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# 2020 Technical Regulations Version 1.1



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#### ENQUIRIES

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#### ALTERATIONS

Re-Engineering Australia Foundation Ltd. reserves the right to alter any specifications and documentation associated with the 'Challenge' without prior notice.



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# TABLE OF CONTENTS

		.4
Summary o	of Main Revisions from Review of 2018 Season	.4
ARTICLE T1	- DEFINITIONS	. 5
T1.1	Australian Competition Season	.5
T1.2	World Final Competition	.5
T1.3	Language Used	.5
T1.4	Penalties	.5
T1.5	Competition Classes	.5
T1.6	4x4 in Schools Vehicle	.6
T1.7	Chassis	.6
I1.8		.6
11.9 T1.10		.6
T 1.10 T1 11	Topk / Skid Stoor	.0 7
T1 12	Vehicle drive battery	. <i>1</i> 7
T1.12	Body Shell	.7
T1.14	Surface Finish & Decals	.7
T1.15	Engineering Drawings	.8
		0
TO 1	- GENERAL FRINCIPLES	<b>. د</b>
T2.1	Interpretation of the Regulations	0. 8
T2.2	Amendments to the Regulations	.0 8
T2.4	Compliance with Critical Regulations.	.8
T2.5	Compliance with Class Eligibility Regulations	.9
T2.6	Rectification of Critical Regulation Infringements	.9
T2.7	Measurements	.9
ARTICLE T3	- VEHICLE DIMENSIONS	10
T3 1	Overall Length	10
T3 2	Overall Width	10
T3.3	Overall Height	10
T3.4	Ground Clearance	11
T3.5	Approach Angle	
TO C	• • •	11
13.0	Departure Angle	11 11
T3.7	Departure Angle	11 11 12
T3.7	Departure Angle	11 11 12 <b>12</b>
T3.7 ARTICLE T4	Departure Angle	11 11 12 <b>12</b> 12
T3.7 ARTICLE T4 T4.1 T4.2	Departure Angle Break Over Angle	11 11 12 <b>12</b> 12
T3.7 ARTICLE T4 T4.1 T4.2 T4.3	Departure Angle	11 11 12 <b>12</b> 12 12
T3.7 ARTICLE T4 T4.1 T4.2 T4.3 ARTICLE T5	Departure Angle Break Over Angle - DRIVE, WHEELS AND STEERING Drive Wheels	11 11 12 12 12 12 12
T3.0 T3.7 ARTICLE T4 T4.1 T4.2 T4.3 ARTICLE T5 T5 1	Departure Angle Break Over Angle - DRIVE, WHEELS AND STEERING Drive Wheels Steering - VEHICLE MASS Maximum Mass	11 11 12 12 12 12 12 13
T3.0 T3.7 ARTICLE T4 T4.1 T4.2 T4.3 ARTICLE T5 T5.1	Departure Angle Break Over Angle - DRIVE, WHEELS AND STEERING Drive Wheels Steering - VEHICLE MASS Maximum Mass	11 11 12 12 12 12 12 13
T3.0 T3.7 ARTICLE T4 T4.1 T4.2 T4.3 ARTICLE T5 T5.1 ARTICLE T6	Departure Angle Break Over Angle	11 11 12 12 12 12 13 13
T3.0 T3.7 ARTICLE T4 T4.1 T4.2 T4.3 ARTICLE T5 T5.1 ARTICLE T6 T6.1 T6.1	Departure Angle Break Over Angle	11 11 12 12 12 12 13 13 13
T3.0 T3.7 ARTICLE T4 T4.1 T4.2 T4.3 ARTICLE T5 T5.1 ARTICLE T6 T6.1 T6.2 T6.2	Departure Angle Break Over Angle - DRIVE, WHEELS AND STEERING Drive Wheels Steering	11 11 12 12 12 12 13 13 13 13
T3.0 T3.7 ARTICLE T4 T4.1 T4.2 T4.3 ARTICLE T5 T5.1 ARTICLE T6 T6.1 T6.2 T6.3 T6.3 T6.4	Departure Angle Break Over Angle - DRIVE, WHEELS AND STEERING Drive Wheels Steering - VEHICLE MASS Maximum Mass - VEHICLE BODY SHELL Covered Components Firmly Secured to Chassis Size Resemble a Vehicle	11 11 12 12 12 12 13 13 13 13 13
T3.0 T3.7 ARTICLE T4 T4.1 T4.2 T4.3 ARTICLE T5 T5.1 ARTICLE T6 T6.1 T6.2 T6.3 T6.4 T6.4 T6.5	Departure Angle	11 11 12 12 12 12 13 13 13 13 13 13 13
T3.0 T3.7 ARTICLE T4 T4.1 T4.2 T4.3 ARTICLE T5 T5.1 ARTICLE T6 T6.1 T6.2 T6.3 T6.4 T6.5	Departure Angle	11 11 12 12 12 12 13 13 13 13 13 13 13
T3.0 T3.7 ARTICLE T4 T4.1 T4.2 T4.3 ARTICLE T5 T5.1 ARTICLE T6 T6.1 T6.2 T6.3 T6.4 T6.5 ARTICLE T7	Departure Angle Break Over Angle - DRIVE, WHEELS AND STEERING Drive Wheels Steering - VEHICLE MASS Maximum Mass - VEHICLE BODY SHELL Covered Components Firmly Secured to Chassis	11 11 12 12 12 12 13 13 13 13 13 13 13 13



T7.2 T7.3 T7.4	Automatic Lights Cable Management Coding (optional)	.14 .14 .14	
ARTICLE T8	- VEHICLE CONTROL EQUIPMENT	. 14	
T8.1	Radio Control Equipment	.14	
T8.2	Drive Battery Pack	.14	
T8.3	Additional Battery Packs	.14	
ARTICLE TS	- TOW BAR	. 14	
T9.1	Fixed	.14	
T9.2	Suitable for Use	.14	
T9.3	Retract, Fold or Pivot	.14	
ARTICLE T10 - APPENDICES			
T10.1	Trailer	.15	

#### PREFACE

This document only contains 'Technical Regulations'. A separate document encompasses the 'Competition Regulations'.

These regulations will be valid for all 2020 State Finals and the 2020 National Final. Some changes may only be valid for National Finals.

Car diagrams and images used in this document are an illustrative representation only and do not necessarily constitute a 'legal' design.

#### Summary of Main Revisions from Review of 2018 Season

The following summary provides an overview of all technical related regulations that have been revised from the 2019 season's regulations.

It is each team's responsibility to thoroughly read this document in order to identify wording changes and to understand any impact this may have on their project.

All changes between this season and last season are identified within the document by using <u>red underlined</u> <u>text. All changes made since the release of Version 1.0 appear in green underlined text.</u>

#### **ARTICLE T1 - DEFINITIONS**

#### T1.14.1 Updated Challenge Logo

#### **ARTICLE T2 - GENERAL PRINCIPLES**

Nil Changes

#### **ARTICLE T3 - VEHICLE DIMENSIONS**

Nil Changes

#### **ARTICLE T4 - DRIVE, WHEELS AND STEERING**

Nil Changes

#### **ARTICLE T5 - VEHICLE WEIGHT**

Nil Changes

#### **ARTICLE T6 - VEHICLE BODY SHELL**

T6.5 Updated Challenge Logo

#### **ARTICLE T7 - VEHICLE ELECTRONICS**

Nil Changes

#### **ARTICLE T8 - VEHICLE RADIO CONTROL EQUIPMENT**

Nil Changes

#### **ARTICLE T9 - TOW BAR**

Nil Changes



### **ARTICLE T1 - DEFINITIONS**

#### T1.1 Australian Competition Season

The standard sequence of Australian 4x4 in Schools competitions runs across one calendar year. The State Finals held Aug/Sep/Oct will feed to the National Final in November of the same year. This encompasses a complete season, for which the rules **SHOULD** remain constant. REA Foundation Ltd reserves the right to update / revise the rules if deemed appropriate.

#### T1.2 World Final Competition

The Australian National Final will feed into a World Final which is usually held anywhere from April through November the following year depending on the country hosting this competition. For teams aspiring to represent Australia at the World Final, please be aware that the world final rules are different to the Australian rules.

#### T1.3 Language Used

The language of the rules is tiered. Those clauses expressed as "**MUST**" or "**WILL**" are mandatory and failure to comply will attract objective penalties - points and/or racing and/or in the extreme, disqualification. Those expressed as "**SHOULD**" or "**MAY**" reflect some level of discretion and choice.

Some clauses will be satisfied through team registration processes or declarations signed as complied with as part of the Challenge Terms and Conditions, whilst others will be tested through a variety of objective and subjective judging.

#### T1.4 Penalties

A range of penalties will be applied for non-compliance with identified regulations. These penalties include:

#### T1.4.1 Point Penalty

Invoked from non-compliance with technical regulations and some competition regulations governing portfolio or trade booth restrictions. These are identified as [Point Penalty].

#### T1.4.2 Eligibility

Teams need to meet certain eligibility criteria to compete at a State or National Final. Failure to comply with certain eligibility criteria **MAY** lead to disqualification from the competition, a judging element or a class of competition [Eligibility].

#### T1.5 Competition Classes

There are three competition classes in the Australian F1 in Schools<sup>™</sup> competition:

#### T1.5.1 Development Class (Years 5 – 9)

For first time entering students. Students can only participate in this class once with the exception of Year 5 students who can re-register in this class in Year 6. There is no pathway to the World Final. Maximum 3 - 5 team members.

#### T1.5.2 Professional Class (Years 7 – 12)

Open to all students in Years 7 – 12 only. Students may participate in this class multiple times. The National Champion Professional Class team will represent Australia at the World Final. Maximum 3-5 team members.

### T1.6 4x4 in Schools Vehicle

Each team is required to produce a working remote controlled vehicle that satisfies the 4x4 in Schools vehicle technical regulations as outlined in this document. The Vehicle shall be designed and manufactured as much as possible by the team members and judges **MAY** ask teams to prove how the vehicle has been produced. Any work on the vehicle **NOT** undertaken by a team member **MUST** be listed as an outsourced item and **MUST** have engineering drawings, product descriptions and design briefs along with information of the manufacturer. The vehicle must be battery powered.

4x4 in School Technology Challenge vehicles are designed to negotiate the off-road course as controlled and smooth as possible within a set time frame.

As a minimum, a 4x4 in Schools vehicle assembly **MUST** consist of the following mandatory components:

- A Body Shell
- Four (4) (Driven) Wheels
- Vehicle Drive Battery
- Radio Control Receiver
- Vehicle Chassis
- Automatic Lights
- Tilt Sensor
- Tow Bar
- Vehicle Decals



#### T1.7 Chassis

A chassis consists of an internal vehicle frame that supports a manmade object in its construction and use. An example of a chassis is the underpart of a motor vehicle, consisting of the frame, axles and suspension (on which the body is mounted).

#### T1.8 Axle Track

The axle track is the distance between the centreline of two wheels on the same axle.

#### T1.9 Wheelbase

The wheelbase of the vehicle is the distance between the rotational centres of the front and rear wheels as viewed in the side view

#### T1.10 Tolerance

The permissible range of variation in a dimension of an object



#### T1.11 Tank / Skid Steer

By operating the left and right wheel pairs at different speeds, the vehicle turns by skidding, or dragging its fixed-orientation wheels across the ground.

#### T1.12 Vehicle drive battery

This is the battery used primarily to provide power to the vehicle's wheels through one or more electric motors for drive (Such as Nickel-Cadmium (NiCad), Nickel Metal Hydride (NiMH) cells and LiPo). This is supplied as standard with the 4x4 in Schools Starter kit, available from REA Foundation Ltd.. Additional batteries may be used to power control circuits, please see T8.0 for more information

#### T1.13 Body Shell

The body shell is the aesthetic outer shell of a 4x4 in Schools car. This can be a one-piece construction or a combination of different components, designed to protect and cover the vehicle chassis and electronics. The body shell can be finished using paint, decals and other components. The body shell is fixed securely to the vehicle chassis as per T6.1.4

#### T1.14 Surface Finish & Decals

A surface finish on an 4x4 in Schools vehicle is considered to be any applied visible surface covering, of uniform thickness over the profile of a car component. A decal is material adhered to a component or surface finish. To be defined as a decal, it must be a maximum 2mm in thickness and 100% of the area of the adhering side must be attached to a surface. Surface finishes and decals are included when measuring the dimensions of any components they feature on. Refer to the Competition Regulations for more information.

Teams **MUST** use the REA supplied corporate logo vehicle sticker decals. These car sticker decals will be provided at the point of event registration and teams will be given 15 minutes to apply them before submitting their 4x4 vehicle for Specifications Judging. Teams **MUST** leave sufficient space for on their vehicle to accommodate all REA provide decal stickers.

Teams are **NOT** permitted to create their own 4x4 in Schools or REA Corporate Partner vehicle sticker decals.

#### T1.14.1 <u>4x4 in Schools Logo Vehicle Sticker Decals</u>

This consists of the 4x4 in Schools logo graphic printed with a horizontal dimension of <u>30</u>mm and vertical dimension of 20mm. Teams will be provided with the full cololur version only. The 4x4 in Schools logo must be applied to the vehicle so it is 100% visible in plan view. The official vehicle sticker decals are supplied by REA Foundation Ltd at event registration. Refer to the Competition Regulations for more information.



#### T1.14.2 REA Corporate Partner Car Sticker Decals

This consists of the REA Foundation Ltd logo text and globe graphic, Australian Government Department of Defence logo text and coat of arms graphic and Visual Connections logo and text graphic, printed on either black or white with a horizontal dimension of 55mm and vertical dimension of 20mm. Teams will be provided with either the black or the white background sticker decal so as to provide maximum contrast with the colour of the surface the sticker decal is being adhered to. Official car sticker decals are supplied by REA Foundation Ltd at event registration.





#### T1.15 Engineering Drawings

CAD produced drawings which **SHOULD** be such that, along with relevant CAM programs, could theoretically be used to manufacture the fully assembled car by a third party. Such drawings include all relevant dimensions, tolerances and material information. 4x4 in Schools engineering drawings include detail to specifically identify and prove compliance with the technical regulations.

#### **ARTICLE T2 - GENERAL PRINCIPLES**

#### T2.1 Regulations Documents

REA Foundation Ltd. issues the regulations, their revisions and amendments made.

#### **T2.1.1 Technical Regulations**

This document. The Technical Regulations document is mainly concerned with those regulations that are directly related to 4x4 in Schools<sup>™</sup> vehicle design and manufacture. Technical Regulation article numbers have a 'T' prefix.

#### **T2.1.2** Competition Regulations

A document separate to this one which is mainly concerned with regulations and procedures directly related to judging and the competition event. Competition Regulation article numbers have a 'C' prefix.

#### T2.2 Interpretation of the Regulations

#### T2.2.1 Final Text

The final text of these regulations is in English should any dispute arise over their interpretation. The text of a regulation, diagrams and any related definitions should be considered together for the purpose of interpretation.

#### T2.2.2 Text Clarification -

Any questions received that are deemed by REA Foundation Ltd. to be related to regulation text needing clarification will be answered by REA Foundation Ltd. The question received, along with the clarification provided by REA Foundation Ltd., will be published to all competing teams at the same time.

#### T2.3 Amendments to the Regulations

Any amendments will be announced and released by REA Foundation Ltd. by email notification to all teachers nominated in the school registration, as well as the updated revision being uploaded to the website at <u>http://rea.org.au/4x4-in-schools/</u>. Any amended text will be indicated thus (<u>using red underlined text</u>).

#### T2.4 Compliance with Critical Regulations

Invoked from non-compliance with Technical Regulations which are identified as critical through the use of the danger symbol. Points are deducted for non-compliance with the technical regulations. The 4x4 vehicle will be scrutinised and points will be deducted for any infringements.



#### T2.4.1 Penalties for Critical Regulations

Some of the more critical regulations WILL attract a 15 Point Penalty These critical regulations are:

T3.1 / T3.2 / T3.3 / T4.1.1/ T4.1.2 / T4.1.3 / T4.2.1 / T4.2.2 / T4.3.1/ T4.3.2 / T4.3.3 T5.1 / T6.1.1 / T6.1.2 / T6.1.3 / T6.1.4 / T9.1 / T9.2

#### T2.5 Compliance with Class Eligibility Regulations

The following 'Eligibility' regulations relate to the Development Class only and attract large penalties. Teams are urged to check **ARTICLE C2.3.5** in the Competition Regulations for further information.

#### T2.5.1 Non use of the REA supplied Starter Kit

#### T2.5.2 Non approved Starter Kit modification

#### **T2.6** Rectification of Critical Regulation Infringements

Any team whose vehicle has been deemed by Scrutineers to have infringed a Critical Regulation, will be given an opportunity to rectify this prior to racing with the effect of removing the Track Assessment and Trailer Tow percentage reduction penalty. The original Technical Regulation point penalty will stand. Refer to **ARTICLES C3.10 and C4.1.4.3** in the Competition Regulations for more information.

#### T2.7 Measurements

All units of measure in this document unless otherwise stated for dimensions and mass are in millimetres (mm), kilograms (kg) and degrees (°). Conversion calculations are the responsibility of the team.

#### T2.7.1 Dimensions Tolerance

Tolerance when measuring all dimensions is +/- 1(one) millimetres (mm) unless otherwise stated.

#### T2.7.2 Mass Tolerance

Tolerance when measuring mass is +/- 0.001 kilogram (kg).

#### T2.7.3 Angles Tolerance

Tolerance when measuring angles is  $+/- 2(^{\circ})$ 

#### T2.7.4 Dimensional measures

All car component dimensions are inclusive of any applied paint finish or decal. A series of specially manufactured gauges WILL be used to broadly verify dimensional compliance. Accurate measuring tools, such as Vernier callipers, WILL then be used to closely inspect any dimensions found to be close to the dimensional limits per the initial gauge inspection. Measurements WILL be taken with the vehicle in a ready to compete state.

#### T2.7.5 Mass Measures

All weight measurements WILL be made using the REA provided 4x4 in Schools electronic competition scales which are accurately calibrated to +/- 1(one)g.

#### T2.7.6 Scrutineering of Finished Product

Whilst your CAD design **MAY** comply with dimensional regulations, the process of machining, finishing and assembly **WILL** individually impact on the final dimensions of the finished product submitted for scrutineering. It is the actual product that is measured in scrutineering. It is not the design intent that is judged in scrutineering.



#### **ARTICLE T3 - VEHICLE DIMENSIONS**



#### Overall Length

#### [Critical Regulation | 10pt Penalty]

Measured from the longest points on the vehicle and including the fixed tow bar. Dimension: 200mm minimum / 360mm maximum





#### **Overall Width**

#### [Critical Regulation | 10pt Penalty]

Measured from the widest points on the vehicle and including features such as side mirrors. Dimension: 160mm minimum / 200mm maximum





#### Overall Height

#### [Critical Regulation | 10pt Penalty]

Measured from the track surface to the highest point on the vehicle excluding aerials. Dimension: 100mm minimum / 200mm maximum



T3.3 Overall Height



[5pt Penalty]

#### T3.4 Ground Clearance

Measured from the track surface to the lowest point under the vehicle including the fixed tow bar. Dimension: 20mm minimum



#### T3.5 Approach Angle

From the front of the vehicle. Dimension: 25° minimum

#### [5pt Penalty]



#### T3.6 Departure Angle

Measured as the angle produced between the rear of the rear wheel and body. Dimension: 25° minimum

[5pt Penalty]





#### T3.7 Break Over Angle

Measured as a supplementary angle produced by the front and rear wheels to the lowest point of the car body.

Dimension: 20° minimum



**IMPORTANT:** The dimensions above are set as a minimum for the vehicles. Certain elements of the test track will exceed these dimensions to test the vehicles overall capability.

#### **ARTICLE T4 - DRIVE, WHEELS AND STEERING**

#### T4.1 Drive

T4.2

- **T4.1.1** The vehicle MUST be powered by an electric motor or motors.
- T4.1.2 The vehicle MUST be capable of forward and reverse drive.
- T4.1.3 Caterpillar tracks are NOT permitted.

#### [Critical Regulation | 2pt Penalty Each]

[Critical Regulation | 2pt Penalty Each]

- T4.2.1 The vehicle MUST have four (4) wheels only.
- T4.2.2 All wheels MUST be driven.

#### T4.3 Steering

Wheels

#### [Critical Regulation | 2pt Penalty Each]

- T4.3.1 The vehicle can have the following steering arrangements
  - T4.3.1.1 Professional Class: 4 or 2 Wheel Steering
  - T4.3.1.2Development Class: 2 Wheel Steering ONLY[10pt penalty]
    - \* Excludes T4.3.1.2 which is a 10pt penalty

T4.3.2 All vehicles MUST have functional steering, that is, MUST have the ability to turn left and right.

T4.3.3 Tank, crab or skid steer is NOT permitted.



#### **ARTICLE T5 - VEHICLE MASS**



#### Maximum Mass

The vehicle must not exceed 2.0 kilograms in mass Maximum Mass: 2.0kg

#### **ARTICLE T6 - VEHICLE BODY SHELL**



#### **Covered Components**

The vehicle's body shell **MUST** cover 100% of the following components:

- T6.1.1 The vehicle's battery.
- T6.1.2 All motors and receivers
- T6.1.3 All four (4) wheels and tyres from plan view (above).





#### **Firmly Secured to Chassis**

The body shell **MUST** be firmly secured to the Chassis.

## [Critical Regulation | 5pt Penalty]

[Critical Regulation | 5pt Penalty]

#### Size T6.3

The vehicle shell **MUST** comply with the overall vehicle dimensions (see T3).

T6.4

**Resemble a Vehicle** [Critical Regulation | 15pt Penalty]

### The body shell **SHOULD** realistically resemble a vehicle.

#### **Challenge Logo** T6.5

The vehicle **MUST** display the challenge logo below.

30mm



[1pt Penalty]

### [Critical Regulation | 15pt Penalty]

[Critical Regulation | 5pt Penalty Each]

The vehicle must have a lateral (centre to left and centre to right) tilt detection system to trigger lights or a buzzer on the vehicle when the angle of tilt is greater than 25°. Positioning of Other Corporate Sticker Decals

#### T7.2 **Automatic Lights**

**Tilt Sensor** 

T7.1

The vehicle must have an automated system to turn the vehicle lights on when the light level drops to below 25 lux.

#### T7.3 **Cable Management**

Cables and wiring should be protected by the body shell where possible. Cables should be tied together neatly and routed in a logical manner, so as not to catch on any external element or pose a safety risk.

#### T7.4 Coding (optional)

Teams have the option to add a programmable computer such as an Arduino or a Raspberry Pi to their vehicle, allowing them to code functions such as parking sensors, automatic lights and GPS. These must use a power source with a maximum nominal voltage of 9v.

### **ARTICLE T8 - VEHICLE CONTROL EQUIPMENT**

The following vehicle control equipment is needed to participate in the 4x4 in Schools Technology Challenge:

#### **Radio Control Equipment** T8.1

A digital speed controller MUST be used to control the vehicle

#### T8.2 **Drive Battery Pack**

One battery pack with a nominal maximum voltage of 7.4v must be used.

#### **T8.3 Additional Battery Packs**

Additional batteries can be used to power non-drive control circuits (e.g. light sensor, buzzer), these must have a maximum nominal voltage of 9v.

### **ARTICLE T9 - TOW BAR**

**T9.1** Fixed

The vehicle **MUST** have a fixed tow bar which must be carried by the vehicle throughout the competition.

#### **T9.2** Suitable for Use

The tow bar must be suitable for use with the tow eye on the supplied trailer.

Diameter: 5mm maximum

#### **Retract. Fold or Pivot T9.3**

It is permissible to retract, fold or pivot the tow bar providing this is done without the use of any tool.

### **ARTICLE T7 - VEHICLE ELECTRONICS**

### [10pt Penalty Each]

[10pt Penalty Each]

#### Page 14 of 16

#### [Critical Regulation | 5pt Penalty]

### [2pt Penalty]



#### 2020 4x4 in Schools Australian Technical Regulations

#### [Advice]

[Advice]

### [2pt Penalty]

[2pt Penalty]

# [2pt Penalty]

[Critical Regulation | 5pt Penalty]





### **ARTICLE T10 - APPENDICES**

#### T10.1 Trailer

- Event organisers will provide the trailer on the day of the competition.
- The trailer has no brakes.
- The trailer or towed object will have 2 or more wheels
- The towing eye on the trailer is rigidly fixed to the trailer there is no rotational movement.
- The towing eye is a ring type.



Dimension	Label	Value
Trailer max width	W	200mm
Trailer max length including tow eye	L	350mm
Towing eye height	h	35mm
Hitch length (see diagram)	н	210mm
Drawbar length	А	70mm
Tow eye inner diameter	d	5mm
Tow eye outer diameter	D	15mm
Trailer mass	М	500g



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