an accident. We recommend using INEOS Automotive standard parts.

4.2.8 Brake system

> Do not make any changes to the brake system.

> Do not carry out any modifications to the air inflow and air outflow around the disc brakes.

> For vehicles with a permissible total mass > 4 t, wheel chocks are prescribed.

WARNING: Improperly performed work on brake hoses, lines and cables can impair their function. This can lead to failure of components or safety-relevant parts. Work on brake hoses, lines and cables must be performed by a qualified specialist.

After completing the work, check the brake system for proper function. We recommend acceptance by a technical inspection agency.

When making necessary routing changes avoid crossing sharp edges and routing in spaces that are too narrow or in the vicinity of moving parts.

Hydraulic brake system

> Replace hydraulic brake lines completely with approved 4.75 mm × 0.7 mm or 6 mm × 0.7 mm coiled tubing.

> Mind following bending radii for brake lines:

Tube ø	Limit feasible	Best practice
ø 4.75	R12	R15
ø 6	R15	R20

> Brake lines may only be formed in a bending device. The cross-section must not be reduced.

> Fit nuts at the ends of the lines and make flanges (DIN 74234).

> The lines must be cleaned internally before installation.

> Do not use plastic pipes in hydraulic systems.

> The brake fluid must be replaced every two years.

> If the service life of a vehicle with hydraulic brake system is not known, the brake fluid must be renewed.

> When routing between two components that can move relative to each other, use a flexible line (hose, steel flex, etc.).

Line routing

WARNING: A sufficient distance of the brake lines from heat sources, sharp-edged and moving parts must be maintained. Otherwise, bubble formation in the brake fluid or chafing points in the brake line may result in impairment and total failure of the brake system.

For fastening, we recommend original brake line holders from INEOS Automotive for clipping in the brake line.

> The distance from holder to holder must not exceed 500 mm.

> Always lay brake cables without kinks.

> Refrain from making angle changes at the end pieces of the brake cable sheath (free strand pieces).

> No additional items to be secured to hydraulic brake lines.

Laying cables along the brake hoses / brake lines

The cables must not touch the brake hoses.

> Spacers must be used.

> After completing the work, check the brake system for proper function.

> Check the setting of the handbrake and adjust it if necessary.

Brake cable for the parking brake

If a new brake cable for the parking brake is required, a standard brake cable must be used.

For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

The holders of the brake cables are torque-optimized, do not make any changes to them. Also do not make any other changes to the parking brake and cable guide.

Disc brakes

Cooling must not be impaired by spoilers underneath the bumper, additional wheel trims or brake disc covers, etc.

WARNING: Do not make any modifications to brake components (e.g. brake callipers or discs) or sensors. Modifications to brake components can cause these systems to no longer function as intended or to fail. This may cause the driver to lose control of the vehicle and cause an accident.

4.3 Limit values for the body-in-white

4.3.1 Changes to the body in white

Please also refer to section 6.2 “Body-in-white/body”.

> Do not interfere with the cross member structure from the front up to and including the B-pillar

> Do not make any changes to the rear portal including the roof area

> In the event of modifications to the load-bearing structure, the overall replacement rigidity of the structure introduced by the body manufacturer must be at least equal to that of the production vehicle

> In the case of modifications to floor panels, a replacement stiffness must be ensured by the body manufacturer

> When installing equipment that is friction-locked to the body-in-white, proof of operational strength must be provided by the body manufacturer

> Clearances for fuel filler necks, fuel tanks and fuel lines must be maintained

> No drilling or welding may be carried out on the A and B pillars.

4.3.2 Roof/roof load

Construction	Maximum roof load dynamic [kg]	Maximum roof load static [kg]
Station Wagon*	150	420
Pick up**	120	375
Chassis Cab**	120	375

* Values have been validated for the INEOS approved 8FT roof rack system only and is the combined rack and payload weight.

** Values have been validated for the INEOS approved 6 FT roof rack system only and is the combined rack and payload weight.

If a non approved mounting solution is used the weights stated cannot be guaranteed It is the responsibility of the converter to ensure that the integrity and dynamics of the vehicle is maintained, special considerations made but not limited too

- Roof stress
- Door operations
- Water drainage
- Vehicle handling
- The maximum permissible centre of gravity position must not be exceeded

For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

For modifications to the roof structure, observe section 6.2.5 "Modifications to the roof structure".

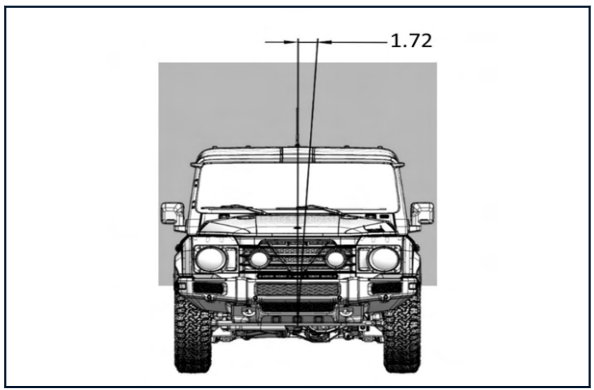
NOTE: Due to constant development and validation process always refer to the latest version of the mounting instructions for the INEOS Roof Rack for system and payload weights. For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

4.3.3 Relative movement of cab/body during torsion

In order to persevere the vehicle's ability to twist, components such as the engine and transmission are connected to the frame via a three-point mounting. The cab is attached to the frame via a torsion-resistant four-point mounting.

Torsion causes relative movements between the cab and the body.

When routing cables between the cab and the body and components fixed to the body (e.g. auxiliary headlights), pay particular attention to the movement in the opposite direction.

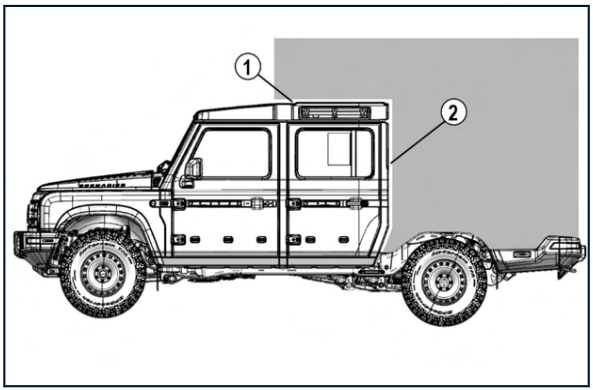


Relative movement of cab/body during twisting with instantaneous pole "P".

During the relative movement, the cab and body can rotate relative to each other by up to 1.72°. The instantaneous pole "P" of this rotational movement is an (imaginary) axis in the longitudinal direction of the vehicle which, as a first approximation, runs at the height of the longitudinal member profile centre. The resulting relative displacement is proportional to the cab height or the body height.

4.3.4 Distance between cab and body

Due to the relative movements between the cab and the body, a minimum distance of 35 mm must be maintained between the rear edge of the cab and the front edge of the body.



4.3 Minimum distance between cab and body

> 1 Minimum distance z-axis 35 mm.

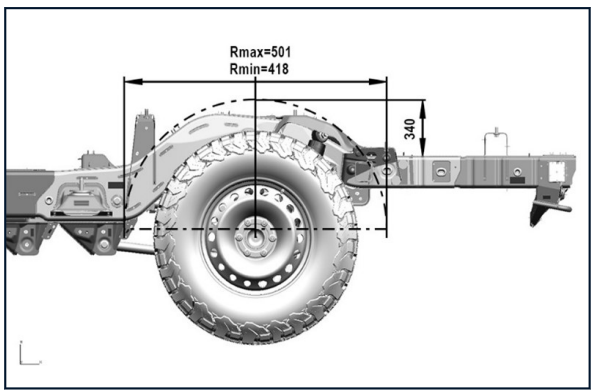
> 2 Minimum distance x-axis 35 mm.

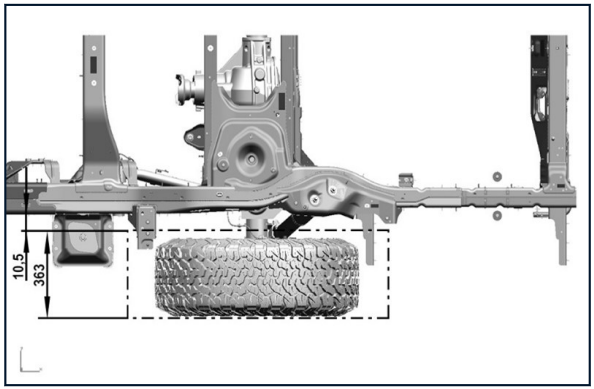
INEOS Automotive recommends the use of rubber bump stops in the gaps between the main cab and the applied body.

4.3.5 Clearances on the rear axle

The distance from the tyre to the mudguard or wheel housing must be sufficient, even with snow chains or anti-skid chains fitted and full deflection and interlocking.

The following limits must be observed for the design of wheel housings on chassis (e.g. for box bodies) by the body manufacturer.





4.4 Clearances on the rear axle

The dimensions cover the use of snow chains (snow chains should be suitable for tyres Bridgestone Dueler 265/70 R17 116S, 255/70 R18 116S, BF Goodrich All Terrain KO2 (L T 265/70 R17 / 121/118 S, L T 255/70 R18 / 117/114 S).

4.4 Electrical/electronic limit values

All installed electrical equipment must be tested in accordance with regulation UN-R 10 and bear the CE mark.

See also chapter 8 “Electrics/electronics”.

4.4.1 Electrical cables/fuses

The following table is valid for cables with an insulation limit temperature of more than 105 °C.

Max. Continuous current rating [A]	Rated current of the fuse [A]	Cable cross-section [mm2]
0-4.0	5	0.35
4.0-8.0	10	0.75
9.0-16	20	1.0
17-24	30	2.5
25-32	40	4
33-40	50	6
41-56	70	10
57-80	100	16
81-100	125	25
101-120	150	35

In all instances any wire is to have a higher total current rating than the fuse that is protecting the circuit.

4.4.2 Vehicle marker and side marker lights

- For all vehicles with an overall width of 2.10 m or more, vehicle marker lights are required in accordance with UN-R 48.
- For all vehicles over 6 m in overall length, side marker lights are prescribed in accordance with UN-R 48.

4.4.3 Retrofitting of electrical equipment

All retrofitted electrical equipment must comply with the version of EC Directive 72/245/EEC currently in force at the time of installation. An EC type approval in accordance with the currently valid version of the above-mentioned EC Directive is required for electromagnetic compatibility (EMC) if the electrical device to be retrofitted is related to immunity functions.

A certificate from the manufacturer or a CE mark may be sufficient for retrofitted electrical devices if these devices do not influence immunity. Whether such influences exist must be checked by an approved technical service before installation by the body manufacturer.

4.5 Limit values for additional units

When retrofitting additional units (e.g. additional air-conditioning compressors, pumps), observe the following:

- Vehicle parts must not be impaired in their function.
- The free movement of the vehicle and the add-on parts must be ensured in every driving situation.

NOTE: When using refrigeration systems/components in conjunction with. R1234yf, observe all applicable laws, regulations and safety requirements. Ensure compliance with the safety requirements according to ISO 13043 both at component and overall system level (FMEA, leakage requirements, concentration measurements, etc.). Also consider safety requirements related to flammability and flammability risk for R1234yf (keep the best possible packaging or the greatest possible distance from hot parts, if necessary, install additional equipment to ensure the required safety). When using R1234yf, attach a specific information plate with information regarding quantity and flammability risk in a clearly visible position. In some countries, R134a is being used. Observe all applicable laws, regulations and safety requirements. The filling quantity (in g) must be visible in the engine compartment along with the gas type and PAG oil amount. If the air conditioning system is modified, the specification is no longer relevant!

DAMAGE PREVENTION

5.1 Brake hoses/cables and lines

NOTE: Comply with the accident prevention regulations when working on the vehicle.

NOTE: Make sure to observe country-specific laws, directives and regulations.

- Before welding, drilling, grinding, and working with cutting disks, plastic lines and brake hoses must be covered and, if necessary, removed.
- After installing compressed air lines and hydraulic lines check the system for pressure loss and tightness.
- No other lines than the standard ones may be attached to brake hoses and brake lines.
- Protect the lines from heat with proper insulation.
- Hydraulic and compressed air lines must have suitable support.
- Hydraulic and compressed air lines are not to be used to support other components.

WARNING: Improperly performed work on brake hoses, lines and cables can impair their function. This can lead to the failure of components and/or safety-relevant components. There is a risk of accidents!

CAUTION: Have work on the brake hoses, lines and cables carried out at a qualified specialist workshop.

5.2 Welding work

WARNING: Welding in the area of the restraint systems (airbag, airbag sensors, airbag control unit or seat belt components) can cause these systems to no longer function as intended. If restraint systems no longer function as intended, the occupants cannot be protected in the event of an accident. There is a risk of injury! Therefore, if welding is needed in those areas, restraint systems must be removed beforehand.

WARNING: Improperly performed welding work can lead to the failure of safety-relevant components and thus to accidents. There is a risk of injury and even death!

WARNING: Have welding work performed at a qualified specialist workshop. Improper handling can result in a fire during welding work. There is a risk of injury! Always comply with the legal regulations when performing welding work.

Observe the safety measures listed in the following points in connection with welding work:

- Welding work on the vehicle may only be performed by qualified personnel.
- Before welding, remove components which might contain flammable or explosive gases - e.g. the fuel system - or protect them from flying sparks with a fireproof blanket. Replace components damaged by flying sparks during welding work.
- Before welding in the area of the above-mentioned restraint systems, the components must be removed for the duration of the work. For important information on handling, transporting and storing components with pyrotechnic units, refer to section 6.4 "Interior".
- Before welding, springs and spring bellows must be covered to protect them from welding beads. Springs must not be touched with welding electrodes or welding guns.
- Do not weld on units such as the engine, transmission, axles or on the frame and crash-relevant structural pillars of the body-in-white.
- Remove and cover the negative and positive terminals of the batteries.
- Connect the ground clamp of the welding machine directly to the part to be welded. The ground clamp must not be connected to aggregates, e.g. engine, gearbox, axles.
- Do not touch the housing of electronic components (e.g. control units) and electrical cables with the welding electrode or ground clamp of the welding machine.
- Weld only with electrodes connected to the positive pole of a direct current source. Welding should be performed from bottom to top.
- During manual arc welding, the current intensity must not exceed 40 A per mm electrode diameter.
- For manual arc welding, only well-dried electrodes (2.5 mm diameter) with a lime-based coating may be used.
- Gas-shielded arc welding is to be preferred over manual arc welding.
- In gas-shielded arc welding, the choice of welding wire thickness should follow the welding task and sheet thickness. Welding wires with a thickness between 1 and 1.2 mm are common.
- The welding material must have at least the same yield strength and tensile strength as the material to be welded.
- Plug welding is only permitted in the vertical webs of the frame side member.
- In case of weld penetration formation, grind the welds and reinforce them with angle sections to prevent undesirable notch effect.
- Welding must not be carried out in bending radii.

> The distance between weld seams and outer edges must be at least 15 mm.

For more information on welding work, refer to section 3.8 “Threaded and welded connections”.

5.3 Corrosion protection measures

After conversion and installation measures on the vehicle, surface and corrosion protection measures must be carried out on the affected areas.

NOTE: Only use preservatives tested and approved by INEOS Automotive for all corrosion protection measures.

*NOTE: **ENVIRONMENTAL NOTICE:** Since 01.07.2007, surface protection (e.g. galvanizing) may no longer contain chromium 6.*

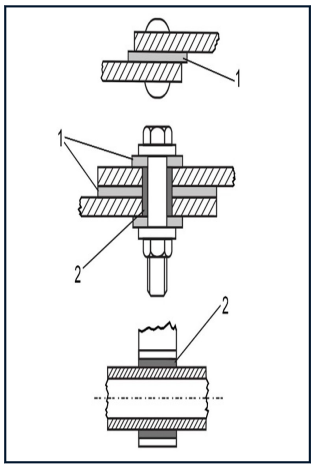
Measures during planning

Corrosion protection should be included in the planning and design stages by suitable material selection and design of components.

If two different metallic materials are joined by an electrolyte (e.g. atmospheric moisture), a galvanic connection is formed. Electrochemical corrosion occurs, whereby the less noble metal is damaged. The further apart the two metals are in the electrochemical series, the more intense electrochemical corrosion becomes.

Therefore, electrochemical corrosion must be prevented by appropriate treatment of the components or insulations or kept low by suitable material selection.

Avoidance of contact corrosion by electrical insulations



5.2 Avoidance of contact corrosion

1. Insulating washer.
2. Insulating sleeve.

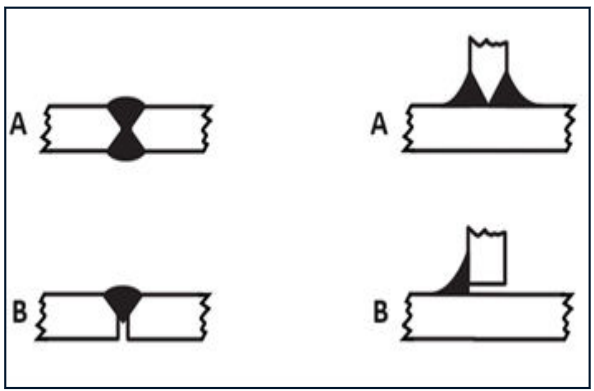
Contact corrosion can be avoided by using electrical insulations such as washers, bushings or sleeves.

Avoid welding work on inaccessible cavities.

Measures through component design

- Corrosion can be reduced by design measures, especially in the design of joints between the identical or different materials.
- Corners, edges, creases and folds involve the risk of dirt and moisture accumulation.
- The use of inclined surfaces, drains and the avoidance of gaps in joints should already counteract corrosion by design.

Design-related gaps at welded joints should be avoided



5.3 Examples of welded joints

- **A** favourable (through-welded).
- **B** unfavourable (gaps).

Coating Measures

The vehicle can be protected against corrosion by applying protective coatings (e.g. galvanising, painting, preservation or zinc application by flame).

After all work on the vehicle

- Remove drilling chips.
- Deburr edges.
- Remove burnt paint and thoroughly prepare surfaces for painting.
- Prime and paint all bare parts.
- Preserve cavities with wax.
- Carry out corrosion protection measures on under-body and frame parts.

Measures for drilling through the vehicle body

Every time an assembly hole is drilled into the vehicle body, one or more elements of the existing protection system are damaged.

Therefore, the body manufacturer performing the installation is obliged to restore a corrosion protection system of a quality comparable to that of the base vehicle.

1. Protection of the exposed sheet metal edge

- Remove drilling chips.
- Deburr the borehole.
- Prepare the surface: degrease the sheet metal edge and adjacent areas for painting.
- Prime and paint all bare parts (phosphate base coat).

2. Ensure tightness of the drilled hole if it leads to the outside.

- Use round body tape sealant between the installation parts and the body (except roof vent elements).
- Use of silicone for floor vent element.
- Spray all mounting parts protruding downwards from the vehicle with under-body protection.
- Proper application of these measures ensures that the basic vehicle will be rust-free for years.

5.4 Painting and preservation work

CAUTION: For paint drying, a circulating air temperature of 80 °C and a component temperature of 60 °C must not be exceeded. Higher temperatures may cause damage to the control units or other components.

Paintwork or preservation damaged by the body manufacturer must be repaired by the body manufacturer.

It is essential to observe the following:

- Adhere to the INEOS Automotive quality requirements for initial painting and refinishing.
- Use only materials tested and approved by INEOS Automotive or equally suitable materials for all painting and preservation work.
- Adhere to the layer thickness's of the individual paint layers specified by the factory.
- Paint compatibility must be ensured when over-painting.

The paint materials and INEOS Automotive paint numbers used at the factory can be obtained from any INEOS Automotive Service Centre.

The following areas must be covered before painting:

- Disc brakes
- Brake hoses
- Brake fluid reservoir
- Parking brake
- Contact surfaces between disc wheels and wheel hubs or brake discs
- Contact surfaces of the wheel nuts/wheel bolts
- Airbags and seat belts
- Sealing surfaces

- Windows, mirror glasses
- Illumination openings
- Vents on gearboxes, axles, etc.
- Door locks
- Door stops in the hinges of the rear revolving door
- Coupling flanges of drive shafts and power take-offs
- Piston rods, e.g. on gas springs of the tailgate
- Pneumatic control valves (compressed air system/vacuum system)
- Spring/spring support area.

5.5 Towing the vehicle

WARNING: Before towing, read the section "Towing" in the detailed operating instructions. Otherwise, you may fail to recognise hazards, cause an accident and injure yourself or others. In addition, the vehicle may be damaged.

CAUTION: If instructions in the operating manual are not followed, damage to the vehicle, e.g. in the drive train, may occur. Only tow the vehicle with the battery connected.

5.6 Fire prevention

5.6.1 Fire hazards

Fire hazards for the complete vehicle can originate from:

- Bodies and implements
- Use
- Environment

To avoid vehicle fires, it is essential to observe the following instructions!

5.6.2 Attachments and bodies

- For all attachments and bodies, ensure that neither flammable objects nor flammable liquids/operating fluids (e.g. due to leaks in the hydraulic system) can reach heated units such as the engine, transmission, exhaust system, turbocharger or similar
- To avoid a possible fire, components which are at risk of leakage (e.g. hydraulic valves, screw fittings, etc.) should be positioned in a way that ensures escaping fluids (e.g. due to dripping, fluid jets, fluids blown away by the airflow or fan) cannot reach hot parts in the event of a fault
- If this is not feasible for functional reasons, install suitable protective measures (e.g. covers, seals or cladding).

- Protect components from radiated heat.

5.6.3 Notes on the design of electrical installations

There is also a risk of vehicle fire due to overloading of electrical wiring. When connecting electrical consumers, use the electrical interfaces on the vehicle described in the installation guidelines and observe their maximum power consumption.

Appropriately dimension and fuse the electrical wire on the body, especially those with high loads. Electrical wiring amperage rating to be greater than the fuse protecting the circuit.

No factory fitted fuse rating to be changed.

Lay the electrical wiring in such a way that

- they are protected from the effects of heat. If this is not possible, protect the lines by suitable insulation measures.
- no chafing points occur, especially at crossing points, sharp edges, screw heads, protruding threaded bolts and nuts etc. If necessary, use cable ducts, protective conduits, corrugated tubes or similar.

Connect the individual cables properly and professionally.

End sleeves are not permitted for moving cables. Subsequent connection to existing electrical wiring with insulation piercing connectors (also known as vampire connectors or wire taps) or simple twisting or soldering is prohibited.

If lines on the chassis side (especially electric and hydraulic) are damaged during body assembly, they must be replaced.

5.6.4 Notes on the design of hydraulic installations

- When retrofitting hydraulic lines or hoses, ensure that they are properly and professionally fastened and designed (keep maximum bending radii, chafing points, operating pressure, bursting pressure etc. in mind)
- When using hydraulic hose lines, observe the storage and usage duration according to DIN 20066
- Hydraulic lines must not be fixed on existing lines of the chassis (e.g. hydraulic pipes, battery cables, brake lines, etc.)
- The relative movements between individual components (e.g. engine and chassis or body and chassis, etc.) occurring during operation of the vehicle and the resulting expansion and compression of the lines must be taken into account when laying the lines.

Lay hydraulic lines in a way that

- protects the lines from the effects of heat. If this is not possible, protect the lines by suitable insulation measures
- no chafing points occur, especially at crossing points, sharp edges, screw heads, protruding threaded bolts and nuts, etc.

If this is not possible, use suitable holders to exclude chafing points. If chafing points cannot be avoided despite the use of suitable holders, chafing protection must be provided.

Chafe-free routing is always preferable to the use of a chafe guard.

CAUTION: If lines on the chassis, especially electrical and hydraulic lines, were damaged during body assembly, they must be replaced.

MODIFICATIONS TO THE BASIC VEHICLE

6.1 Suspension

6.1.1 General information on the suspension

WARNING: Modifications to suspension components can lead to an impairment of the handling and to unstable driving behaviour. This can cause the driver to lose control of the vehicle. There is a risk of accident! For this reason, do not apply any modifications to the suspension parts.

Do not make any modifications to the following chassis parts and components:

- Front wishbones: Do not change the wheel position values.
- It is not permissible to modify the front axle carrier to mount additional assemblies or to make other modifications.
- Modifications to stabiliser bars (diameter, material) at the front and rear as well as their subsequent installation.
- Rear axle: Do not make any modifications.
- Brakes: Do not make any modifications.
- Devices, sensors, routing of lines for ESP/ABS: Do not make any modifications.
- When installing the front axle, use new bolts. All bolts and screw connections must be tightened in accordance with the INEOS- Automotive tightening instructions. Information on this can be obtained from your INEOS- Automotive service centre or INEOS Aftersales portal.
- For all assembly work, VDI Guideline 2862 must be observed, in particular, the section entitled "Threaded connections with special safety relevance", must be implemented.
- Do not shorten the clamping length clearance, make changes to a stretch shank, or use screws with a shorter thread clearance.
- Observe the settlement properties of threaded connections.
- Additionally clamped components must have the same or higher strength than the previous clamping assembly.
- The use of INEOS- Automotive tightening torques requires screw friction coefficients in the tolerance range of (μ = 0.08 to 0.14).
- We recommend using original INEOS Automotive original parts.

Further information, about INEOS Automotive tightening instructions and the setting behaviour of threaded connections, can be obtained from any INEOS Automotive service centre or INEOS Aftersales portal.

NOTE: To avoid increased tyre wear, it may be economical to change the standard wheel setting values (camber, toe-in) on the front axle if the vehicle unladen mass is increased due to body mounting work or

equipment. The information in 3.4 Dimensions and weight specifications on vehicle unladen mass and associated axle loads before and after body mounting work, "Checking the wheel setting" in 3.10.3 Work before delivery of the converted vehicle and 3.11 "special equipment" must be observed. In the event of a planned change to the standard wheel alignment values, consultation with an INEOS Automotive partner is recommended. The same applies to the use of fully loaded vehicles, as it can be assumed that the maximum permissible axle loads are predominantly utilised to the limit here as well.

6.1.2 Spring/damper elements

Modifications to springs, dampers, stabilisers and tension springs can only be carried out on the front and rear axles in the combinations specified by INEOS Automotive. In this case, a clearance certificate is not required. Modifications going beyond this must be matched to each other on the front and rear axles and require a clearance certificate.

- We recommend INEOS Automotive original springs, dampers, stabilisers and tension springs.
- During installation work, ensure that the surface and corrosion protection of the springs, dampers, stabilisers and tension springs is not damaged.
- Before welding work, springs, dampers, stabilisers and tension springs must be covered to protect them from welding beads.
- Springs, dampers, stabilisers and tension springs must not be touched with welding electrodes or welding guns.

WARNING: Never use springs, dampers, stabilisers and tension springs that do not meet the characteristics of the standard parts or the parts available as special equipment. Otherwise, on vehicles with ESP, this system may no longer function as intended and may fail. This may cause the driver to lose control of the vehicle. There is a risk of accident!

6.1.3 Brake system

WARNING: Improperly performed work on brake lines/ brake hoses can impair their function. (This includes lines for hydraulics and air or electrical control signals). This can lead to the failure of components or safety-relevant parts. This can cause the driver to lose control of the vehicle. There is a risk of accident! Only have work on brake lines/brake hoses performed by a qualified specialist workshop.

- After completion of the work, the brake system must be checked for proper function. We recommend approval by a technical inspection agency.
- If routing changes are necessary, avoid crossing sharp edges and spaces that are too narrow or near moving parts.

Hydraulic brake system

- Replace hydraulic brake lines without additional disconnection points using tubes approved by INEOS, or fully assembled INEOS genuine brake lines with connection parts. The brake lines from the master brake cylinder to the hydraulic unit must not be replaced!
- Brake lines between master brake cylinder and hydraulic unit must not be modified.

Bending radii

Tube ø	Limit feasible	Best practice
Ø 4,75	R12	R15
Ø 6/6,35	R15	R20

- Lines may only be formed in a bending machine.
- The cross-section must not be reduced.
- The lines must be cleaned internally before installation.
- Do not use plastic lines in hydraulic systems.
- The brake fluid must be renewed regularly in accordance with INEOS- Automotive regulations, but at least every two years. If necessary, renew the brake fluid before customer delivery.
- If the brake fluid change interval has been exceeded or the age of the brake fluid is not known, the brake fluid must be renewed.
- When routing between two components that can move relative to each other, use a high-pressure-resistant flexible line (brake hose, if possible, INEOS- Automotive genuine brake parts). Ensure that the flexible lines are not stretched in all operating conditions and do not rub against other components.
- Brake lines must not be modified. In the event of modification, the responsibility lies with the manufacturer.

Line routing

WARNING: A sufficient distance between the brake lines and heat sources, sharp-edged and moving parts must be maintained for all operating conditions. Otherwise, bubbles in the brake fluid or chafing in the brake line may cause impairment and total failure of the brake system. This can cause the driver to lose control of the vehicle. There is a risk of accident! Only have work on brake lines performed by a qualified specialist workshop.

- For fastening, we recommend original brake line holders from INEOS- Automotive for clipping in the brake line.
- The distance from holder to holder must be kept <500 mm.
- Always lay the brake lines without kinks.

Laying lines along the brake hoses and brake lines

No other lines may be attached to brake hoses and brake lines.

Brake cable for the parking brake

- If a new brake cable is required for the parking brake, a standard brake cable must be used.
- The brake cable holders are torque optimised, do not make any changes to them. Also do not make any other changes to the parking brake or cable guide.
- Always route brake cables without kinks.
- Do not make any angular changes to the end pieces of the brake cable conduit.
- Do not attach any lines other than the standard lines to the brake cables.

For further information, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

Disc brakes

Cooling must not be impaired by spoilers below the bumper, additional wheel trims or brake disc covers, etc.

WARNING: Do not make any modifications to the air inflow and air outflow of the brake system. Modifications to the steering and brake system can cause these systems to no longer function as intended and to fail. This may cause the driver to lose control of the vehicle. There is a risk of accident! Therefore, always ensure a sufficiently cooling air supply.

WARNING: Modifications to brake components can cause these systems to no longer function as intended and to fail. This may cause the driver to lose control of the vehicle. Do not make any modifications to brake components. There is a risk of accident!

6.1.4 Wheels/Tyres

WARNING: Only use tyre types and tyre sizes approved by INEOS- Automotive for your vehicle type and observe the tyre load capacity and speed index required for your vehicle. The wheels must be equipped with sensors for tyre pressure monitoring. In addition, observe the country-specific approval regulations for tyres. These regulations may specify a certain type of tyre for your vehicle or prohibit the use of certain types of tyres that are approved in other countries. If you have wheels fitted which are not approved by INEOS- Automotive,

- the wheel brakes or suspension components may be damaged.
- the clearance of the wheels and tyres is no longer guaranteed.
- the wheel brakes or chassis parts may no longer function as intended.
- the values displayed in the speedometer and odometer may be distorted.

> the performance of the ESP and thus driving safety may be impaired.

The body manufacturer must ensure that the following requirements are met:

> Only tyres and tyre sizes approved by INEOS - Automotive may be used, see vehicle registration document or section 4.2.3 "Approved tyre sizes".

> Use approved wheels only with the associated tyre pressure.

Air pressure for cold tyres		
Bridgestone Dueler AT (265/70 R17 116XL) (255/70 R18 116XL)	Max. 3 people* (225kg)	5 people* (375kg)
Front Axle	2.5 bar	3 bar
	250 kPa	300 kPa
Rear Axle	2.5 bar	3.4 bar
	250 kPa	340 kPa
Spare	3.4 bar	3.4 bar
	340 kPa	340 kPa

Air pressure for cold tyres		
BF Goodrich/ All Terrain T/A Ko2 LT265/70R17 121/118S LT255/70R18 117/114S	Max. 3 people* (225kg)	5 people* (375kg)
Front Axle	2.5 bar	3 bar
	250 kPa	300 kPa
Rear Axle	2.5 bar	3.4 bar
	250 kPa	340 kPa
Spare	3.4 bar	3.4 bar
	340 kPa	340 kPa

* A person is defined as 68kg +7kg luggage.

For more information on wheels/tyres, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website. Alternatively, refer to section 3.11 “special equipment”.

NOTE: We explicitly point out that the use of corresponding tyre sizes only applies in conjunction with the weight and speed indices approved and intended for this purpose.

6.1.5 Wheel clearance

The body manufacturer must ensure that the distance from the tyre to the mudguard and/or wheel housing or body is sufficient even with snow chains or anti-skid chains fitted and fully compressed suspension (even with axle articulation).

6.1.6 Spare wheel

The country-specific equipment or special equipment may include a spare wheel.

When mounting it, observe the following requirements in addition to the legal guidelines:

- Only attach the spare wheel to the extra holder on the cargo bed (pick-up) or on the rear door (station wagon).
- Good accessibility and ease of operation must be ensured.
- Secure the spare wheel twice against loss.

6.1.7 Wheel chocks

When securing, observe the following requirements in addition to the legal guidelines:

- Good accessibility and easy operation must be ensured.
- The wheel chocks must be secured twice to prevent loss.
- The mounting must be suitable for the wheel chocks and vibration-free.

6.2 Body shell/Body-In-White

6.2.1 General information Body-in-white/body mounting work

Modifications must not impair the function and strength of units and operating devices of the vehicle or the strength of structural parts.

During conversions, no changes may be made which impair the function and freedom of movement of vehicle parts (e.g. during maintenance and testing work) and accessibility to them.

It is essential to observe the following instructions:

- All modifications must be fully represented in advance by drawings and calculations and certified by the vehicle manufacturer.
- Do not change the wheelbase under any circumstances.
- Do not exceed the permissible axle loads.
- Do not interfere (such as drilling or welding) with the support structure from the front to behind the B-pillar.
- Modifications to the windscreen and windscreen frame as well as to the A and B pillars are not permitted.
- Holes on the frame side member result from the production process and are not suitable for attaching bodies; otherwise damage to the frame may occur.
- No cutting is permitted on the C and D pillars (rear portal), including the associated roof bows.

- Retrofitting of vehicles with curtain airbags is not permitted in the B-pillar roof area.
- Partition walls may be removed in whole or in part.
- The free space for the fuel filler neck and for the fuel tank and fuel lines must be maintained, see section 6.3.1 "Fuel system".
- Avoid sharp-edged corners.
- Check trailer connections for function.
- If an INEOS-Automotive trailer coupling is fitted, refer to section 6.6.5 "Trailer coupling".
- The attachment of additional equipment to longitudinal and transverse members must be carried out using brackets (plug welding) and requires approval.
- The function of the Tyre Pressure Monitoring System must not be disturbed by modifications in the immediate vicinity of the antennas and wheels.

Welding on the body-in-white

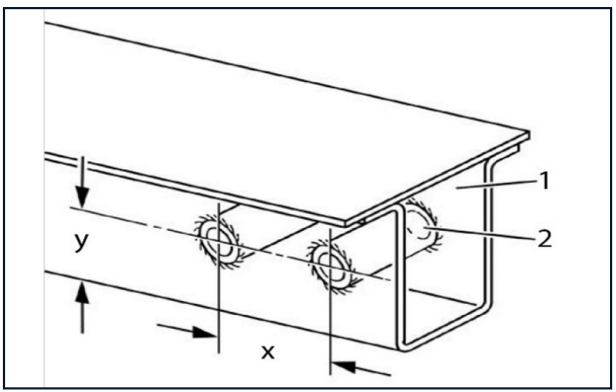
- Welding work may only be carried out by qualified personnel.
- For welding work, refer to section 5.2 “Welding work”. In addition, you will find information on the execution of welded joints in section 3.8 “Threaded and welded joints”.

Drilling on the body-in-white

NOTE: Do not drill in the following areas:

- *A and B pillars*
- *Lower flange of the frame*
- *Area of the rear axle, which performs structural functions*
- *Area of components attached to the frame*
- *Load application points (e.g. spring blocks, brackets)*

Drilling holes in the web of the longitudinal member is only permitted in accordance with the following illustration and using spacer bushes welded to the longitudinal member:



6.1 Drilling work on the longitudinal frame member

- 1 Chassis frame
- 2 Spacer bushes
- y distance at least 20 % of frame height
- x Hole spacing at least 50 mm

NOTE: After drilling, deburr and ream all holes, remove chips from the frame and apply cavity sealant through the holes.

NOTE: Existing holes on the frame side member result from the production process and should not be used.

6.2.2 Side panel, windows, doors and flaps

Side wall

- If modifications are made to the side wall, the rigidity of the modified body must be equal to that of the basic vehicle.
- The roof frame must not be impaired in its function and must be retained.

NOTE: After completing the work on the vehicle, observe the specified corrosion protection measures.

For more information on modifications to the side panel, refer to section 6.6.4 “Shelf installations”.

Windows

Windows must be enclosed with a sturdy frame. Connect this frame with other body elements in a force-fit manner.

If the retrofitting of windows (panoramic glazing) results in interventions in the load-bearing structure (pillars, reinforcements, connection of the bows) of the basic vehicle, the rigidity of the modified body must be equal to that of the basic vehicle.

Doors and flaps

If the load-bearing structure of the basic vehicle (cross-members, frames, pillars, reinforcements, bows) is affected by modifications to doors, the rigidity of the modified body must be equal to that of the basic vehicle.

- Seats must be directly accessible from the outside through a door or from the cab.
- Locked doors must also be quick and easy to open from the inside.
- Doors must open wide enough and entrances must be designed to allow safe and convenient entry and exit.
- The correct detection of the driver's door position (open/closed) via the installed door contact switch must be ensured.
- The distance between the road and the lowest step must be kept <400 mm.
- After all work on the vehicle, observe the specified corrosion protection measures.

CAUTION: Do not attach any additional masses to the doors.

CAUTION: Do not make any modifications to the locking system, in the immediate area of the door, or in the area of pillars or cross members.

6.2.3 Attachment to the chassis frame

WARNING: If attachments are made to the frame at the front, the function of the crash structure required for passive safety and the function of the airbag units can be disrupted.

NOTE: The ease of repair of the series vehicle must be maintained as far as possible.

Further information on the standard body mounts, section 7.2.4 “Fastening parts for third-party bodies”.

6.2.4 Wheel arches and wings

CAUTION: Do not lower the wheel housings under any circumstances. Otherwise, damage to the vehicle (e.g. wheel housings and tyres) may occur.

6.2.5 Modifications to the roof structure

NOTE: Modifications to the roof structure including the rear portal are only permitted in exceptional cases and only with a clearance certificate from the responsible department.

WARNING: If modifications are subsequently made to the headliner or the roof panel between the A-pillar and the B-pillar, the deployment of the curtain airbag may no longer function as intended. If curtain airbags no longer function as intended, the occupants cannot be protected in the event of an accident. There is a risk of injury! Do not subsequently modify the headliner or the roof panel between the A-pillar and the B-pillar if equipped with a curtain airbag.

- Roof bows or supporting parts must not be removed or damaged without replacement.
- If the roof panel and roof bows are removed and no surrounding profile frame is possible, at least two additional roof bows are required in front of and behind the location of the removed bow.
- The connection of the bows to the side walls must be designed in such a way that a force-fit connection is ensured (rigid connection of bow and roof frame).
- Observe the maximum roof load.

Version	Maximum roof load dynamic [kg]	Maximum roof load static [kg]
Station Wagon*	150	420
Pick-up**	120	375
Chassis Cab**	120	375

*Values have been validated for the INEOS approved 8FT roof rack system only and is the combined rack and payload weight.

** Values have been validated for the INEOS approved 6 FT roof rack system only and is the combined rack and payload weight.

> The maximum permissible centre of gravity position must not be exceeded, see section 4.1.2 "Maximum permissible centre of gravity position".

> When mounting a carrier system directly to the rivet nuts, only use the mounting brackets approved by INEOS-Automotive or brackets according to drawings from INEOS-Automotive as a direct connection to the roof.

> The maximum roof load must not be exceeded.

NOTE: Due to constant development and validation process always refer to the latest version of the mounting instructions for the INEOS Roof Rack for system and payload weights. Information can be found in the accessories section of the INEOS Aftersales portal.

Subsequent installation of lifting roof/roof hatches

Roof hatches are special equipment.

Plastic roofs are only suitable for the installation of roof hatches to a limited extent.

The roof load is limited.

Modifications to cab roof

CAUTION: Modifications to the cab must not impair the function of any safety-relevant components (such as airbag units, sensors, pedals, gearshift levers, lines and others). This may result in the failure of components or safety-relevant parts.

6.3 Engine peripherals / Drivetrain

Modifications to the engine control unit/engine performance enhancement.

NOTE: Any tampering with the engine control unit is not permitted for customers and body manufacturers. Manipulations or modifications to the engine control unit cause changes to the certified engine and emission values and thus lead to the immediate expiry of the operating permit.

6.3.1 Fuel system

WARNING: Fuels are highly flammable. There is a risk of fire and explosion if fuel is handled improperly! It is essential to avoid fire, open flames, smoking and sparks.

CAUTION: Unauthorised modifications to the fuel system (fuel tank, lines ...) can lead to impaired driving performance and engine emergency start-up.

When working on the fuel system, it is essential to observe the following instructions:

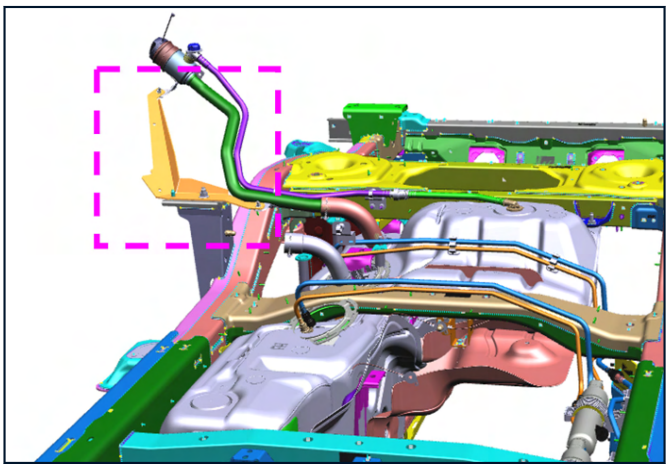
- Do not attach any heat-conducting components or components that restrict the installation space.
- Do not make any changes to the fuel pump, fuel line length or fuel line routing. Modifications to these coordinated components can impair the function of the engine.
- The clearance for the fuel filler neck and for the fuel tank and fuel lines must not be changed.
- Follow the type approval for connections for fuel supply of auxiliary heaters.

*NOTE: **ENVIRONMENTAL NOTICE:** Improper modifications to the fuel system may have an adverse effect on the environment.*

Fuel / AdBlue filler neck positioning

Fuel transport bracket

NOTE: The fuel transport bracket is used solely for transportation purposes and must not be used on the road. Remove and discard the fuel transport bracket!

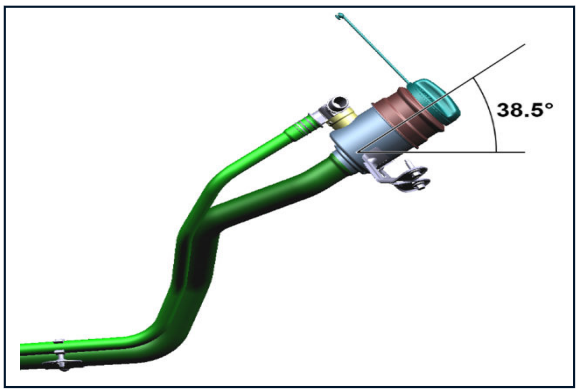


Relocation or modification of Fuel - AdBlue filling systems

It is important that any installations performed where alterations are made to the fuel filling or AdBlue filling system do not alter the filling rate, breather function or angle of the filling point. If alterations are

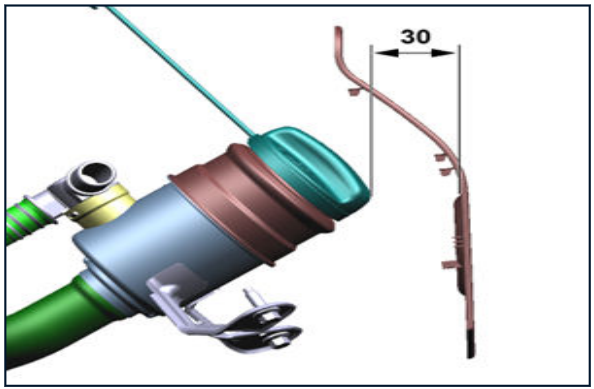
made that change any of the above functions, vehicle operation will be affected and could result in warning messages being displayed.

Angle of fuel filler neck:



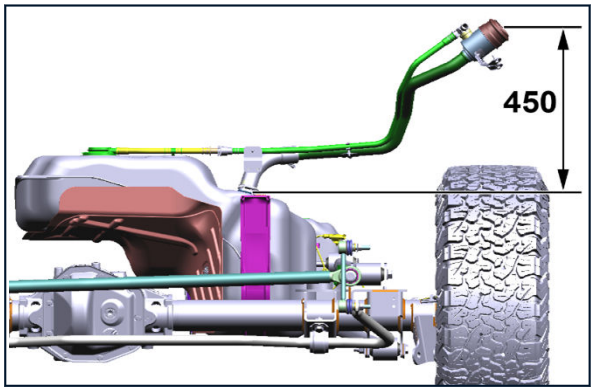
A 38.5° angle should be maintained to ensure good flow of fuel when refuelling and prevent flow back.

Clearance from vehicle body / fuel flap:



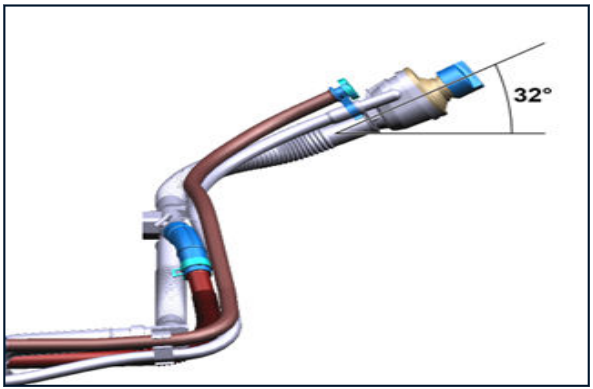
At least 30 mm clearance between the fuel filler cap and vehicle body should be maintained.

Fuel Filler Height:



A filler neck opening height of at least 450 mm should be maintained, measured from the fuel tank opening centre point to the fuel filler pipe opening centre point.

Angle of Ad Blue filler neck:



A 32° angle must be maintained from the filler cup to ensure adequate flow of AdBlue when refilling to prevent flow back.

6.3.2 Exhaust system

INEOS- Automotive recommends refraining from modifications to the exhaust system of Grenadier vehicles.

- If the exhaust system on a vehicle is replaced, we recommend that you use genuine INEOS- Automotive parts.
- When selecting a different exhaust system, make sure that it is also available for the same engine version and emission rating from INEOS- Automotive production plants. This ensures that the planned special exhaust system has been certified in this vehicle configuration. For further information, please contact your INEOS- Automotive service centre.
- Be sure to observe country-specific laws, regulations and directives.

General

Please note that modifications to the exhaust system geometry and piping are only permitted under the following general conditions:

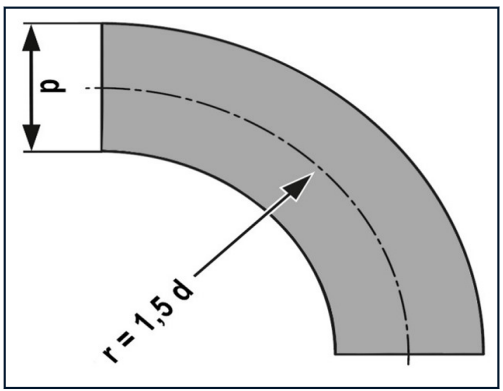
- In the context of such modifications, measurements of the exhaust back pressure (before/after) must be taken to ensure that it has not increased compared to the unmodified exhaust system.
- Upon request from INEOS- Automotive, these measurements must be verified by the respective body manufacturer.

NOTE: Modifications going beyond this represent the change of a certified condition with regard to emissions and noise.

NOTE: After all work on the vehicle, observe the specified corrosion protection measures.

Exhaust system geometry

The following dimensions must be observed when modifying the exhaust system:



6.3 Pipe bend design example

- Pipe bend maximum 90°.
- Avoid additional pipe bends.
- Bending radii > 1.5 d.

Minimum distances from pipes and attachments

When the vehicle is in operation, temperatures of more than 120 °C can occur between the exhaust system (catalytic converter or rear silencer) and the floor panel. Shields or insulation must therefore be fitted to the substructure to reduce heat radiation.

WARNING: If the minimum distance to fuel lines, plastic lines and electrical cables is not maintained, a fire may occur due to intense heat. There is a risk of fire and explosion!. Always maintain the specified minimum distances.

Specification for minimum distances for fuel lines, plastic lines, electrical cables and spare wheels as well as all components made of non-heat-resistant materials:

- 200 mm for exhaust systems without shielding.
- 80 mm for sheet metal shielding.
- 40 mm for sheet metal shielding with additional insulation.

Consider not only the radiant heat of the exhaust system, but also the exhaust jet after the outlet under all operating conditions.

Additional shielding is required

- In the area of control panels.
- In the area of major assemblies, attachments and fixtures, if they are not made of heat-resistant material.

Exhaust gas emission

- Make sure that the out-flowing exhaust gases from the exhaust tailpipe cannot enter the passenger compartment, especially when designing access points and doors.
- Also note that exhaust gas flows directed at e.g. aggregates, hoses, cables, sheet metal components and tyres, can impair the service life and/or performance of these components. The tolerable continuous temperature of vehicle components can vary!.
- Avoid direct exhaust gas flows and/or too short distances from flow outlet openings on tyres.

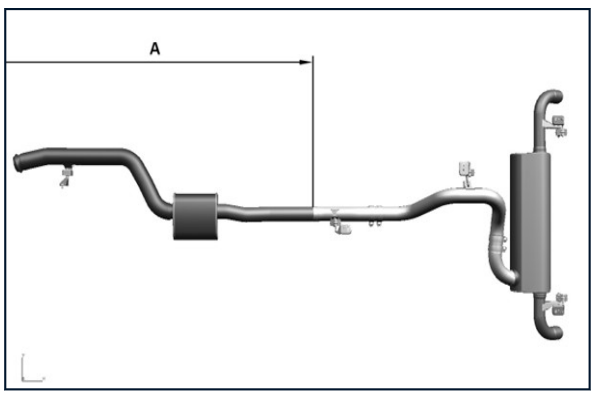
WARNING: If the direction of exhaust gas flow is changed, the body manufacturer is responsible for the functional safety of vehicle components that are exposed to the exhaust gas in terms of continuous temperature resistance and the leak-tightness of the vehicle interior. There is a risk of accidents due to components failing as a result of the temperature or a risk of suffocation due to exhaust gas entering the passenger compartment.

Exhaust system

The length and installation position of the flexible metal hose (decoupling element) between the exhaust manifold and exhaust pipe must not be changed.

The free cross-section of the exhaust pipe behind the main silencer must not be reduced and the overall vehicle acoustics (interior and exterior acoustics) must not be impaired by modifying the exhaust system.

The following is a schematic representation of the area in which no modifications are permitted.



6.4 Schematic diagram of exhaust system

> A - Area in which no modifications are permitted.

WARNING: The lengths and guides, e.g. between particulate filter and main exhaust silencer, are optimised in regard to temperature behaviour. Changes can lead to higher or even extreme heat input into the exhaust system and surrounding components (drive shafts, fuel tank, floor panel, etc.). There is a risk of fire! Modifications of the exhaust system up to the exhaust silencer are not permitted.

6.3.3 Engine cooling

> The cooling system (radiator, radiator grille, air ducts, coolant circuit, etc.) must not be modified, as sufficient cooling air flow must be ensured.

> The cross-sectional areas of the cooling air intake surfaces must be kept free.

> Warning plates, badges or other decorative parts must not be attached in the area in front of the cooler.

> Additional cooling devices for aggregates must be provided - when the vehicle is stationary and a high continuous output is required.

Cooling air openings at the front of the Grenadier:

6.5 Cooling air openings at the front of the Grenadier

1. Radiator Grille
2. Bumper Grille

6.3.4 Intake air system

Observe the following instructions when making changes to the engine air intake system:

- To ensure proper functioning, standard parts such as filters, hoses, suspensions (decoupling elements), etc. must be mounted equivalent to the standard series version.
- Do not modify the clean air side and the maintenance indicator connection (if available).
- The installation conditions in the area of the intake opening must not be changed.
- The flow velocities in the intake area and inside the air intake duct must not be increased. The free cross-section must not be constricted. The pressure loss must be equivalent to the pressure loss of the series air intake.
- The water separation of the intake air system can also be worsened by minor modifications in the area of the intake opening (for example the radiator grille). Therefore, approval from the responsible department is always required for modifications in this area.

Warm air

- Intake of warm air results in loss of engine performance. A partition between the engine interior and the intake point is therefore essential.
- The intake temperature should not exceed the outside temperature by more than 10 °C.

Water

- Water running off the body, splash water or water from washing the car must not flow directly past the intake point.
- Make sure that water does not reach the intake point through any fresh air supply openings.
- The flow velocity at the intake point must not be increased by changing the intake point opening.

Dust/dirt

- Increased dust pick-up will result in shortened maintenance intervals for the air filter.
- To avoid increased dust pick-up, place the engine air intake as dust protected as possible.
- Another way to reduce increased dust pick-up is to use pre-filters, such as the INEOS Raised Air Cyclone Pre-cleaner (GRA-0B14-009860), information on this can be found via the INEOS Aftersales portal accessory section.

NOTE: The detachable pieces of the air intake represent a certified condition with regard to emissions and outer edges. Attachments or conversions that change the size of the air intake may result in the emissions type approval of the base vehicle no longer being generally valid. The body manufacturer must ensure compliance with the certified limits and the associated approval requirements of the vehicle if modifications are made in this area.

6.3.5 Clearance for major assemblies

In order to ensure the function and operational safety of the major assemblies, sufficient clearances must be maintained (in particular to electric, brake and fuel lines). Observe the dimensional data in the quotation drawings.

The distance between the driver's cab and the body must be at least 35mm in x-axis.

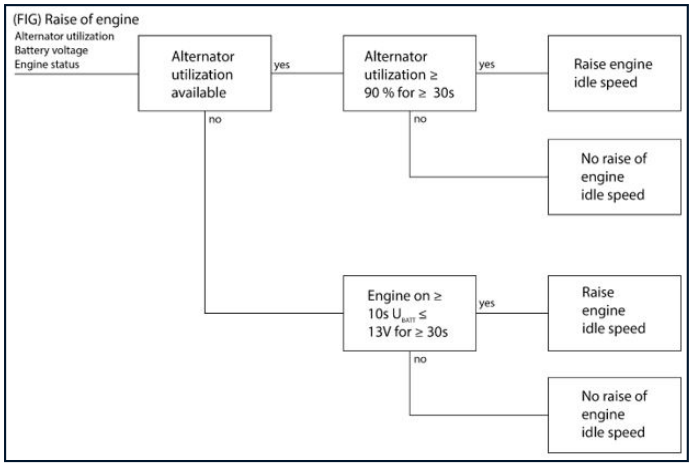
6.3.6 Cardan shafts

NOTE: Do not make any modifications to the drivetrain.

6.3.7 Engine RPM control

To avoid a negative charging balance because of customer specific consumers (on-board network is fed by the battery) when idling, an idling boost must be provided in the engine control. The message to increase the idle speed of the engine depending on the generator load is sent from the BCM to the DXE. This is then implemented as required. The idle speed should increase at least by 150 rpm.

This application is carried out in such a way, that the increase is as unobtrusive as possible.



6.7 Engine Speed Control

6.4 Interior

6.4.1 General information

All legal regulations listed in this chapter refer to EU/EC or UN directives. Observe country-specific laws, directives and regulations.

WARNING: Airbag and seat belt pre-tensioner units are pyrotechnic objects. There is a risk of explosion when handling pyrotechnic objects. As a result, persons may be injured. Handling (installation, removal, transport, storage and disposal) of airbag and belt tensioner units may therefore only be performed by appropriately qualified personnel. The accident prevention regulations must be observed.

The handling, transport and storage of pyrotechnic articles are subject to the "Law on Explosive Substances" and must therefore be registered with the responsible trade supervisory authority.

WARNING: Modifications to restraint systems or their wiring can cause restraint systems to no longer function as intended. A restraint system may fail or be activated unintentionally. There is a risk of injury! Do not make any modifications to the restraint systems or their wiring.

WARNING: If paint or surface treatment is applied to the instrument panel, the steering wheel impact damper or the tear seams of the airbags, chemical reactions may occur on the treated surfaces. This can weaken or damage the materials so that the restraint systems no longer function as intended. There is a risk of injury! Do

not paint or treat the surfaces of the instrument panel, the steering wheel impact damper or the tear seams of the airbags.

Modifications in the cockpit area and above the belt trail line must meet the criteria of the head impact tests according to UN-R 21 or FMVSS 201.

Near the airbag deployment areas, modifications to the surface of the cockpit, interior trim and seats (additional fixtures, cell phone cradle, bottle holder or similar) are not permitted. See also the illustration on the deployment ranges of the airbags.

The permissible centre of gravity and axle loads must not be exceeded.

Observe the following when installing or modifying the interior:

- Appropriate information sheets for vehicle conversions can be obtained from the relevant technical inspection agency for motor vehicle traffic.
- Design the interior with soft edges and surfaces.
- Fixtures must be made of flame-retardant material and be firmly mounted.
- Unobstructed access to the seats must be ensured. There must be no protruding parts, corners or edges in the area of the seats that could cause injury.

6.4.2 Safety equipment

WARNING: Safe operation of restraint systems is no longer guaranteed if the following interventions are made in the structure of the vehicle:

- Modifications to the seats.
- Modifications to the front-end assembly.
- Installations of parts near the exit openings and in the deployment area of the airbags. This also applies to any installations of parts in the area of the instrument panel (cockpit) and A pillar between the deployment area of the airbags and the front and side windows.
- Installation of third-party seats.
- Modifications to the A and B pillars as well as to the roof frame and its trim.
- Modifications to the doors.

Do not make any of the listed modifications. Otherwise, personal injury may result.

NOTE: Attachments with rigid connections to the structure at the front, side and rear of the vehicle at the height of potential accident areas may alter the passive safety characteristics.

Seat belts

- Vehicles with a maximum design speed above 25 km/h must be equipped with seat belts.
- For safety belts and anchorage points of the safety belts the regulations UN-R 14, R 16 and R 17 have to be observed and verified.

Airbags

The installed airbag units include driver airbag, passenger airbag knee airbag, curtain airbag and thorax airbag (side airbag). All airbag units are marked "AIRBAG":

- The driver's airbag can be identified by the words "AIRBAG" on the steering wheel pad.
- The front passenger airbag can also be identified by the "AIRBAG" inscription on the dashboard.
- Knee Airbag, fitted only in certain markets. Please check local vehicle specification or consult local INEOS Service Agent for further information.
- The curtain airbag can be identified by the words "AIRBAG" on the B-pillar.
- The thorax airbag is located on the side of the driver and passenger seat.

The front is covered by the driver and co-driver airbag (and knee airbag if applicable).

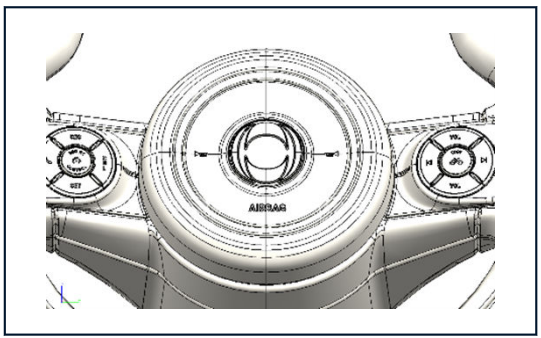
The sides are protected by a thorax and a curtain airbag.

An additional identification feature is the red indicator lamp in the instrument cluster.

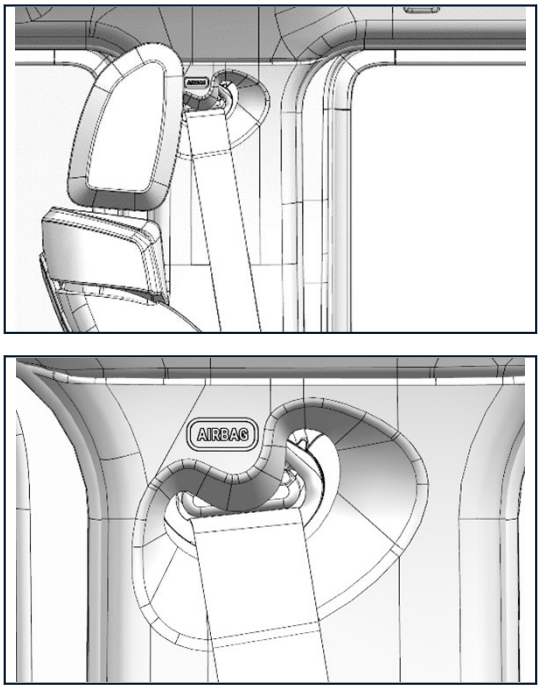
For more information on the airbags available as standard equipment and as special equipment, please contact your INEOS Automotive service centre or refer to section 3.11 “Special equipment”.

NOTE: Do not make any changes to the centre console/ floor structure in the area of the airbag control unit.

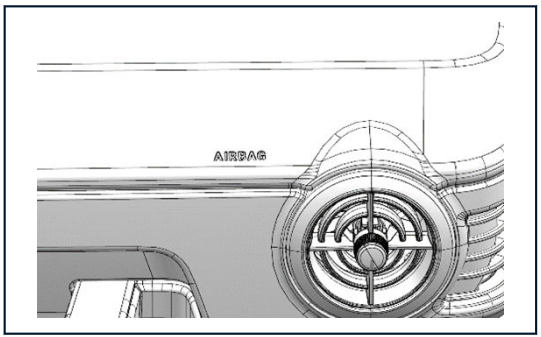
The following illustrations show the position of the airbags:



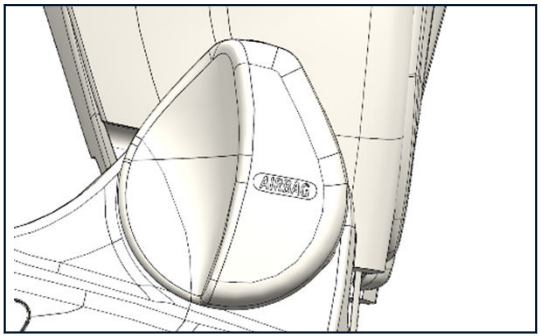
6.8 Airbag-Label – Steering wheel.



6.10 Airbag-Label – B-Pillar.



6.11 Airbag-Label – Front Passenger seat (above glove compartment).



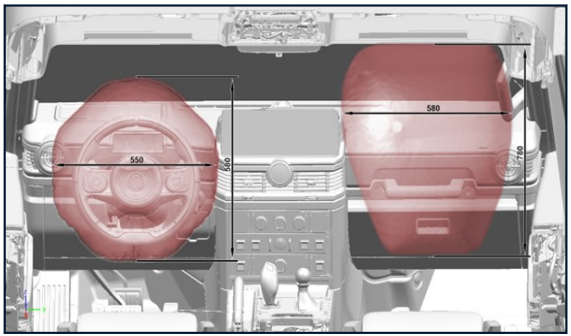
6.12 Airbag-Label – on the side of the driver and passenger seat.

It should be noted that airbags require room for oscillation during deployment.

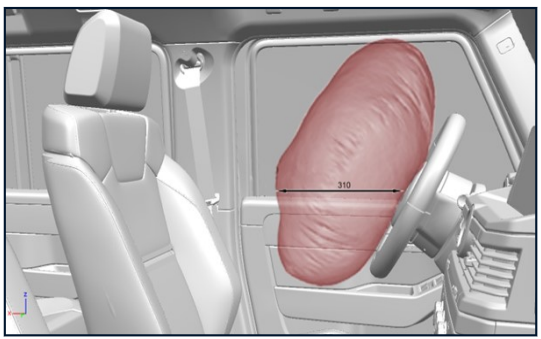
Driver and Passenger Front Airbag Deployment Zones

WARNING: Do not install any components in the red marked areas! This could cause improper function of the airbags / safety system and there is a risk of injury for all occupants!.

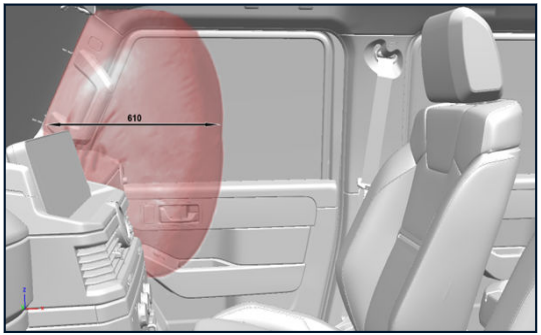
All shown dimensions in [mm]:



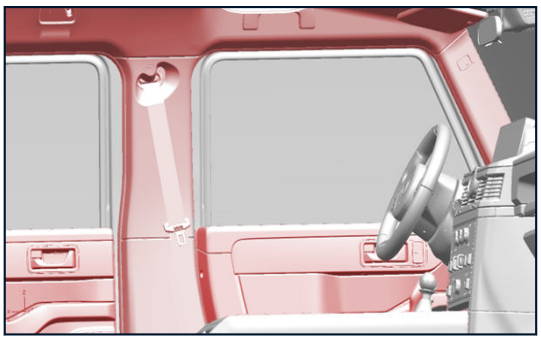
6.13 Airbag deployment front view.



6.14 Driver Airbag deployment side view.



6.15 Passenger Airbag deployment side view.



6.16 Required modification free zones for airbags (also counts for passenger side).

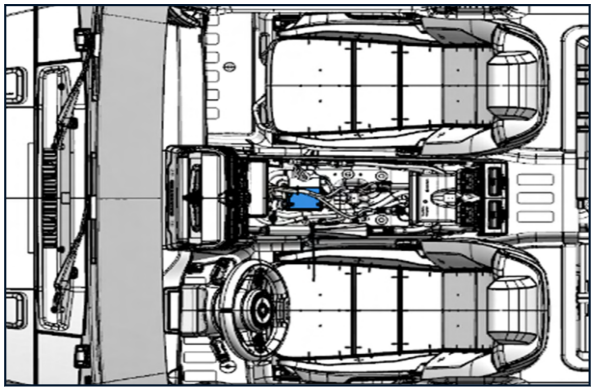
Airbag control unit

The airbag control unit for occupant safety in the vehicle must not be modified regarding its installation location, position and fastening compared with the standard version. The lines of the airbag control unit must also not be changed.

> Other vehicle components must not be placed or fastened to the airbag control unit or its fastening points.

WARNING: Any modifications to the restraint system components (airbag control unit, satellite sensors, airbags, seat belt pre-tensioners, etc.), their lines and fasteners are not permitted. Vehicle parts that generate vibrations must not be fixed near the airbag control unit or sensor mounting locations. Do not make any changes to the centre console/floor structure in the area of the airbag control unit. Otherwise, the safe function of the restraint systems is no longer guaranteed and personal injury may result.

The airbag control unit is installed in the footwell / centre console behind the trim.



6.17 Airbag control unit.

The removed airbag control unit is sensitive to impact and must be stored in a vibration-free location.

WARNING: Airbag sensor systems or airbag control units that have fallen to the ground must no longer be installed for safety reasons. These parts must be replaced with appropriate genuine INEOS Automotive parts. Otherwise, the safe function of these systems is no longer guaranteed and personal injury may result.

Handling pyrotechnical components of the restraint systems

WARNING: Airbag units must always be stored in their removed state with the padded side facing up. If the padded side is pointing downwards, the airbag unit will be shot through the air in the event of accidental ignition. This may result in personal injury.

NOTE: Removed units must be stored in a suitably rated metal cabinet when not fitted to the vehicle.

Observe the following specifications when handling pyrotechnical components of the restraint systems:

- Work with dismantled components, testing and assembly work may only be performed by qualified personnel.
- Electrical testing may only be carried out when the system is installed and using the prescribed test equipment. We recommend having the test performed at an INEOS-Automotive service centre.
- Dismantle or install components only when the battery is disconnected, the negative terminal is covered and the test coupling/plug connection is disconnected.
- After disassembly, only store components in a suitable storage area and only remove them immediately before assembly.
- If work is interrupted, store the components under lock and key.

- Do not treat components with grease, cleaning agents or similar substances.
- Do not expose components to temperatures above 100 °C under any circumstances.
- Replace components that have been dropped.

Transport and storage of pyrotechnic components

NOTE: The transport of pyrotechnic components of any kind in the passenger compartment is prohibited. Always transport such components in the boot or cargo area of the vehicle using the spare parts packaging.

Disposal of pyrotechnic components

Pyrotechnic components must be disposed in accordance with the country-specific laws and guidelines.

To avoid additional expenses for these safety measures, we recommend assigning the disposal of pyrotechnic items to a disposal company. The disposer will carry out the necessary safety measures (including a 10 m safety distance and a special ignition device).

When taking over, the disposer must sign a declaration in which he undertakes to dispose of pyrotechnic articles in accordance with the accident prevention regulations. Agreements of this type must ensure that it is not possible to extract pyrotechnic articles after disposal and pass them on for repair.

If the bolster plates of the airbag units are not damaged, the airbag units must be detonated with the 2-pin plug-in coupling by trained personnel.

6.4.3 Seats

- The strength verification of the factory-supplied seats is only valid in conjunction with the original fastening elements.
- Front and rear seats with 2-point or 3-point seat belts that deviate from the standard seating must meet the requirements of Regulation UN-R 14 (seat belt anchorages), UN-R 17 (seats and head restraints) and UN-R 16 (seat belts).
- Seat systems without seat belts are not permitted.
- It is essential to observe the country-specific regulations.
- When reattaching the seat belts and seats (including seat box), the specified bolts must be tightened to the specified torque.

For information on the retrofitting of seats, refer to chapter 7 “Design of bodies”.

6.4.4 Reducing interior noise

To reduce the noise level in the vehicle interior, noise-insulating materials can be installed. These must be flame retardant.

Floor area

Additional covering with heavy-duty insulating foil can be carried out in the area of the wheel housings for sound insulation.

NOTE: Insulating foils, e.g. bituminous felt, have limited temperature resistance. They must therefore not be laid in the immediate vicinity of the engine and exhaust.

Roof and side walls

In addition to effective insulation, the insulation materials used should have the following properties:

- Non-hygroscopic
- Not water retentive
- Not water absorbent
- Not water attracting
- Water repellent.

Make provisions for the rapid and unobstructed drainage of moisture accumulations or condensates to avoid corrosion-enhancing influences.

The standard drain openings are to be retained.

The inside must be covered with a sound-permeable material (e.g. perforated cardboard, plastic, textile covering).

Sealing

Carefully seal openings, gaps and slots between the engine compartment, underside of the vehicle or fire wall and the vehicle interior with elastic material. Do not install ventilation openings in the immediate vicinity of noise sources.

In addition, manufacturers or suppliers of sound insulation material should be consulted. They will be able to make suggestions for optimum sound insulation for your conversion.

6.4.5 Ventilation

- The driver's compartment must be ventilated sufficiently.
- Defrosting of the front and side windows must remain effective, especially if the arrangement and design do not correspond to the standard equipment.

Heating/ventilation and air conditioning systems are standard equipment. Additional seat heating for the front seats is available as a special extra. For more information on special equipment, contact your INEOS- Automotive Service Centre, the INEOS Aftersales portal or refer to section 3.11 “Special equipment”.

6.4.6 Connection points for load compartment trim side panel/roof

If body manufacturer-specific l oad c ompartment l inings a re fitted, observe the following specifications:

- Additional mounting holes must not be drilled.
- It is advised to use fasteners recommended by INEOS, which you can request through your INEOS Automotive Service Centre.
- The body manufacturer bears sole responsibility for the selection and use of suitable fastening elements with sufficient strength required for the respective body situation.

6.4.7 Rear cab panel for Pick-up / Chassis Cab

NOTE: Do not make any openings in the rear wall of the driver's cab.

6.5 Additional units

Observe the notes in section 5.3 “Corrosion protection measures” and section 5.4 “Painting and preservation work”.

6.5.1 Auxiliary heater

- If exhaust gases are conducted under the vehicle, the vehicle floor must be gas tight.
- Floor openings for operating parts must be sealed with rubber sleeves.

Retrofitting an auxiliary heater

When retrofitting an auxiliary heating system, the regulations for fire protection, crash behaviour and accident prevention must be observed. Avoid hazards from poisoning or asphyxiation by gaseous substances by selecting an appropriate installation location or by taking sealing measures.

The following auxiliary heating system components must not be installed inside the driver, passenger or cargo compartment:

- Auxiliary heater.
- Exhaust pipes of the auxiliary heater.
- Vents for the components of the auxiliary heating system.
- Fuel pipes.
- Fuel tank and tank filler neck.

Route all pipes, hoses and electric lines so that they are free of mechanical loads.

Observe the specifications on the distance to the exhaust system in section 6.3.2 “Exhaust system”.

NOTE: When installing accessory stationary heaters (diesel tapping), we recommend that you use genuine INEOS- Automotive parts. Failure to do so may result in the following problems:

- *Insufficient fuel supply to the injection system.*
- *Faulty diesel recirculation.*
- *Undesirable vaporization in the supply system.*

Before installing auxiliary / stationary heaters, refer to the INEOS Aftersales portal. Alternatively, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

For more information, refer to section 3.11 “special equipment”.

6.6 Attachments

- The permissible centre of gravity positions and axle loads must always be observed, see chapter 4 “Technical limits during planning”.
- Make allowance for any interactions with driving assistance systems, see section 8.8 “Driving assistance systems”.
- The function of vehicle parts must not be impaired by attachments.

It is essential to observe country-specific legal laws, guidelines and regulations.

6.6.1 Attachment above cab

- Observe both the permissible centre of gravity position, see section 4.1 “Limit values basic vehicle”, and the front axle load, see section 4.2 “Limit values chassis”.
- Design the connection to the roof in accordance with section 6.2.5 “Modifications to the roof structure”.

6.6.2 Air deflectors

Air deflectors on the cab roof may only be attached to the roof drip rail using clamping pieces.

NOTE: Do not drill any additional holes for fastening in the cab roof.

In the case of other roof attachments (for example an air-conditioning system), a technical certificate from the responsible department is required, see section 2.1 “Advice from body manufacturers”.

6.6.3 Roof rack

- Ensure even load distribution over the entire roof.
- Ensure that operation of the doors is maintained.
- Only approved INOES roof rack systems are to be used. It is the responsibility of the converter to obtain any required certification for any non approved roof systems used.
- INEOS will not warrant the roof if load limits are exceeded or a non approved mounting system is used.
- Vehicle stability and handling can be affected is load limits or non approved mounting system used.

Limit values roof rack

Construction	Maximum roof load dynamic [kg]	Maximum roof load static [kg]
Station Wagon*	150	420
Pick-up**	120	375
Chassis Cab**	120	375

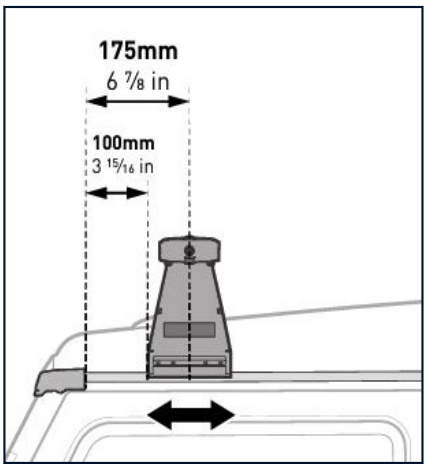
*Values have been validated for the INEOS approved 8 ft roof rack system only and is the combined rack and payload weight.

** Values have been validated for the INEOS approved 6 ft roof rack system only and is the combined rack and payload weight.

NON Load-Bearing

For the installation of a light bar the following position can be used

Front of vehicle:



NOTE: Due to constant development and validation process always refer to the latest version of the mounting instructions for the INEOS Roof Rack for system and payload weights, and bar mounting data. Information can be found in the accessories section of the INEOS Aftersales portal.

6.6.4 Shelf systems

General

Shelf systems must

- be sufficiently stable
- self-supporting
- rest on the cross members and longitudinal members of the vehicle floor
- distribute all forces and loads evenly.

The force must be transmitted via the fastening points on the floor.

The rack may only be supported via the attachment points on the vehicle side wall.

Please also observe the information given in section 4.1 “Basic vehicle limits”.

NOTE: Do not carry out any fastenings that transfer forces to the vehicle side walls only. Point loads must not be applied to the vehicle wall.

Partition grilles from factory

For the N1 2-seater with standard equipment, there is a grille installed behind the 1st row of seats. For the 5-seater, there is a grille

available to separate the luggage compartment as an accessory. Nothing should be attached to any of them!

Safety equipment

The installation locations of safety equipment and deployment areas of airbags must not be restricted or modified. Please observe the notes in chapter 6.4.2 “Safety equipment”.

6.6.5 Trailer coupling

We recommend that you only use trailer couplings approved by INEOS Automotive and that you only attach them to the designated points on the rear longitudinal member.

Trailer couplings are available as additional equipment.

- Ensure accessibility to the spare wheel in the case of trailer couplings with a ball head that cannot be removed (especially when the vehicle is fully loaded).
- The installation of the trailer coupling must comply with the regulations of the respective countries (e.g. in the EU according to UN-R 55).
- Consider country-specific clearance dimensions (e.g. in the EU according to UN-R 55).
- In the event of deviations from the accident prevention regulations, a technical certificate must be requested from the relevant country-specific authority.

6.6.6 Winch equipment

A fixed winch (front) and a portable winch (rear) are available as special equipment for the Grenadier:

The front winch is designed for a maximum pulling force of 55 kN in the x-direction.

The portable rear winch is designed for a maximum pulling force of 35 kN in the x-direction.

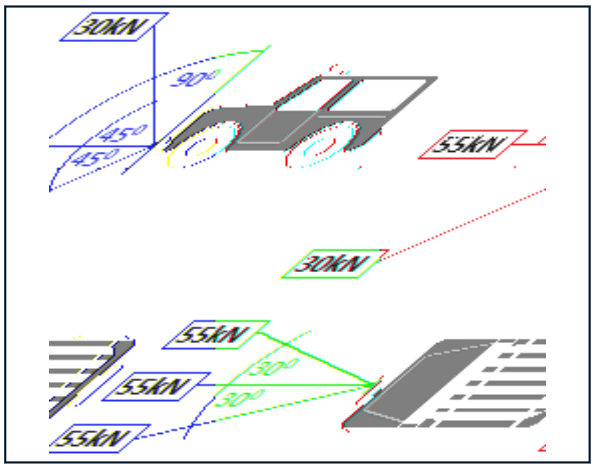
Be aware that the cars that are bought with the fixed winch will have a different front cross member.

With the portable winch, the cable set for the "auxiliary socket" must also be purchased. The portable winch can be mounted on the rear of the vehicle, but the cross member must be retrofitted.

Electrical specifications:

The maximum short-term current of the front winch lies around 350 A at 12 V. The maximum continuous current is limited to 150 A at 12 V with a circuit breaker.

Take into account the permissible angles when pulling at an angle.



6.18 Permissible angles when pulling with front winch: vertical ±45°, horizontal ±30°

NOTE: The pull rope of the cable winch may only be used "as a pulley" via a deflection pulley if the loose rope end is attached to the vehicle structure, e.g. to the lashing eye.

Coordinate permanently attached after-market cable winches with INEOS- Automotive with regard to design and mounting location.

6.6.7 Under-ride guard (side guard)

According to EC Directive 89/297/EEC, a lateral protection device is mandatory for vehicles over 3.5 t permissible total mass.

Semi-trailer tractors, work machines and special vehicles whose intended use cannot be fulfilled with side guards mounted are excluded.

Components such as battery boxes, air tanks, fuel tanks, lights, reflectors, spare wheels and tool boxes may be installed in the side guard if the specified clearance dimensions are observed.

Brake, air or hydraulic lines and similar parts must not be attached to the side guard.

The function and accessibility of all equipment on the vehicle must not be impaired.

The side guard may consist of a continuous flat surface.

The outer surface shall be smooth and substantially flat.

The parts of the guard shall be rigid and firmly mounted. They must be made of metal or other suitable material.

The edge radius must be at least 3 mm.

7.1 Interior modifications

In this chapter you will find information concerning the body to be produced by the body manufacturer.

7.1.1 Modifications in the cockpit area

Modifications in the cockpit area and above the belt rail line are not permitted. This applies in particular to the deployment areas of the airbags (additional installations, cell phone holders, bottle holders or similar).

7.1.2 Subsequent installation of seats

The strength certificate of factory-supplied seats is only valid in conjunction with the original fastening elements.

When retrofitting seats, compliance with the H-point is required.

When reattaching the seat belts, the specified bolts must be tightened to the original torque.

WARNING: Do not make any modifications to the driver and front passenger seat or connect seats to the wheel housing. In the event of an accident, the seats may be torn out of their anchorage. Persons cannot be protected as intended. There is a risk of injury!

WARNING: If you attach seats to the wheel housing, they could be torn out of their anchorage in the event of an accident. There is a risk of injury! Therefore, do not install any seats on the wheel housing.

A seat system with 3-point seat belts that deviates from the standard seating must meet the requirements from chapters 6.4.1 “General information”, 6.4.2 “Safety equipment” and 6.4.3 “Seats”.

A rear bench system with 3-point seat belts that deviates from the standard seating must meet the requirements according to regulation UN-R 14 (seat belt anchorages), UN-R 17 (seats and head restraints) and UN-R 16 (seat belts).

Seat systems without seat belts are not permitted. Test certificate UN-R 14 (tensile test including floor assembly) must be submitted for approval by INEOS- Automotive. Test certificates for seating systems on a rigid plate are not accepted.

For more information on special equipment, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website. Alternatively, refer to section 3.11 “special equipment”.

7.1.3 Modi ications to the roof

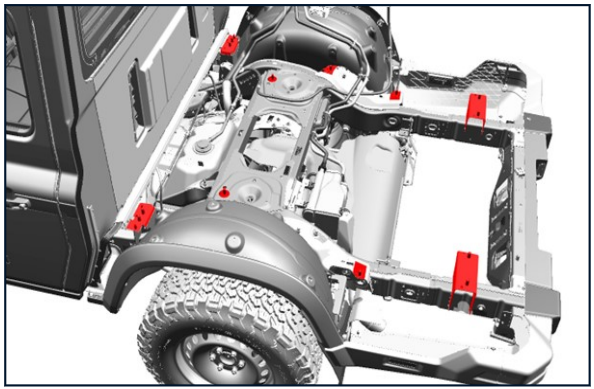
For information on changes to the roof, refer to section 6.2.5 “Changes to the roof structure”.

7.2 Customer set-up

7.2.1 General notes on customer body Pick-up / Chassis Cab

Bodies with torsional stiffness may not influence the torsional flexibility of the chassis. They must be connected to the chassis in

accordance with the provisions of this body guideline. Fixed bearings are used for this purpose.



7.2 Customer development: fixed bearings

Fixed bearing

The fixed bearings are highlighted in the picture above. All forces are transferred from the body / device to the frame via the fixed bearings.

CAUTION: A body that deviates from the above attachment options may result in damage to the body and chassis and is therefore not permitted.

For further information, please contact the INEOS Aftersales portal. Alternatively, contact your INEOS service agent or use the "Contact Us" page on your local INEOS website.

7.2.2 Platform bodies

Only chassis are delivered from factory for the Chassis Cab.

Due to the design and special features of the vehicle, conformity with the currently valid EC or ECE approval directives cannot be confirmed. Approval is only possible through individual approval procedures (with exemptions) under the customer's own responsibility with the help of their own expert.

The body manufacturer is responsible, in cooperation with its customer and in consultation with an officially recognised approval official, for approving the vehicle for the customer's purposes by means of individual approval.

NOTE: ***When designing flat-beds, it is essential to observe the following instructions!***

Platform size

- Consideration of the platform length for N2 approval.
- Determine platform width for entry in registration papers (including hinges or lashing eyes for tarps).
- Observe overhang from centre of axle (if necessary, under-ride guard, if EC approval does not apply).
- Lashing points on flat-bed floor must be available.

- Climbing helps (grab handles and non-slip steps) must be provided on the platform.
- Side board latches should be easy to operate and must not have any pinch points (check hand clearance).
- Use side board latches with internal load pressure detection (only for approval in EC region).

Wheel covers

The body manufacturer is responsible for ensuring that the wheel covers meet all the requirements of 1009/2010/EC.

Vehicle length

Side marker lights are required for a total vehicle length > 6 m. Requirements according to VO(EU) 1230/2012 and 96/53/EC and requirements according to UN-R 48 must be fulfilled.

Vehicle width

Requirements according to VO(EU) 1230/2012 and 96/53/EG and requirements according to UN-R 48 must be fulfilled.

Vehicle height

The total vehicle height of 4 m must not be exceeded, taking into account tarps and tarp frames. Requirements according to VO(EU) 1230/2012 and 96/53/EG must be fulfilled.

Lighting

Check the attachment and visibility of the lighting equipment according to section 8.5 “Lighting”.

Inner rearview mirror

Check field of vision and adjust mirror setting if necessary.

Wheel chocks

Wheel chocks must be secured against loss and attached to the outside of the vehicle without rattling.

Curb weight

The curb weight of the vehicle consists of the weight of the ready-to-use vehicle plus 90 % tank filling.

Payload

The payload is to be determined depending on the type of vehicle, the curb weight and the permissible total mass.

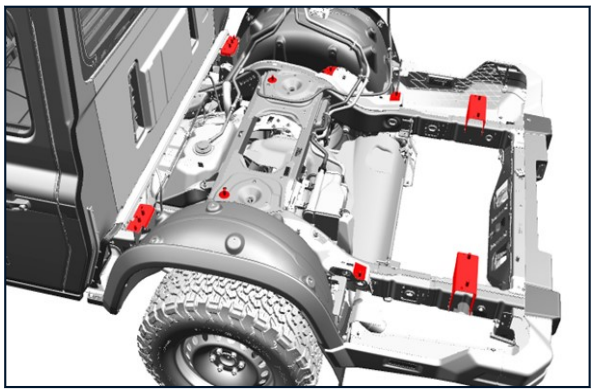
7.2.3 Fastening parts for third-party bodies

For bodies with their own floor assembly, use the existing fastening parts.

The attachment parts for bodies consist of the following components:

- Ten fixed bearings.

On the following pages the arrangement of the mounting parts for foreign bodies is shown with the most important dimensions as well as the corresponding part numbers.

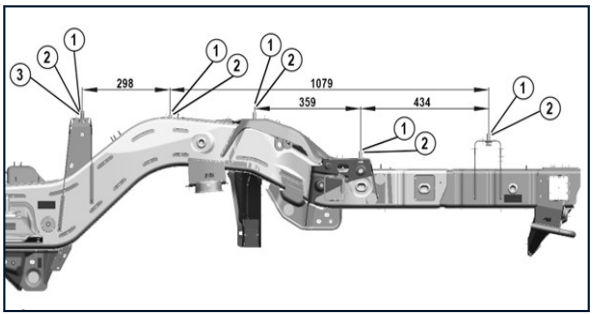


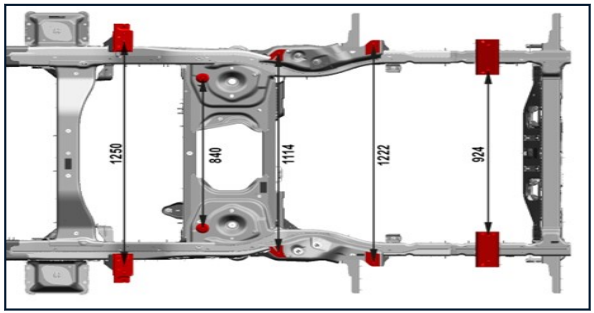
7.5 Fastening parts for third-party bodies

Scope

Item	Description	Part Number
1	HEXAGON HEAD SCREW EN1665-M12X1.5X25-10.9-VDA235-104.42	GRA-0000-003300
2	WELD NUT ISO21670-M12X1.5-10-FE/ZN5/CN/T0	N/A

Item	Description	Part Number
3	FRAME CENTER PIN LOADING BAY	Part of Assembly
		GRA-4A00-03312 (RH)
		GRA-4A00-033101 (LH)





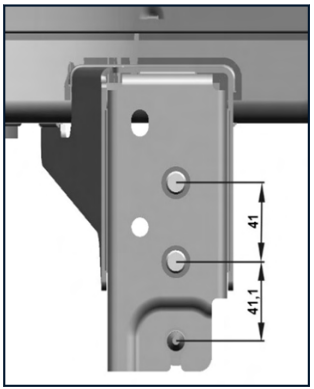
7.6 Scope of mounting parts for third-party bodies

NOTE: Measurements displayed are referenced to the inner fixing points of front and rear bearings.

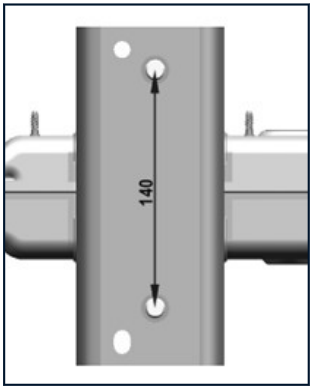
Connection dimensions

7.11 Connection points of fixed bearings:

Front bearing:

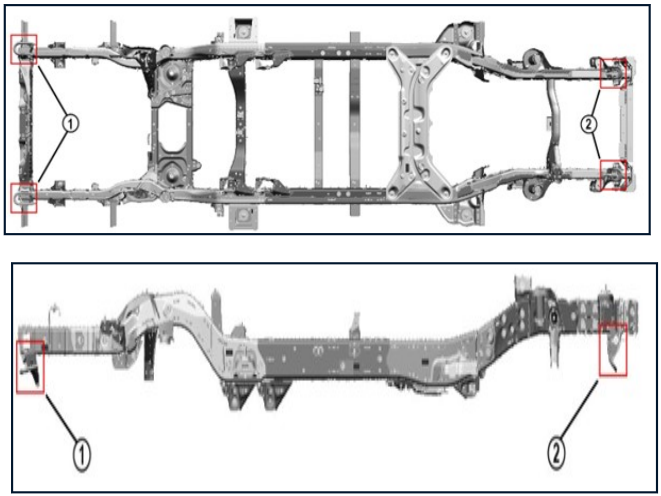


Rear bearing:



7.2.4 Lashing and towing points

Two towing and lashing rings are mounted on the front and two are mounted on the rear of the vehicle. They are used for towing and for securing the vehicle during transport. (e.g. on low loaders, in aircraft, rail wagons, etc.).



7.14 towing and lashing rings

1. Towing and lashing rings front
2. Towing and lashing rings rear

Maximum permissible forces during towing/lashing

Front		Rear	
Two towing and lashing rings	Max. load	Two towing and lashing rings	max. load
Horizontal	35kN	Horizontal	35kN
Vertical	35kN	Vertical	35kN

Angle restrictions when lashing

GRENADIER		Minimum permissible angle	Maximum permissible angle
Front	Horizontal	70°	70°
	Vertical	35°	35°
Rear	Horizontal	70°	70°
	Vertical	35°	35°

Additional lashing devices by the body manufacturer

On the Grenadier, in addition to the towing and lashing rings on the basic vehicle, further rings can be attached to the body.

All additional devices fitted by the body manufacturer for lashing the vehicle must meet the geometric requirements of STANAG 4062.

For exact positioning, follow the specifications of STANAG 4062. The body manufacturer must design the body structurally so that it can safely withstand the forces according to STANAG 4062 at the attached lashing points.

ELECTRICS / ELECTRONICS

8.1 General notes

WARNING: Modifications to electronic components, their software or wiring can impair their function and/or the function of other networked components. Safety-relevant systems may also be affected. As a result, they may no longer function as intended and/or jeopardise the operational safety of the vehicle. There is an increased risk of accident and injury! Do not tamper with the cabling, electronic components or their software. Always have work on electrical and electronic devices carried out at a qualified specialist workshop.

NOTE: When connecting additional electrical consumers, ensure a positive overall charging balance. When the engine is running, the battery clamps must not be loosened or removed. Batteries may only be charged with an INEOS approved smart charger if the positive and negative terminals are disconnected from the vehicle.

- Electrical and electronic components must meet the test requirement according to ISO 16750.
- When installing additional batteries, observe the following notes.
- Cables that are laid in the vicinity of exhaust systems must be sheathed in a high-temperature resistant material. see section 5.1 “Brake hoses/cables and lines”.
- Cables must be routed in a way that prevents them from getting damaged due to chafing points. see section 5.1 “Brake hoses/cables and lines”.
- Disconnect the battery before leaving the vehicle unused for more than a week.
- When starting the vehicle again after more than a week, reconnect the battery and make sure that the charge level of the battery is sufficient.
- Always observe the operating instructions.

NOTE: The body manufacturer is responsible for functional safety for the scopes developed by them, in compliance with current standards and regulations. If applicable, the body manufacturer must also ensure compliance with the international standard ISO 26262 on functional safety. See section 2.3 “Product safety and product liability”.

8.2 Electromagnetic compatibility (EMC)

Electromagnetic compatibility is the property of an electrical system to behave neutrally in the environment of other systems when fully functional. This means that no active systems in the environment are disturbed and, conversely, there is also no interference.

In vehicle electrical systems, electrical disturbances occur due to the various consumers. At INEOS Automotive, the electrical and electronic components installed at the factory have been tested for

electromagnetic compatibility in the vehicle. In the event of subsequent modifications, comfort may be restricted in individual cases (e.g. radio noise).

When retrofitting electrical and electronic systems, their electromagnetic compatibility must be tested and verified.

All installed electrical devices must have a type approval in accordance with regulation UN-R 10 in the current version and bear the CE mark.

Observe the notes in section 8.4.4 “Additional circuits/consumers”, section 8.6 “Mobile communication systems” and section 4.4 “Electrical/electronic limit values”.

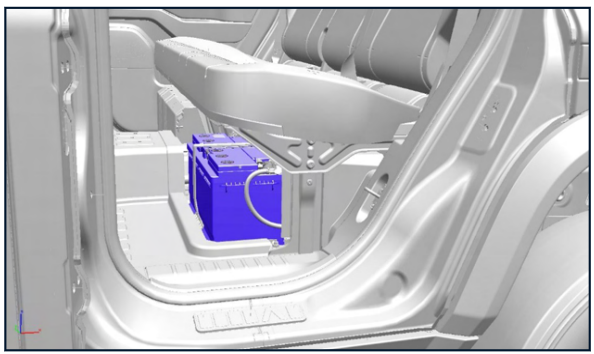
The following regulations provide information on this topic:

- CISPR 12
- CISPR 16
- CISPR 25
- DIN EN 55012
- DIN EN 55025
- ISO 7637
- ISO 10605
- ISO 11451
- ISO 11452
- MBN 10284
- UN-R 10

8.3 Battery

8.3.1 Main battery

The main battery is located under the rear seat bench.



8.1 Installation position of the main battery

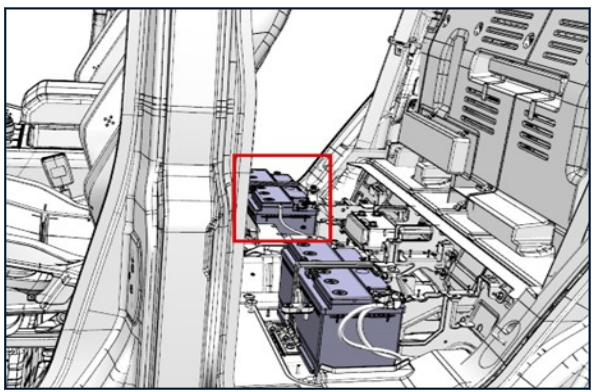
NOTE: The vehicle systems (standard and special equipment from factory) are powered by the main battery. If one or more vehicle systems are operated when the vehicle is stationary (e.g. radio), ensure that a

positive charge balance of the main battery is achieved by starting the engine.

If the vehicle is to be started by a 12 V external power supply, use either the starting points on the battery (under rear seat bench) or the jump-start points in the engine compartment.

8.3.2 Additional battery

The additional battery (12 V) is located under the rear seat next to the main battery.



8.2 Position of the additional battery

Other auxiliary batteries

CAUTION: If the vehicle is already equipped with an auxiliary battery, no additional auxiliary batteries may be connected in parallel without a charging current limiter. This can be achieved through supplementary electronics. The body manufacturer must ensure a maximum charging current for additional batteries totalling 80 A. Failure to do so may damage the basic vehicle.

NOTE: A positive overall charging balance must be ensured by selecting a suitable alternator.

8.3.3 Battery maintenance and storage

Batteries must be checked regularly - even when removed - for voltage drop (self-discharge).

For more information, refer to section 3.10.2 “Maintenance and storage of batteries”.

8.4 External High Voltage Power Outlet (HVPO)

8.4.1 General Warnings and Cautions

WARNING: Only qualified personnel should work on the vehicle and electrical components. Unauthorised or untrained individuals may risk serious injury or death.

WARNING: Always use the correct tools for the job. Using improper tools can result in serious injury or damage to the vehicle and its components.

WARNING: Failure to wear the correct PPE can result in serious injury or death. Always wear appropriate personal protective equipment, including gloves, goggles, and protective clothing, when working on vehicles and electrical components.

WARNING: Always disconnect power before working on or around the vehicle. Failure to do so may result in electric shock or fire.

WARNING: Keep electrical equipment dry. Water ingress can lead to malfunction or electric shock.

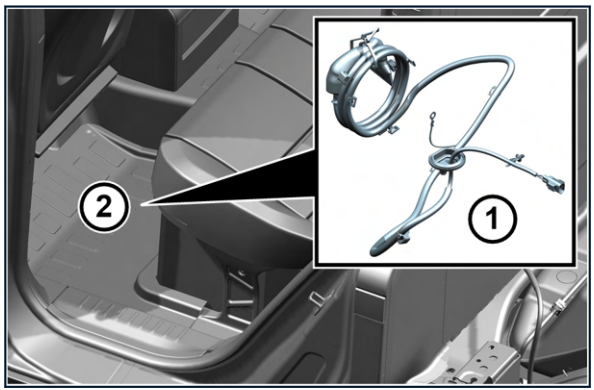
CAUTION: Always disconnect power before making any wiring changes to prevent electric shock or equipment damage.

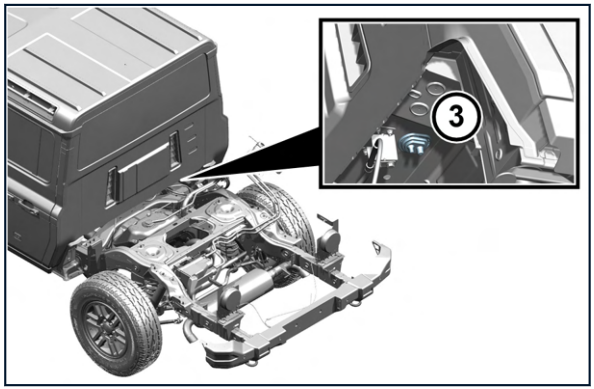
CAUTION: Static electricity can damage sensitive components. Use a grounding strap when handling electronics.

CAUTION: Avoid bending or twisting cables excessively. Damaged cables can cause short circuits or fire.

8.4.2 Exterior Harness - Supplied Condition (Chassis Cab)

1. Do not fit exterior HV harness
2. Place coiled harness in bag and then place into the LHS foot well
3. Fit blanking grommet to BIW.

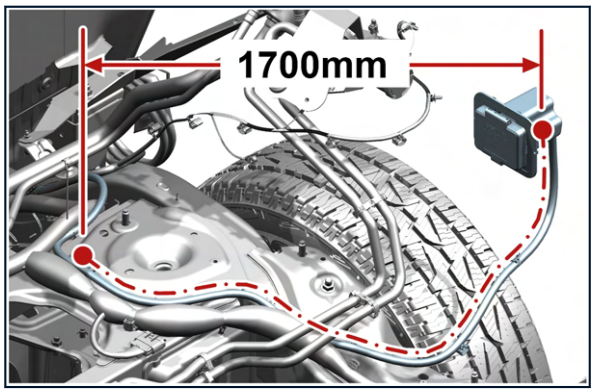




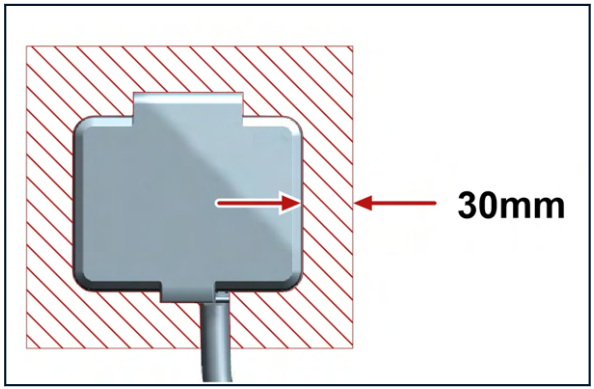
8.4.3 Recommended Installed Position for HVPO

WARNING: Ensure there is a minimum of 150 mm clearance between the cable and the fuel lines. Failure to do so may result in serious injury or death, as well as damage to the vehicle and its components.

The HVPO cable must be installed on the right-hand side of the vehicle to ensure it reaches the earth location point. The cable length should be 1.7 m from the earth fixation point.



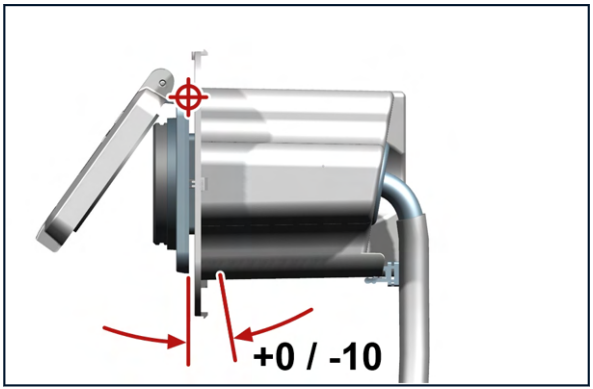
NOTE: When installing the socket to the panel, ensure it sits flush with the surface and that there is a safe clearance boundary of 30 mm in all directions around the socket.



8.4.4 Wet Area / Dry Area

Ensure the socket is installed in a dry area. If installation is in a wet area, use the provided protective housing / cap.

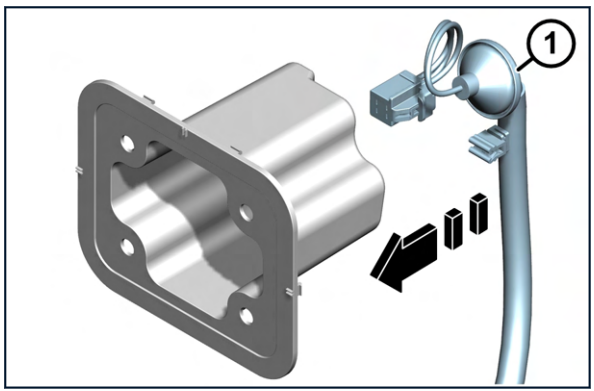
Ensure the socket is mounted in a vertical position or at a negative inclination to allow water to escape.



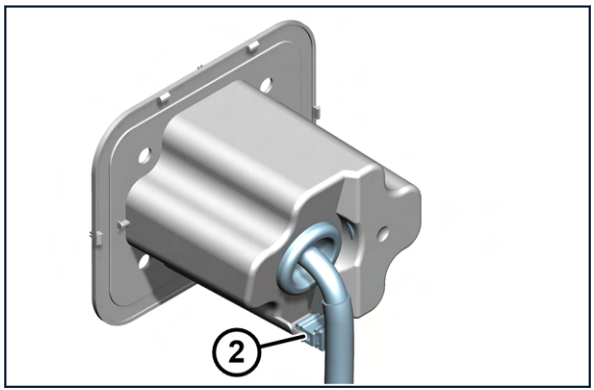
NOTE: Use the supplied protective housing and cap, which are IP66k rated when the lid is closed.

8.4.5 Wet Area Installation: Harness To Cover

During a wet area installation, insert the grommet into the HVPO cover (1).

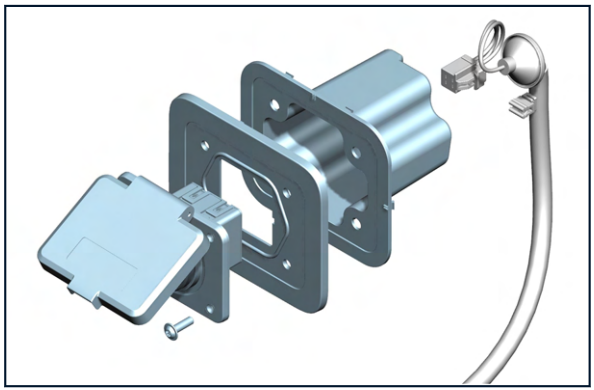


Then fit the edge clip (2) to the cover for strain relief.



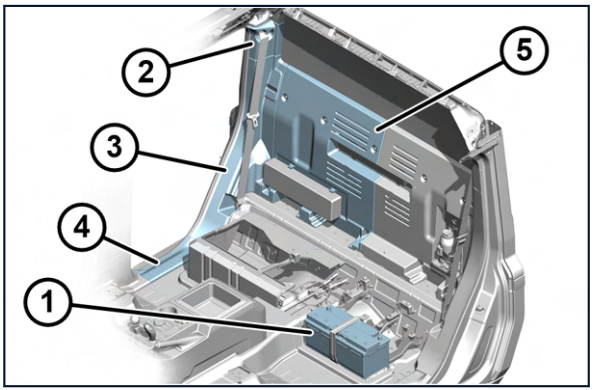
8.4.6 Wet Area Installation - Socket Assembly

To assemble the socket, mate the connector to the power outlet. Fit the power outlet to the cap and cover, then secure the power outlet with the cap and cover flush to the panel using M6 screws.



8.4.7 Remove Trim / Panels and Battery as per service instructions

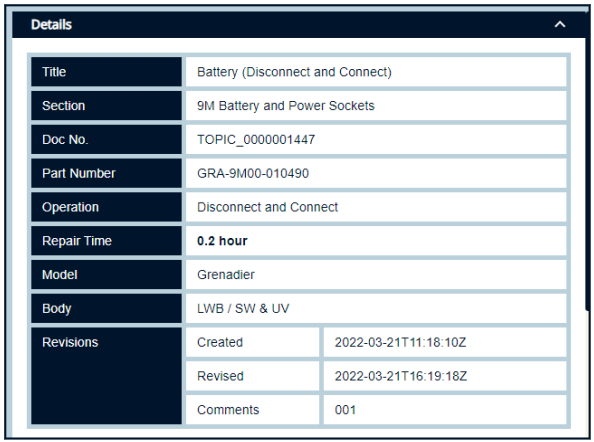
The following service instructions are recommended by INEOS Automotive to correctly remove the battery, trims, and panelling to complete the installation of the HV harness and cabling.



NOTE: Documents can be accessed via the INEOS Aftersales portal. Contact your INEOS service agent or use the "Contact Us" page on your local INEOS website for information about access.

8.4.8 Disconnect Batteries

To disconnect the Battery (1), refer to the document **TOPIC_0000001447**.

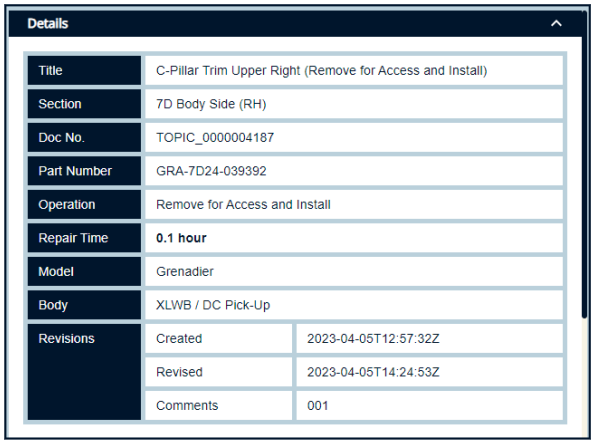


Details

Title	Battery (Disconnect and Connect)	
Section	9M Battery and Power Sockets	
Doc No.	TOPIC_0000001447	
Part Number	GRA-9M00-010490	
Operation	Disconnect and Connect	
Repair Time	**0.2 hour**	
Model	Grenadier	
Body	LWB / SW & UV	
Revisions	Created	2022-03-21T11:18:10Z
	Revised	2022-03-21T16:19:18Z
	Comments	001

8.4.9 Remove Upper Right C-Pillar Trim

To remove the Upper Right C-Pillar Trim (2), refer to the document **Topic_0000004187**.



Details

Title	C-Pillar Trim Upper Right (Remove for Access and Install)	
Section	7D Body Side (RH)	
Doc No.	TOPIC_0000004187	
Part Number	GRA-7D24-039392	
Operation	Remove for Access and Install	
Repair Time	**0.1 hour**	
Model	Grenadier	
Body	XLWB / DC Pick-Up	
Revisions	Created	2023-04-05T12:57:32Z
	Revised	2023-04-05T14:24:53Z
	Comments	001

8.4.10 Remove Entrance Trim Rear Right

To remove the Entrance Trim Rear Right (3), refer to the document **Topic_0000001470**.

Details

Title	Entrance Trim Rear Right (Remove for Access and Install)	
Section	7D Body Side (RH)	
Doc No.	TOPIC_0000001470	
Part Number	GRA-7D26-006272	
Operation	Remove for Access and Install	
Repair Time	**0.1 hour**	
Model	Grenadier	
Body	LWB / SW & UV	
Revisions	Created	2022-03-23T14:36:20Z
	Revised	2022-03-23T15:19:24Z
	Comments	001

8.4.11 Remove C-Pillar Trim Lower Right

To remove the C-Pillar Trim Lower Right (4), refer to the document **Topic_0000004189**.

Details

Title	C-Pillar Trim Lower Right (Remove for Access and Install)	
Section	7D Body Side (RH)	
Doc No.	TOPIC_0000004189	
Part Number	GRA-7D24-039412	
Operation	Remove for Access and Install	
Repair Time	**0.7 hour**	
Model	Grenadier	
Body	XLWB / DC Pick-Up	
Revisions	Created	2023-04-05T12:57:32Z
	Revised	2023-04-05T14:24:53Z
	Comments	001

8.4.12 Remove Rear Bulkhead Trim Panel Right

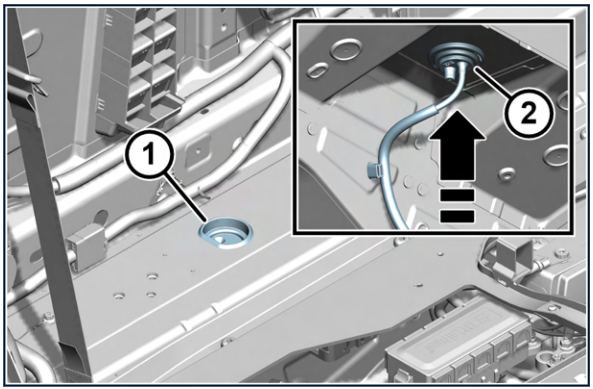
To remove the Rear Bulkhead Trim Panel Right (5), refer to the document **Topic_0000004384**.

Details

Title	Rear Bulkhead Trim Panel Right (Remove for Access and Install)	
Section	7H Rear End	
Doc No.	TOPIC_0000004384	
Operation	Remove for Access and Install	
Repair Time	**0.8 hour**	
Model	Grenadier	
Body	XLWB / DC Pick-Up	
Revisions	Created	2023-05-19T11:26:28Z
	Revised	2023-05-19T11:28:06Z
	Comments	001

8.4.13 Remove Blanking Grommet

Remove Blanking Grommet as indicated in the image, marked as point (1).

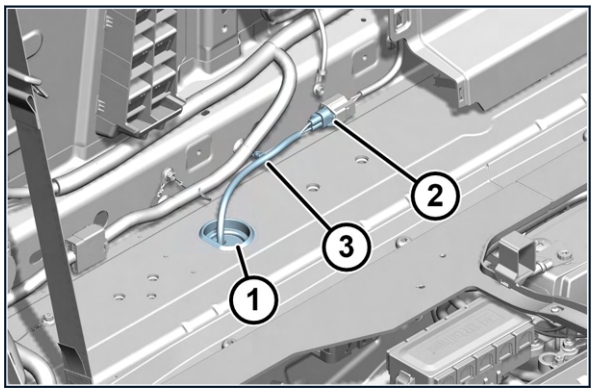


Insert the HVPO harness cable from the outside of the cabin through the hole towards the inside of the cabin, ensuring the HVPO harness cable grommet is firmly seated against the panel, as indicated in the image, marked as point (2).

8.4.14 Install HV Cable to the HV In-line

To install the HV cable to the HV in-line, follow these steps:

1. Ensure that the HV cable grommet is seated correctly
2. Connect the cable to the HV in-line
3. Fasten the stud clip securely to the stud.



8.4.15 Secure and Ground the HV Harness

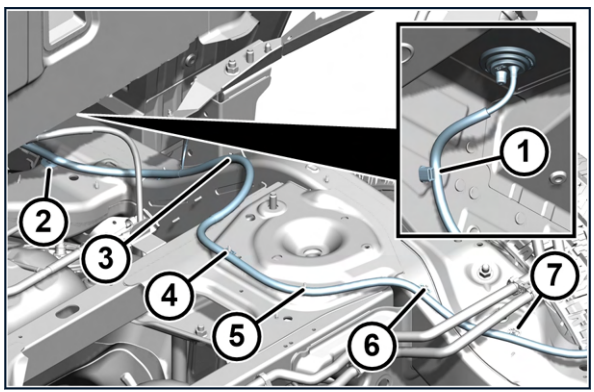
WARNING: When grounding, do not splice with other loads! Failure to do so may result in injury, death and/or damage to the vehicle and/or vehicle components.

CAUTION: Make sure the HV grommet is fully sealed. Failure to do so may result in damage to the vehicle and/or vehicle components.

CAUTION: Grounding points should be in shielded areas, away from debris, spray, salt and foreign objects.

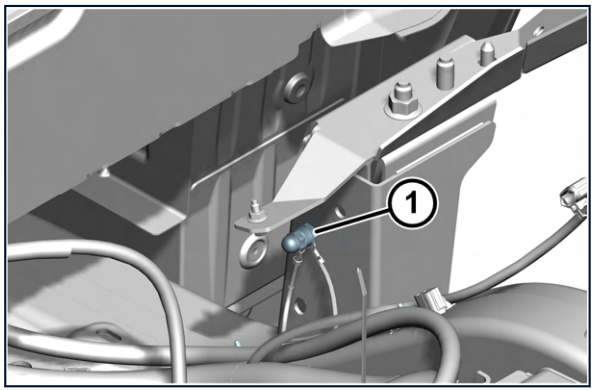
CAUTION: Contact surface between any eyelets, nut and stud thread must be clear of paint. Contact must be bare metal on bare metal.

To secure the HV harness, locate the HV cable from the outside of the cabin where the Blanking Grommet was removed. Now secure the HV harness to the BIW using the provided stud clip, as shown in image point (1).



Now secure the HV harness to the chassis frame as shown in the imagery, at points (2), (3), (4), (5), (6) and (7).

Next, remove the nut shown in the following image as point (1), attach the eyelet to the stud for the HV ground and then re-apply the nut.

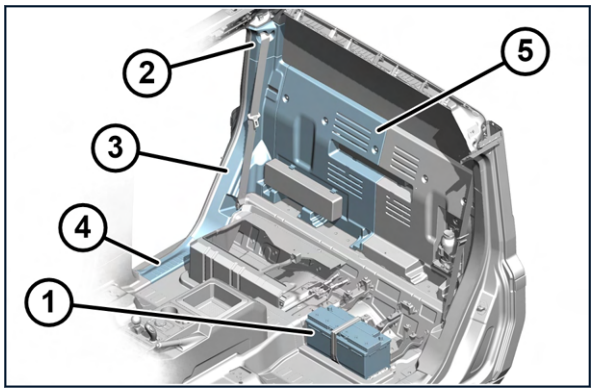


NOTE: Torque T C C 20.0 +/_ 2 Nm.

NOTE: Eyelet stacking is acceptable.

8.4.16 Reinstate Trim / Panels and Battery as per Service Instructions

Re-install any removed trims and panels, followed by the battery as shown in the service instructions.



8.4.17 Ground Straps

The ground path must be established between chassis frame and any attachments that are added to the rear of the vehicle, such as but not limited to the tray, loading bay and cubby box.

Remove ground cable / straps from the provided bundle and attach to the assembled body.

8.4.18 Socket Validation and Testing

WARNING: All validation and testing of any electrical components, such as sockets, wiring, and harnesses, should be undertaken by qualified technicians using an approved power socket testing device.

The following tests should be completed to ensure the installation is correct and safe for operation:

1. Polarity Test
2. Earth Continuity Test
3. Insulation Resistance Test
4. Earth Leakage Test
5. Earth Loop Impedance Test
6. Functional Test.

NOTE: To switch on the inverter, the power switch located in the overhead console must be switched on.

8.5 Interfaces/electrical lines

WARNING: The CAN bus must not be modified due to the networking and internal system-side monitoring of consumers. Any change to the cable harness in length, cross-section or resistance can lead to failures of safety-relevant components or loss of comfort.

8.5.1 Electric lines/fuses

Only lead-free PVC-sheathed cables with an insulation limit temperature of more than 105 °C may be used. Cables and connections used must be professionally designed, watertight, and protected against tearing, damage by rubbing on moving parts or by sharp edges, and heat. Dimension the line in accordance with the current level drawn and protect it with fuses.

Cable routing

Observe the following instructions when installing the electrical lines:

- If routing changes are necessary, avoid spaces that are too narrow or near moving parts and crossing sharp edges.
- We recommend only original INEOS Automotive connectors may be fitted to the cable ends.
- Electrical lines may only be connected via junction boxes.
- If structural modifications are made to the vehicle, the routing of the electrical lines must be restored as unchanged as possible.
- Longitudinal stresses in the cable harness must be avoided.

> Cable entries in devices, junction boxes or similar components outside the passenger compartment must be designed to be watertight.

8.5.2 Cable extension

For cable extensions, use the same or a higher cable cross-section. Only lead-free PVC-sheathed cables with an insulation limit temperature of more than 105 °C and the same cross-section and colour as the series cables may be used. The protective effect of fuse elements must not be impaired.

All connections must be made professionally and watertight to IP69k (resistant to high-pressure cleaning).

Cables for ABS may only be extended using an original INEOS Automotive cable set.

Extension of the cables to the ABS sensors of the rear axle may only be carried out in consultation with the responsible department.

8.5.3 CAN bus and networking

WARNING: Any modification to bus systems can lead to failures of safety-relevant components. The consequences may be accidents or damage to the vehicle! Do not interfere with the bus systems (e.g. by interrupting, extending or "tapping").

Internal and external vehicle diagnosis is possible via the OBD diagnostic socket. Each ECU is self-diagnostic capable and has a fault memory.

Communication with the ECU can be done with a diagnostic device and the software developed for it. For the Grenadier, this is the "Bosch" development device with the associated hardware and software (GradeX).

For more information, contact your INEOS Automotive service centre or refer to section 2.2.4 “Diagnostics”.

8.5.4 Additional circuits/consumers

WARNING: Improper interventions or installations in the vehicle electrics/electronics can impair their function. This can lead to the failure of components or safety-relevant parts. This may result in accidents or damage to the vehicle! Do not make any improper interventions or installations in the vehicle electrics/electronics.

NOTE: Tampering with the vehicle's electrical or electronic systems can void the warranty and/or operating permit.

NOTE: All INEOS Automotive vehicles as delivered from factory meet Global Cyber Security requirements for the markets INEOS Automotive sell within. If any part of the Electrical Harness, Modules or associated components are altered in anyway, then it is the responsibility of the Body-builder to ensure local Cyber Security requirements are still met.”

If additional circuits/consumers are installed, they must be protected against the main circuit by suitable fuses.

Observe the following instructions when retrofitting additional electrical consumers:

- Cables used must be dimensioned according to the load and protected against tearing, impact and heat.
- No additional lines may be connected to existing lines (cut-and-clamp connections etc).
- The cable cross-section must be dimensioned according to the current drawn, see section 4.4.1 “Electric lines/fuses”.
- Electrical lines must be routed correctly, see section 8.4.1 “Electric lines/fuses”.
- The accessibility of the installed units and the ease of maintenance must not be impaired.
- The required air supply and the cooling of the engine must not be impaired, see section 6.3.3 “Engine cooling”.
- The guidelines of the unit manufacturer for compatibility with the basic vehicle must be observed.

8.5.5 Subsequent installation of electrical equipment

Observe the following instructions when retrofitting additional electrical consumers:

- In the case of higher electrical power requirements, we recommend only the use of alternators and batteries approved by INEOS.
- Do not connect additional alternators to the vehicle electrical system.
- Do not connect any additional consumers to already occupied fuses.
- Do not connect any additional lines (e.g. with insulation displacement connectors) to existing lines.
- Provide consumers sufficient protection with additional fuses.

All installed electrical consumers must be tested according to UN-R 10 in the currently valid version and bear the CE mark, see section 8.2 “Electromagnetic compatibility (EMC)”.

For retrofitted electrical equipment, a certificate from the manufacturer or a CE marking is sufficient if this equipment has no effects on the immunity to interference.

WARNING: Improper interventions or installations in the vehicle electrics/vehicle electronics can impair their function. This can lead to the failure of components or

safety-relevant parts. This may result in accidents or damage to the vehicle!

CAUTION: Do not perform any improper interventions or installations in the vehicle's electrical or electronic systems.

8.5.6 Ground bolts

For retrofitted electrical attachments or installations, use only the ground bolts approved by INEOS for an optimum ground connection to the basic vehicle.

- A maximum of 3 cable lugs may be bolted to a ground bolt.
- Tighten the nuts to the corresponding torque, depending on the installation position. Contact the responsible department if you have any questions.
- The ground bolts for the safety systems must not be used for attachments!

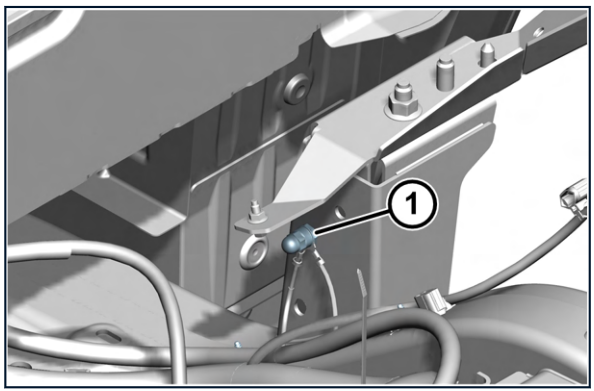
8.5.7 Ground for Lamps

CAUTION: Contact surface between eyelet, nut and stud thread to be clear of paint.

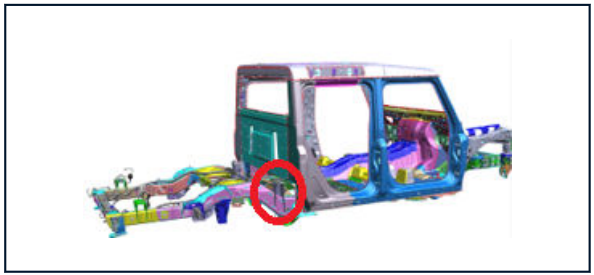
NOTE: Ground path must be established between chassis frame and any attachments added to the rear of the vehicle (tray, loading bay, cubby box, ...)

NOTE: Grounding points should be in shielded areas where possible, away from debris, spray, salt, foreign objects.

Remove the ground cable from the bundle and then attach it to the assembled body.



1. Example of chassis frame connection point already provided on support bracket.



8.5.8 Subsequent installation of an alternator

If additional electrical consumers are retrofitted, the increased power requirement can be ensured by using a more powerful alternator.

All installed electrical equipment must be tested in accordance with regulation UN-R 10 and bear the CE mark.

If other alternators are to be retrofitted, observe the following instructions:

- Do not impair vehicle parts or their function by installing an alternator.
- The capacity of the battery and the available power of the alternator must be sufficiently dimensioned.
- Provide the alternator circuit with additional fuse protection, see section 4.4.1 “Electric lines/fuses”.
- Dimension the cable cross-section according to the current drawn, see section 4.4.1 “Electric lines/fuses". The higher current requirement may necessitate replacement of the starter/alternator wiring harness. We recommend using genuine INEOS Automotive parts for this purpose.
- Electric lines must be routed correctly.
- The accessibility of the installed units and the ease of maintenance must not be impaired.
- The required air supply and cooling of the engine must not be impaired.
- The equipment manufacturer's guidelines for compatibility with the basic model vehicle must be observed.
- The operating instructions and the maintenance manual of the additional assemblies must be included when the vehicle is handed over.

8.5.9 Operating switch

Free switch positions are available for additional special bodies and equipment.

8.3 1 Example of free switch location (Overhead Console)

Detailed information on the arrangement of the control switches can be found in the vehicle operating manual.

8.5.10 Radio equipment, FM/AM/DAB+ antenna system and GNSS/LTE

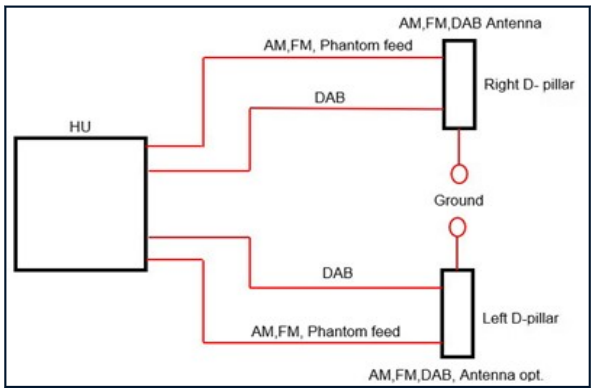
The radio equipment is designed for the AM, FM and DAB frequency ranges.

A charging module for electrical devices is available. The USB port is located in the storage compartment in the armrest.

Position of antennas

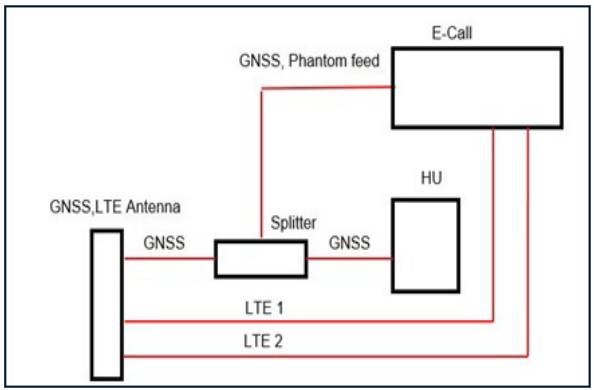
Station Wagon: The antennas for FM/AM/DAB+ are located in the two D-pillars.

The GNSS/LTE is located in the area of the display in the dashboard.



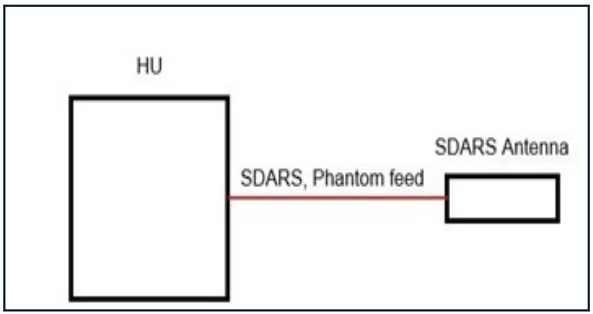
Station Wagon Concept: Antennas AM, FM, DAB in D-pillar

Pick-up: The single antenna for FM/AM/DAB+ is located on the roof. The GNSS/LTE is also located in the area of the display in the dashboard.



Grenadier concept: Antenna GNSS, LTE in Cockpit

For the NAFTA market there is a SDARS-Antenna available, it is located on the roof.



Grenadier NAFTA concept: Antenna SDARS

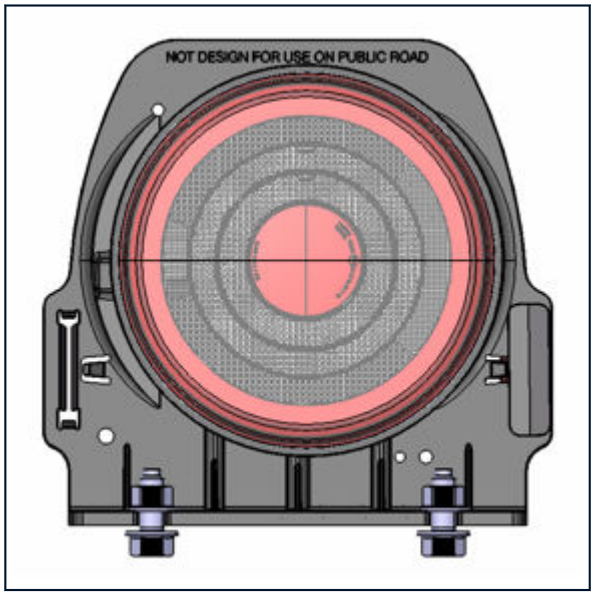
NOTE: The position of the antennas in the vehicle is optimised for the Grenadier. A change of the position in the vehicle can worsen the antenna function. If the position is changed, the body manufacturer is responsible for optimising the antenna performance.

8.6 Lighting

NOTE: Please refer to UN-R 48 for the legal regulations on the "installation of lighting equipment", which also contains the mandatory information on the third brake light for vehicles of class N1 (commercial vehicles ≤ 3500 kg).

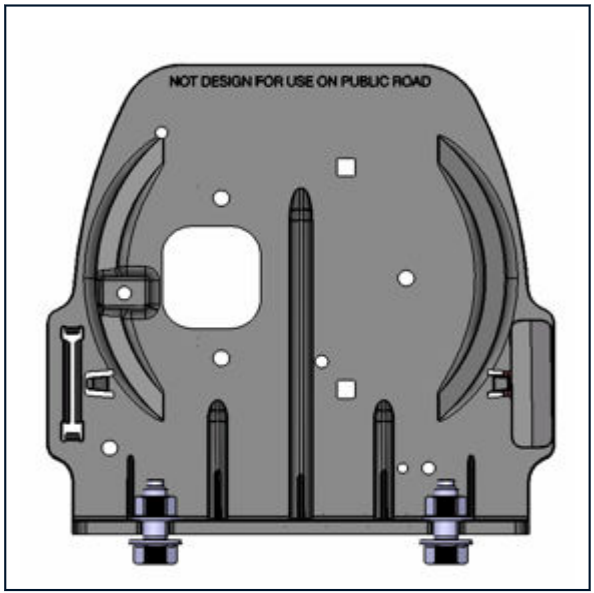
The rear lights are delivered using temporary shipment brackets. These brackets are not road legal and must be removed and recycled. It is the responsibility of the converter to install the rear lights according to the required regulations as part of their conversion.

Temporary shipment bracket with the rear lamp attached:



NOTE: Remove the rear taillight from the bracket, retain the lamp for the finial conversion .
Remove recycle the shipment brackets; they are not to be used on road-registered conversions!

Temporary shipment bracket that should be removed and recycled:



8.6.1 Adjusting the headlights

It is essential to observe the country-specific approval regulations.

Observe the basic headlight setting.

Check headlight position only with unloaded vehicle (ready for operation - fully tanked and loaded with 1 driver).

- Place vehicle on a level, horizontal surface.
- Align headlamp leveller and vehicle at right angles to each other.
- Correct tyre pressure (see tyre pressure table).
- Set headlamp leveller to basic position 0.
- Switch on headlights.
- Check each headlight individually.

8.6.2 Attachment of additional lamps

The country-specific approval regulations apply.

If more than 50% of a lighting device is covered by moving vehicle parts during operation, the vehicle must be safeguarded accordingly.

An appropriate note must be attached to a point where it can easily be seen by the driver of the vehicle.

For detailed information on the installation of lighting and signalling equipment as well as requirements when lighting and signalling equipment is concealed by movable vehicle parts, please refer to UN-R 48.

In the NAFTA version, you can turn off the exterior lights with the light switch. In the EU version the daytime running lights are always active.

8.6.3 Rear lights

To ensure the function of the standard lamp failure check, only lamps of the same type and wattage as in the series may be installed.

The standard rear lights are self-contained and designed for wading.

8.6.4 Vehicle marker lights/clearance lights

Marker lights increase passive safety and are mandatory for vehicles with a width of more than 2.10 m.

8.6.5 Exterior lights

The outdoor light functions of the lamps are controlled by the Body Control Module (BCM).

Error monitoring is always active when the relevant function is active / the corresponding lights are actuated. Take this implemented function into account especially when designing and using the body manufacturers' own electronic ballasts, otherwise errors will be shown and stored in the control unit.

Lighting positions

According to UN-48R

Rear combination lamps (Fog light included):

Minimum distance from ground to lower edge of lamp	350 mm
Maximum distance from ground to upper edge of lamp	1500 mm (2100 mm)
Minimum angle of obstruction free zone downwards of the lamp	15°
Minimum angle of obstruction free zone upwards of the lamp	15°
Minimum angle of obstruction free zone towards the outside of the vehicle	80°
Minimum angle of obstruction free zone towards the centre of the vehicle	45°
Maximum distance from outer edge of vehicle to inner edge of lamp	400 mm

Rear licence plate lamps:

Distance from rear face of licence plate to centre of lamp along lamp mounting face	in a way that the device illuminates the mounting point of the licence plate
Angle between licence plate and lamp mounting face	in a way that the device illuminates the mounting point of the licence plate
Distance between top of rear face of licence plate and lamp mounting face	in a way that the device illuminates the mounting point of the licence plate

Distance between licence plate centre line and centre of lamp	in a way that the device illuminates the mounting point of the licence plate

8.6.6 Interior lights

The interior lights are controlled via the BCM. Interior light sources like the reading light etc. are supplied with electric current by the clamp KL30S, while ambient light sources like switches, buttons etc. are connected to the clamp KL 58.

Interior lights have an after run time of 10 minutes when the ignition is turned off.

If the interior lights are replaced by other body manufacturer-specific lights, only lamps of the same type and the same or lower power as in the series should be installed.

All interior lamps are LEDs, and only replaceable as a whole unit.

Part Name		Lamps per car	Part number	Total current @13.5V
1ST ROW READING LIGHT LH		1	GRA-9B31-033421	70mA
1ST ROW READING LIGHT RH		1	GRA-9B31-033432	70mA
2ND ROW READING LIGHT		1	GRA-9B31-033410	100mA
LOAD SPACE LIGHT		1	GRA-9B31-026590	100mA
AMBIENT LIGHT -OHC		1	GRA-9B31-026530	50mA
AMBIENT LIGHT-Glove box		1	GRA-9B31-026530	50mA
AMBIENT LIGHT-Foot well		2	GRA-9B31-026530	100mA
AMBIENT LIGHT-Door handle		4	GRA-9B31-026530	200mA
PUDDLE LIGHT (Door exit)		4	GRA-9B31-026520	200mA

8.7 Mobile communication systems

When retrofitting mobile communication systems (e.g. telephone, CB radio), the following requirements must be met in order to avoid subsequent operating faults on the vehicle:

- All installed electrical devices require type approval in accordance with UN-R 10 and must bear the CE mark.
- It is essential that you observe the instructions in section 8.2 “Electromagnetic compatibility (EMC)”.

8.7.1 Devices

The maximum transmission output (PEAK) at the base point of the antenna must not exceed the following values. Also observe country-specific laws regarding the maximum permissible transmission output.

Frequency band	Recommended Maximum Transmit power
Shortwave: 3-54 MHz	100 W
4 m band: 74-78 MHz	30 W
2 m band: 144-174 MHz	50 W
Trunked radio/Tetra: 380-460 MHz	10 W
70 cm band: 400-460 MHz	35 W

Frequency band	Recommended Maximum Transmit power
GSM/DCS/PCS: 850/900/1800/1900	10 W
UMTS/LTE	10 W

- The mobile communication systems and mounts must not be within the deployment range of the airbags.
- Devices must be permanently installed. The operation of portable or mobile devices inside the driver's cab is only permitted with a non-reflective external antenna connected.
- The transmitter unit must be installed as far away from the vehicle's electronic system as possible.
- Protect the device from moisture and strong mechanical shocks and observe the permissible operating temperature.

8.7.2 Antenna Connection and Cable Routing (Radio Communication)

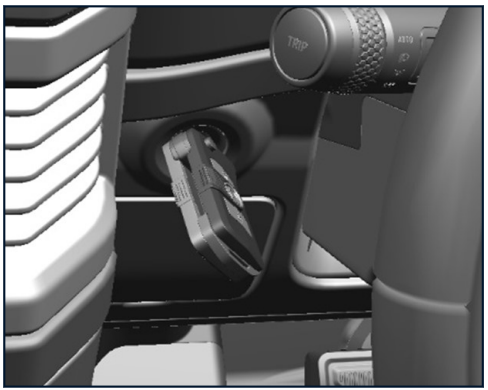
- Observe the manufacturer's notes and installation instructions.
- The connection should be made directly to clamp 30 auxiliary fuse box including an additional fuse. Disconnect the device from the electrical system before performing starting assistance.

- Keep the lines as short as possible, twist them and use shielded cables (coaxial cable). Avoid chafing.
- Ensure good ground connections to the car body (antenna and device).
- Route the antenna and connecting lines between the transmitter, receiver and control unit spatially separated from the vehicle wiring harness near the body ground.
- Do not kink or pinch the antenna cable.

Observe the instructions in section 5.3 “Corrosion protection measures” and section 5.4 “Painting and preservation work”.

8.8 Ignition key

The grenadier vehicle is started by turning the ignition key.



8.8 Ignition key

8.9 Driving assistance systems

WARNING: Driving safety and driving assistance systems are only aids. Driving safety and driving assistance systems cannot reduce the risk of accidents caused by inappropriate or inattentive driving or override physical limits. The responsibility for safe driving in accordance

with traffic regulations (safe distance, speed, braking in good time) lies with the driver. The driving style must always be adapted to the current road, traffic and weather conditions.

The driving safety systems described can only achieve their maximum effect if there is adequate contact between the tyres and the road surface. In particular, observe the information on tyres, recommended minimum tyre tread depth, etc. in section 3.7 “Tyres”, section 4.4.2 “Vehicle marker and side marker lights” and section 6.2.4 “Mudguards and wheel housings”.

In wintry road conditions, always use winter tyres (M+S tyres), if necessary with snow chains. Only in this way will the driving assistance systems described in this section work as effectively as possible.

WARNING: Improper interventions or installations in vehicle systems, safety-relevant components or driving assistance systems can impair their function. This can lead to the failure or malfunction of components or safety-relevant parts and, as a result, to accidents or damage to the vehicle.

In addition, interventions in the vehicle, safety or driving assistance systems or in safety-relevant components may void the warranty/ operating permit.

8.9.1 Electronic Stability Program (ESP)

ESP is a dynamic vehicle control system which actively regulates both the longitudinal and lateral dynamics of the vehicle.

ESP provides greater driving stability with an advanced sensor system that constantly compares the vehicle's current actual course with the target course specified by the driver.

ESP can contribute to the vehicle's stability in all driving situations - during acceleration, braking and free rolling, in a straight line and in corners.

Together with the signals of other sensors, a processor monitors that the direction specified by the driver is maintained.

If the vehicle deviates from the set course (under-steer or over-steer), a stabilizing counteraction can be initiated with an individual brake intervention.

WARNING: Do not make any of the following modifications to vehicles equipped with ESP:

- Changes to the permissible total mass
- Wheelbase modifications outside the approved ranges or standard configurations
- Changes to sensor systems (steering angle sensor, yaw rate sensor, wheel speed sensor, vacuum sensor)

- Changes to the vibration characteristics in the area of the yaw rate sensor due to body modifications
- Changing the position of ESP components
- Changes to the suspension
- Changes to wheels and tyres
- Modifications to the engine
- Changes to the steering
- Modifications to the braking system
- Changes in the installation position of the hydraulic unit, the holder and its attachment to the basic vehicle
- Attachment of vibration generating devices in the vicinity of the ESP control unit
- Changes in the position of the centre of gravity beyond the maximum permissible values are not permitted
- On vehicles with ESP, modifications can cause this system to no longer function as intended, resulting in system shut-downs and faulty control. This may cause the driver to lose control of the vehicle and cause an accident.

The ESP turn rate sensor must not be modified regarding installation location, installation position and fastening compared to the series vehicle.

The ESP turn rate sensor is installed in the centre console, in the centre of the vehicle.

For safety reasons, an ESP control unit that has fallen to the floor may no longer be installed. In this case, a genuine INEOS Automotive part must be installed.

8.9.2 Tyre pressure monitoring

WARNING: Do not make any modifications to the vehicle axles and the system components of the tyre pressure monitoring system. Otherwise, the function of the tyre pressure monitoring system may be impaired by electromagnetic reflection effects. This might result in the driver being unaware of any tyre pressure loss, and they could cause an accident.

In addition, the vehicle may lose its registration requirements under certain circumstances.

According to the regulations of the European Community (EC 661/2009, last amended by VO(EU) 2019/543), all vehicles of class M1 registered for the first time on or after 01.11.2014 must be equipped with a precise monitoring device for the tyre pressure which has been type-approved in accordance with Supplement 01 to the 02 series of amendments to UN Regulation No. 64 or in accordance with UN Regulation No. 141.

This also applies in the case of conversion to winter tyres or accessory wheels, and for vehicles which have been reclassified as Class M1 from other classes. The affected vehicles must permanently be operated with a tyre pressure loss warning system. Otherwise this represents a deviation from the EU regulations and can invalidate the vehicle's operating permit.

If other vehicles (non-M1) are equipped with a tyre pressure monitoring system, this system must comply with the above regulations.

The wireless tyre pressure monitoring system on front and rear axles complies with the regulations above. It is required for the initial registration of new vehicles of class M1 from 1.11.2014 in the EU and EFTA countries.

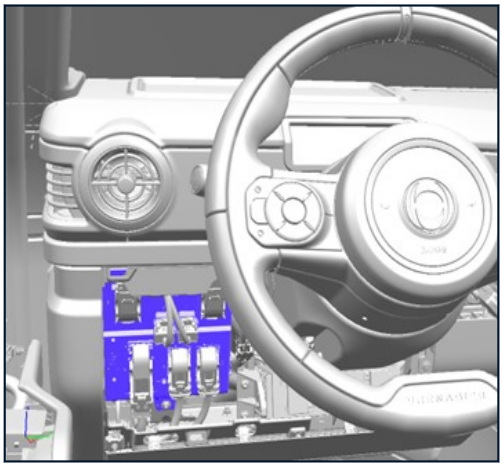
Therefore, modifying the components of this system or influencing them by modifying or adding electromagnetic fields or repositioning the system components is not permissible.

The same applies to other countries that apply the EU regulations and UN regulations. The national regulations must be observed.

After body mounting work has been carried out in this area, it may be necessary for the tyre pressure monitoring system to be retested in accordance with UN Regulation No. 64 or No. 141 by a nationally recognised testing organization at the expense of the body manufacturer. This serves to prove that the vehicle's eligibility for approval in accordance with this regulation is still given by non-interference with the tyre pressure monitoring system.

The receiver / control unit of the system is the BCM. It is located under the cockpit trim on the Driver's side.

LHD



RHD

The pressure sensors are integrated into the tyre valves.

8.10 Windscreen wiper

8.10.1 Windscreen wiper motor

We recommend the use of original INEOS Automotive wiper motors.

For further information, please contact the INEOS technical service team, see section 2.1 “Advice from body manufacturers".

8.11 Circuit diagrams

Circuit diagrams can be made available to body manufacturers via the INEOS Aftersales portal.

CALCULATIONS

9.1 Centre of gravity

The overall centre of gravity height (vehicle with complete body and without load) must be kept as low as possible.

The position of the centre of gravity in the longitudinal direction of the vehicle (x-direction) is given in relation to the centre of the front axle.

The centre of gravity height is specified in relation to the road.

INEOS Automotive recommends that the centre of gravity is determined by a recognized and experienced testing institution.

For the determination of the centre of gravity by the body manufacturer itself, it is recommended that you use the methods described in section 9.1.1 “Determining the centre of gravity in the x-direction” and section 9.1.2 “Determining the centre of gravity in z-direction”.

The vehicle must be loaded in a condition that is appropriate for the intended use.

NOTE: The Practical determination of the centre of gravity position in the x and z-directions may only be carried out by appropriately qualified staff using suitable and calibrated vehicle scales. In order to reduce measuring errors, each measurement value should be determined at least three times and the average should be calculated from these three values.

9.1.1 Determination of Centre of Gravity in X-direction

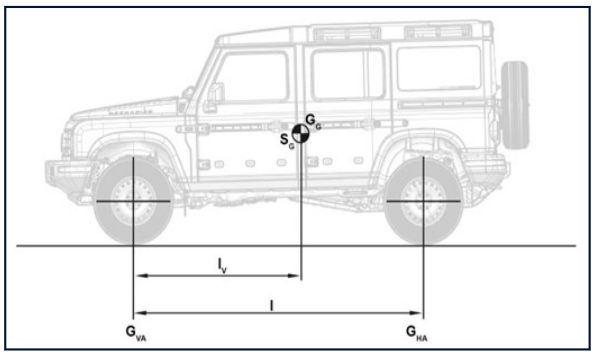
Centre of gravity coordinates in x-direction (front/rear axle load distribution)

Recommendation for the procedure:

- In a first series of measurements, the vehicle is to be weighed with the complete attachment or body and without payload.
- In a second series of measurements, the vehicle is to be weighed with the complete attachment or body and with a payload appropriate for its intended purpose, taking into account the permissible gross mass and the permissible axle loads.
- For the measurement, the tyre pressure of all tyres must be set to the maximum permissible pressure stated on the tyre.
- All fluid reservoirs (fuel tank, windscreen washer reservoir, hydraulic tank, if applicable, fresh water tank, etc.) should be completely filled.
- On the scales, shut off the engine, shift the transmission to neutral and release the brakes.
- The vehicle must be parked horizontally on level ground for weighing.
- First weigh the individual axle loads (front and rear axle loads) and then the gross vehicle mass.

> The measured values can be used to determine the position of the centre of gravity in the longitudinal direction of the vehicle. This can be calculated using equations (3) and (4).

> Use (2) to check the results from (3) and (4).



9.1 Display coordinates and dimensions

Axle load calculation $GG = GHA + GVA$ (1) $l = lV + LH$ (2)	**Weights:** GG Total mass of vehicle GVA Front axle load of the empty vehicle (specification or weighing of the respective basic vehicle) GHA Rear axle load of the empty vehicle (specification or weighing of the respective basic vehicle)
Calculation of the centre of gravity position in x-direction $lv = \frac{GHA*l}{GG}$ (3) $lh = \frac{GVA*l}{GG}$ (4)	**Dimensions** lV Distance of the total centre of gravity of the empty vehicle to the front axle lH Distance of the total centre of gravity of the empty vehicle from the rear axle l Wheelbase SG Overall vehicle centre of gravity

The wheelbase "l" is defined by the build designation (see order) or determined by length measurement in accordance with DIN 70020, Part 1.

9.1.2 Determination of the centre of gravity position in z-direction

Coordinates of the centre of gravity in the z-direction (centre of gravity height hS for the complete vehicle)

INEOS Automotive recommends the following procedure for determining the overall vehicle centre of gravity height hS by the body manufacturer after completion of the complete vehicle:

After conversion, the vehicle is to be weighed in two driving positions in succession on a plate scale or on suitable wheel load scales. The measured axle loads in the level state (GVA and GHA, see section 9.1.1 “Determining the centre of gravity position in the x-direction”) as well as the axle loads with an axle raised by the amount h' (QHA or

QVA) must be determined. The lifting height h' should be as large as possible in accordance with the front and rear overhang angle of the vehicle (also referred to as front and rear "slope angle", respectively). The target value is h' > 600 mm.

To reduce measurement errors, at least six individual measurements must be carried out for each vehicle axle when determining the axle load: three per axle in the level vehicle state and three with a raised axle. The mean value for each axle is to be calculated from the three measurements of one condition. The mean value shall be calculated from these three values and used in the calculation according to equations (5) to (7). To improve the accuracy of the final result, the axle load change shall be determined both with the rear axle raised and with the front axle raised.

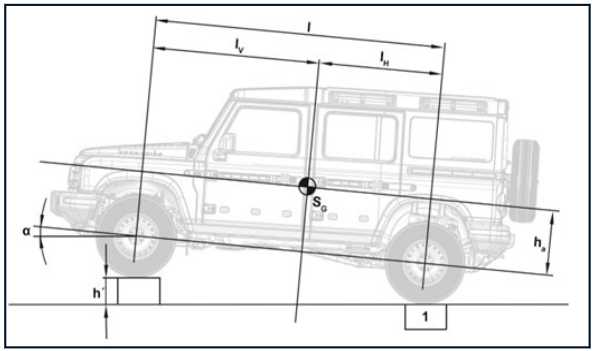
NOTE: To avoid incorrect measurements, please note:

- *When weighing in level vehicle condition, the vehicle must be exactly horizontal. Height differences between the axles caused by a scale must be compensated accordingly.*
- *Both axles must be blocked to prevent suspension jounce and rebound when raising to the required lift height.*
- *When lifting, the left and right sides must be lifted in parallel.*
- *No part of the vehicle may bottom out when raising to the required lift height.*
- *All vehicle wheels must be able to roll: Gear-shift in neutral, all brakes including parking brake released, chocks placed at a sufficient distance from the wheels if necessary.*
- *All tyres must be set to the maximum permissible pressure stated on the tyre.*
- *For turning (in order to weigh the other axle), move the vehicle under its own engine power so that any stresses in the vehicle are relaxed.*
- *Ensure that no objects can shift in the vehicle during the measurements.*
- *Ensure that all fluids (operating fluids and other media specified/required for the intended purpose - e.g. hydraulic oil) and gear /equipment required for operation as well as any compensating ballasts are all topped up and present.*

If the vehicle suspension cannot be blocked owing to its design or space restrictions, further axle load measurements must be taken at different raised positions. Here, errors can again be limited by averaging. The centre of gravity height is equal to the arithmetic mean value of the individual centre of gravity heights for each raised position.

Recommendation for the procedure

- In a first series of measurements, the vehicle is to be weighed with complete attachment or body with axle blocking without load.
- In a second series of measurements, the vehicle is to be weighed with complete attachment or body, axle blocking and with a load corresponding to the intended use, taking into account the permissible total mass and the permissible axle loads.
- Inflate the tyres to the maximum permissible pressure stated on the tyre.
- Completely fill all fluid containers for operating fluids (fuel tank, windscreen cleaning tank, hydraulic tank, coolant tank, etc.) and load or attach equipment required for operation as well as any necessary compensating ballast.
- On the scale, switch off the engine, shift the transmission to neutral and release the brakes.
- Place the vehicle on the scales with the rear axle (HA) horizontal and level and determine the axle load.
- Raise the front axle (VA) by the value h', at least 600 mm. A greater height h', taking into account the other vehicle-related boundary conditions, is more favourable for the final result. The value h' must be determined for all individual measurements with the axle raised and should be as identical as possible. As an alternative to the raised height h', the angle α between the wheel hubs can be determined.
- Determine the axle load transfer QHA at the rear axle to be set on the scales.
- Lower the vehicle and perform lifting measurements 2 and 3. Between all the individual measurements and to turn it around (in order to weigh the other axle), move the vehicle under its own engine power so that any stresses in the basic vehicle are relaxed.
- After the 3rd measurement, lower the vehicle, turn it around and carry out the corresponding measurements on the front axle (first GVA with the vehicle level and then QVA with the rear axle raised by the lifting height h').
- With the values determined, the centre of gravity height can be calculated according to equations (5) to (7).
- For the calculations according to equations (3) to (9), use all length dimensions in millimetres (mm) and all weights in decanewtons (1 daN = 10 N).
- G = 1 daN = 10 N is the weight force corresponding to the mass m = 1 kg.



9.2 Display coordinates and dimensions

Determining the centre of gravity height

$$hs = ha + \tau stat \quad (5)$$

Formulas for raised front axle:

$$hs = \left(\frac{l}{h'} * \frac{QHA-GHA}{GG} * \sqrt{l^2 + h'^2}\right) + \tau\, stat \quad (6)$$

Formulas for raised rear axle:

$$hs = \left(\frac{l}{h'} * \frac{QVA-GVA}{GG} * \sqrt{l^2 + h'^2}\right) + \tau\, stat \quad (7)$$

QVA	Front axle load with rear axle raised
QHA	Rear axle load with vehicle raised at front
hS	Centre of gravity height above road surface
ha	Centre of gravity height above centre of wheel
h'	Height by which the vehicle was raised
SG	Overall vehicle centre of gravity
1	Weighing device

The wheelbase "l" is defined by the build designation (see order) or determined by length measurement in accordance with DIN 70020, Part 1.

NOTE: The determined centre of gravity must not exceed the limit values speci ied in section 4.1.2 "Maximum permissible centre of gravity position".

9.1.3 CO2 & Consumption Calculation

Annex XXI Sub Annex 7 of the Regulation (EU) 2017/1151 amended to 2018/1832

1 Calculation Steps, Inputs and Outputs

Step	Input	Process	Output
1	Reference Vehicle Definition for Coast Down	Road Load Test	**For the Reference Vehicle:**
			TM_r = 2911 kg A_{fr} = 3,88 m² RR_r = 8,45 kg/T
			f_{0r} = 379,9 N f_{1r} = 0.000 N/kph f_{2r} = 0,10400 N/kph²

Step	Input	Process	Output
2	Output Step 1 For each vehicle High and Low of the Interpolation (IP) Family: Test Mass (TM) [kg] Rolling Resistance (RR) [kg/T] Frontal Area (Af) [m²] Tyre Class	Definition of the High and Low for each IP Family	**IP-24NB58PA6d_02-SC6-1 (Petrol):** RM-24NB58PA6d_02-SC6-1:

Step	Input	Process	Output
			$f_{0,VH}$ = 447,7 N $f_{1,VH}$ = 0,000 N/kph $f_{2,VH}$ = 0.10400 N/kph² $A_{fr,VH}$ = 3,88 m2 TM_H = 3118 kg RR_H = 9,9 kg/T $f_{0,VL}$ = 372,5 N $f_{1,VL}$ = 0,000 N/kph $f_{2,VL}$ = 0,09178 N/kph² $A_{fr,VL}$ = 3,31 m^2 TM_L = 2851 kg RR_L = 8,4 kg/T

Step	Input	Process	Output
2	Output Step 1 For each vehicle High and Low of the Interpolation (IP) Family:	Definition of the High and Low for each IP Family	**IP-24NB58PA6d_02-SC6-1 (Diesel):** RM-24NB57DA6d_02-SC6-1:

Step	Input	Process	Output
	Test Mass (TM) [kg] Rolling Resistance (RR) [kg/T] Frontal Area (Af) [m²] Tyre Class		$f_{0,VH}$ = 447,7 N $f_{1,VH}$ = 0,000 N/kph $f_{2,VH}$ = 0,10400 N/kph² $A_{fr,VH}$ = 3,88 m^2 TM_H = 3118 kg RR_H = 9,9 kg/T $f_{0,VL}$ = 378,2 N $f_{1,VL}$ = 0,000 N/kph $f_{2,VL}$ = 0,09178 N/kph² $A_{fr,VL}$ = 3,31 m^2 TM_L = 2905 kg RR_L = 8,4 kg/T

Step	Input	Process	Output
3	Output Step 2	Emissions tests - For each Vehicle High and Low of the IP Family	**IP-24NB58PA6d_02-SC6-1 (Petrol):**

Step	Input	Process	Output
			$CO_{2,H,Low}$ = 440,57 g/km $CO_{2,H,Medium}$ = 330,75 g/km $CO_{2,H,High}$ = 316,79 g/km $CO_{2,H,Extra-High}$ = 412,32 g/km $CO_{2,H,Combined}$ = 370,00 g/km $FC_{,H,Low}$ = 19,446 l/100km $FC_{,H,Medium}$ = 14,605 l/100km $FC_{,H,High}$ = 13,990 l/100km $FC_{,H,Extra-High}$ = 18,201 l/100km $FC_{,H,Combined}$ = 16,335 l/100km $CO_{2,L,Low}$ = 413,88 g/km $CO_{2,L,Medium}$ = 296,01 g/km $CO_{2,L,High}$ = 283,04 g/km $CO_{2,L,Extra-High}$ = 361,70 g/km $CO_{2,L,Combined}$ = 331,00 g/km $FC_{,L,Low}$ = 18,626 l/100km

Step	Input	Process	Output
			$FC_{,L,Medium}$ = 13,067 l/100km $FC_{,L,High}$ = 12,495 l/100km $FC_{,L,Extra\text{-}High}$ = 15,962 l/100km $FC_{,L,Combined}$ = 14,609 l/100km

Step	Input	Process	Output
3	Output Step 2	Emissions tests - For each Vehicle High and Low of the IP Family	**IP-24NB57DA6d_02-SC6-1 (Diesel):**

Step	Input	Process	Output
			$CO_{2,H,Low}$ = 410,79 g/km $CO_{2,H,Medium}$ = 308,33 g/km $CO_{2,H,High}$ = 280,53 g/km $CO_{2,H,Extra-High}$ = 383,31 g/km $CO_{2,H,Combined}$ = 340,00 g/km $FC_{,H,Low}$ = 15,672 l/100km $FC_{,H,Medium}$ = 11,764 l/100km $FC_{,H,High}$ = 10,704 l/100km $FC_{,H,Extra-High}$ = 14,624 l/100km $FC_{,H,Combined}$ = 12,972 l/100km $CO_{2,L,Low}$ = 383,76 g/km $CO_{2,L,Medium}$ = 284,47 g/km $CO_{2,L,High}$ = 252,21 g/km $CO_{2,L,Extra-High}$ = 341,56 g/km $CO_{2,L,Combined}$ = 308,00 g/km $FC_{L,Low}$ = 14,642 l/100km

Step	Input	Process	Output
			$FC_{,L,Medium}$ = 10,856 l/100km $FC_{,L,High}$ = 9,626 l/100km $FC_{,L,Extra\text{-}High}$ = 13,033 l/100km $FC_{,L,Combined}$ = 11,753 l/100km

Step	Input	Process	Output
4	Output Step 1 Output Step 2 Output Step 3 For an individual Vehicle: TM_{ind} [kg] RR_{ind} [kg/T] Af_{ind} [m²]	Individual Vehicle Calculations	$f0_{,ind}$ [N] $f1_{,ind}$ [N/kph] $f2_{,ind}$ [N/kph²] CED_{ind} [J] $CO2_{,ind}$ [g/km] FC_{ind} [l/100km]

2 Calculations performed on Step 4

On this steps the calculations of the individual vehicles shall be performed based on the configuration of the individual vehicles.

The TM_{ind} and Af_{ind} are calculated based on the options selected and the sum of the respective values.

The f-terms and CED are then calculated:

$$f_{0,ind} = Max((0{,}05 \times f_{0r} + 0{,}95 \times \left(f_{0r} \times \frac{TM_{ind}}{TM_r} + \left(\frac{RR - RR_r}{1000}\right) \times 9{,}81 + TM\right);$$
$$(0{,}2 \times f_{0r} + 0{,}8 \times \left(f_{0r} \times \frac{TM_{ind}}{TM_r} + \left(\frac{RR - RR_r}{1000}\right) \times 9{,}81 + TM\right))$$

$$f_{1,ind} = 0$$

$$f_{2,ind} = Max((0{,}05 \times f_{2r} + 0{,}95 \times f_{2r} \times \frac{Af_{ind}}{Af_r});\ (0{,}2 \times f_{2r} + 0{,}8 \times f_{2r} \times \frac{Af_{ind}}{Af_r})$$

The TM, f0, f1 and f2 terms are used to calculate the Cycle Energy Demand (CED) for each phase of the cycle: Low, Medium, High and Extra High. The total CED is the sum of each part.

Where:

$$CED = \sum_{t_{start}}^{t_{end}} E_i$$

$$E_i = F_i \times d_i \; if \; F_i > 0$$

$$E_i = 0 \; if \; F_i \leq 0$$

And:

- t_{start} is the time at which the applicable test cycle or phase starts, s;
- t_{end} is the time at which the applicable test cycle or phase ends, s;
- E_i is the energy demand during time period (i-1) to (i), Ws;
- F_i is the driving force during time period (i-1) to (i), N;
- d_i is the distance travelled during time period (i-1) to (i), m.

Where:

$$F_i = f_{0,x} + f_{1,x} \times \left(\frac{v_i - v_{i-1}}{2}\right) + f_{2,x} \times \frac{(v_i - v_{i-1})^2}{4} + (1.03 \times TM_x \times a_i)$$

F_i is the driving force during time period (i-1) to (i), N;

V_i is the target velocity at time t i , km/h;

TM is the test mass, kg;

a_i is the acceleration during time period (i-1) to (i), m/s².

$$d_i = \frac{(v_i - v_{i-1})}{2 \times 3{,}6} \times (t_i - t_{i-1})$$

Where:

d_i is the distance travelled in time period (i-1) to (i), m;

v_i is the target velocity at time t i , km/h;

t_i is time, s.

$$a_i = \frac{(v_i - v_{i-1})}{3{,}6 \times (t_i - t_{i-1})}$$

3 Calculations performed on Step 4 for CO2 and FC

For each phase (p) the CO_2 shall be calculated as below with the later "p" representing Low, Medium, High, Extra High phases or Combined.

$$CO_{2,ind,p} = CO_{2,VL,p} + \left(\frac{CED_{ind,p} - CED_{VL,p}}{CED_{VH,p} - CED_{VL,p}}\right) \times \left(CO_{2,VH,p} - CO_{2,VL,p}\right)$$

Where:

VH is the Vehicle High of the IP Family

VL is the Vehicle Low of the IP Family

For each phase (p) the FC shall be calculated as below with the later "p" representing Low, Medium, High, Extra High phases or Combined.

$$FC_{ind,p} = FC_{VL,p} + \left(\frac{CED_{ind,p} - CED_{VL,p}}{CED_{VH,p} - CED_{VL,p}}\right) \times \left(FC_{VH,p} - FC_{VL,p}\right)$$

TECHNICAL DETAILS

10.1 Vehicle data

Further technical data on the vehicle can be obtained via the INEOS Aftersales portal or any INEOS Automotive Service Centre.

INDEX

INDEX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