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**Magirus 100 D 9 FA based expedition vehicle**

# **ExpV “Trolf”**

Operation Manual

Version 2010-10-10

# Table of Contents

▶	<b>Table of Contents</b> .....	2
▶ 1	<b>About this manual</b> .....	4
▶ 2	<b>Usage</b> .....	4
▶ 2.1	Main specifications.....	4
▶ 2.2	Quick reference card.....	5
▶ 2.3	Special equipment operation.....	5
▶ 3	<b>History</b> .....	5
▶ 3.1	Vehicle history.....	5
▶ 3.2	Body history.....	6
▶ 4	<b>Vehicle subsystem documentation</b> .....	6
▶ 5	<b>Body subsystem documentation</b> .....	7
▶ 6	<b>Vehicle parts documentation</b> .....	8
▶	control elements.....	8
▶	model.....	9
▶	general information.....	10
▶	engine.....	10
▶	drivetrain.....	11
▶	masses.....	11
▶	sizes.....	12
▶	wheels.....	12
▶	equipment.....	14
▶	compressed air subsystem.....	14
▶	electric subsystem.....	14
▶	tail lamps.....	15
▶	usage data.....	17
▶	tools and accessory.....	17
▶	manuals.....	17
▶ 7	<b>Body parts documentation</b> .....	17
▶	key cylinders for door and flaps.....	18
▶	door hinges.....	19
▶	frame mounting brackets / supports.....	19
▶	screws to mount the box body on the subframe.....	19
▶	screws for improvised mounting the subframe on the main frame.....	19
▶	windows.....	20
▶	door.....	20
▶	door bolt locking tread.....	20
▶	subframe.....	20
▶ 8	<b>FAQ</b> .....	21
▶ 8.1	Operating a truck.....	21
▶	What mandatory accessory has to be on a truck in the European Union?.....	21
▶	What warning blinklight that is licenced in Europe can be recommended?.....	21
▶	Where to get help for 4x4 truck, Magirus and expedition topics?.....	22
▶	How to maximize the mileage of truck tires?.....	22
▶	How to get around temperature-induced oil changes?.....	22
▶	How to mix my own cleaning agent for the windscreen washer system?.....	22
▶	How to maximize the life span of car batteries?.....	23
▶ 8.2	Maintaining this expedition vehicle.....	23
▶	Where to get manuals for this vehicle?.....	23
▶ 8.3	Modifying this expedition vehicle.....	23
▶	What offroad tires can I use, and how to mount them?.....	23
▶	What's the matter with the different European approval signs on vehicle parts?...24	

▶	What regulations have to be met about vehicle lighting?.....	24
▶	What's the meaning of the different bayonet lamp holder base standards?.....	24
▶	How to calculate what cable cross section to use for what application?.....	24
▶	Where can I find necessary electrical formulae?.....	25
▶	What cables have to be used for electrical installations in cars?.....	25
▶	How many cores fit into 10 mm corrugated tube?.....	26
▶	What suppliers can be recommended for necessary general truck parts?.....	26
▶	What suppliers can be recommended for Magirus spare parts?.....	27
▶	What suppliers can be recommended for repairing oldtimer truck parts?.....	27
▶	Whats the meaning of production series numbers of Magirus cabins?.....	27
▶	What is the standard for 24 V DC power supply?.....	27
▶	Are grease gun parts interoperable?.....	27
▶ <b>9</b>	<b>Shopping protocol</b> .....	<b>28</b>
▶ <b>10</b>	<b>Fueling protocol</b> .....	<b>33</b>
▶ <b>A</b>	<b>Labels</b> .....	<b>33</b>
▶ <b>B</b>	<b>Inbox</b> .....	<b>33</b>

# 1 About this manual

**Content.** This document includes all relevant information about its author's first expedition vehicle. In the sense of an implementation of "Equipment System level A-4". (The Equipment System is published in another document by the same author, and its level A-4 is about an "expedition vehicle". This document includes no part of that specification, but everything about this implementation, esp. where it deviates from the specs.) Vehicle-specific repair and registration documents are not copied herein, but sources to get these are mentioned. Also, the tasks to build and maintain the vehicle are managed separately. The planning of future additions etc. is contained here.

**Structure.** The document is structured in a way so that general information is re-usable for publishing. That is, all confidential information is concentrated into the chapters "History" and "Inbox", which have to be completely removed before publishing.

## Intended purposes.

1. First of all, this document acts as the owner's central repository for all the vehicle-specific information.
2. Next, it acts as a reference manual for people who lend the vehicle. It's written in English in order to be understandable by as many people as possible.
3. Then, the document is stored inside the vehicle as its vehicle-specific manual. To that end, the document must allow comfortable printing, wherefore the page size DIN A4 was chosen. The font size is chosen big enough to allow the creation of a small DIN A5 (two-up) version for storing in the vehicle.
4. Last, the document is intended for being published on the Internet, to be of use by owners of similar vehicles. To that end, the format allows simple high-quality publishing on the Internet: primarily in PDF format, but also as HTML chapter-per-page. The source can be edited with the Open Source software OpenOffice.org Writer.

**Typographic notes for changes.** All OpenOffice.org Draw drawings should be made in 100% size, as resizing them in Writer does not resize fonts, and converting to curves increases file size by 100kiByte or more per drawing and diminishes font quality. The drawing area is therefore a DIN A4 page with 3.5cm left side margin and 1,75cm margin on the other sides, resulting in a 15.75 x 26.2cm square.

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Add hyperlink to the license.

## 2 Usage

### 2.1 Main specifications

Insert here one very compact page with all the most important vehicle data, to show around and share. It should be done just like that for the firefighter typesheets in Germany.

This must esp. include all the technical specs that are relevant for operation, like air pressures in the tires, oil volumes etc..

The information contained here might be reduplicated in other parts of this document.

Insert:

- values that appear in the German firefighter typesheets, like turning circle.
- technical drawing of the expedition vehicle including the box body.
- Bremsanlage
  - Art der Betriebsbremse
  - Art der Feststellbremse
  - Art der Hilfsbremse

## 2.2 Quick reference card

This card is meant to be printed and mounted somewhere in the cabin.

## 2.3 Special equipment operation

This section contains usage instructions for additional, non-original technology in the vehicle and its box body.

# 3 History

This concentrates the vehicle-specific information that should not be included when publishing this document on the Internet.

## 3.1 Vehicle history

The vehicle I bought: <http://www.autoscout24.de/Details.aspx?id=le2elusqhy1p>

My decision proceedings:

On mounting my freezer body on a trailer (in case the truck came with its own, usable body). The trailer could accommodate 8 elements that are used either as beds or shelves, while the truck would accommodate 3 beds and household for three people. The trailer is so-to-speak the extended equipment when on expedition with up to 17 people, while the truck itself is for long-term accommodation of up to three people (those who fit in the cabin). This was related to buying a 4WD bus for 17 people. [2008-09-29]

An old 4WD truck like a Hanomag AL-28 is uncomfortable and may break easily, while a Magirus 110D / 130D / 170D uses too much diesel (25l/100km). Additionally, it will be hard to get an expedition mobile with oldtimer licensing, even if changed before 20 years, as the rules got harder in the last years. Therefore, the best option is to invest into finishing my current box body and use twistlocks to mount it on a unconsumed light 2WD truck, where oldtimer licensing is no problem. This is perfect for travelling in Europe, perhaps even for on-road travelling in Africa. Possibilities: Mercedes 608 from 1979/1980 with <50.000km, uses 14l/100km, may be bought for 1500-1800 EUR from mobile.de.

Disadvantages: no 4WD, no more than three people (without an added passenger car). Therefore, if these points get demanding in practise, get additionally (!) a Magirus 170D with short double cabin, from firefighters or THW, mount also twistlocks on it. May be bought for 2800-3000 EUR from mobile.de. Or even use a MAN KAT I (also possible from 1979 on; people in the body while driving will be no problem in less developed countries). Then, a flexible solution is present: one truck for lightweight, cheap personal travelling, one truck for true expeditions, even with many persons and into tough areas. As both have oldtimer licensing, the overall costs are admittable. The one I don't need can be hired out or used by someone else.

According to this thread (<http://www.allrad-lkw-gemeinschaft.de/phpBB2/viewtopic.php?p=108583>), the Hanomag A-L28 ist no good for an expedition mobile, oldtimer licensing should be avoided (having a truck is always expensive, so better go and earn some money) and a fitting base vehicle for long-term use is e.g. Iveco 110-17 for 4500 EUR from VEBEG, with my box body mounted fixedly and seats in the box body. Uses 20l/100km when used as 7,49t truck. [2008-10-04]

The list of the vehicle's ideal specs was: 4WD truck with 9-seat double cabin and up to 110 PS

- double cabin is needed for travelling short term communities (but it might be replaced by seats in the box body)
- one of the few appropriate models: ex THW truck, 4WD, 130 PS, short double cabin (9 places), built 1979-06
- there are Magirus with long double cabin (11 places) and a slightly shorter version which I need (recognizeable by the fact that the rear doors are not just in rectangular shape)

- it must have no more than 9 places, else one would need a bus licence to drive it
- the double cabin shall be used for living purposes, also: configurable for five beds (men's room?) (two above each other, plus one above the front row of seats) or configurable for a place for all to sit and eat, talk or work on the computer
- summing up, the vehicle must be able to house up to 9 people for up to 4 weeks (mission trips, expeditions etc.), and 4 people permanently if possible, add oldtimer age and 10ft twistlocks (for getting a multi-purpose registered oldtimer truck), but that's not necessary
- 110 PS, as a strong motor with 170 PS uses 30% more fuel

## 3.2 Body history

Everything that's known about the box body:

- Tiefkühl-Kofferaufbau
- Baujahr 1992
- zuletzt auf einem MAN 8150 (mit ~280 Tkm)
- im Oktober 2007 noch eingesetzt zusammen mit einer halb breiten Hebebühne für Altkleidersammlungen
- Ausstattung
- Isolierung rundum 10cm, inkl. Boden und Decke
- 2mm starkes Aluminium-Riffelblech auf dem Boden, mit angeschweißten Seitenteilen
- Türbeschläge aus Edelstahl
- mobile.de Fahrzeug-ID 31456508
- original price 1000 EUR (together with a half-width tail lift), 350 EUR without the tail lift

## 4 Vehicle subsystem documentation

This section documents the systemic aspects of the vehicle, i.e. everything where several parts contribute at once, esp. also interface specifications. Individual parts are documented in the chapter "Vehicle parts documentation".

This section includes a virtual tour through the whole vehicle, consisting of photographs (partially with measures added) and technical drawings. As, this material can help a lot when planning modifications to the vehicle, and communicating about these in person or via Internet forums.

Insert a descriptive, narrative-style text that describes the vehicle as a system.

Insert technical photo documentation of the whole vehicle including the box body.

Insert wiring diagram for this very vehicle.

Color codes of cables in the taillights:

- left tail light

- blue: brake light
- black: indicator
- gray: normal tail light
- brown: ground connection to lamp enclosing
- red: not connected

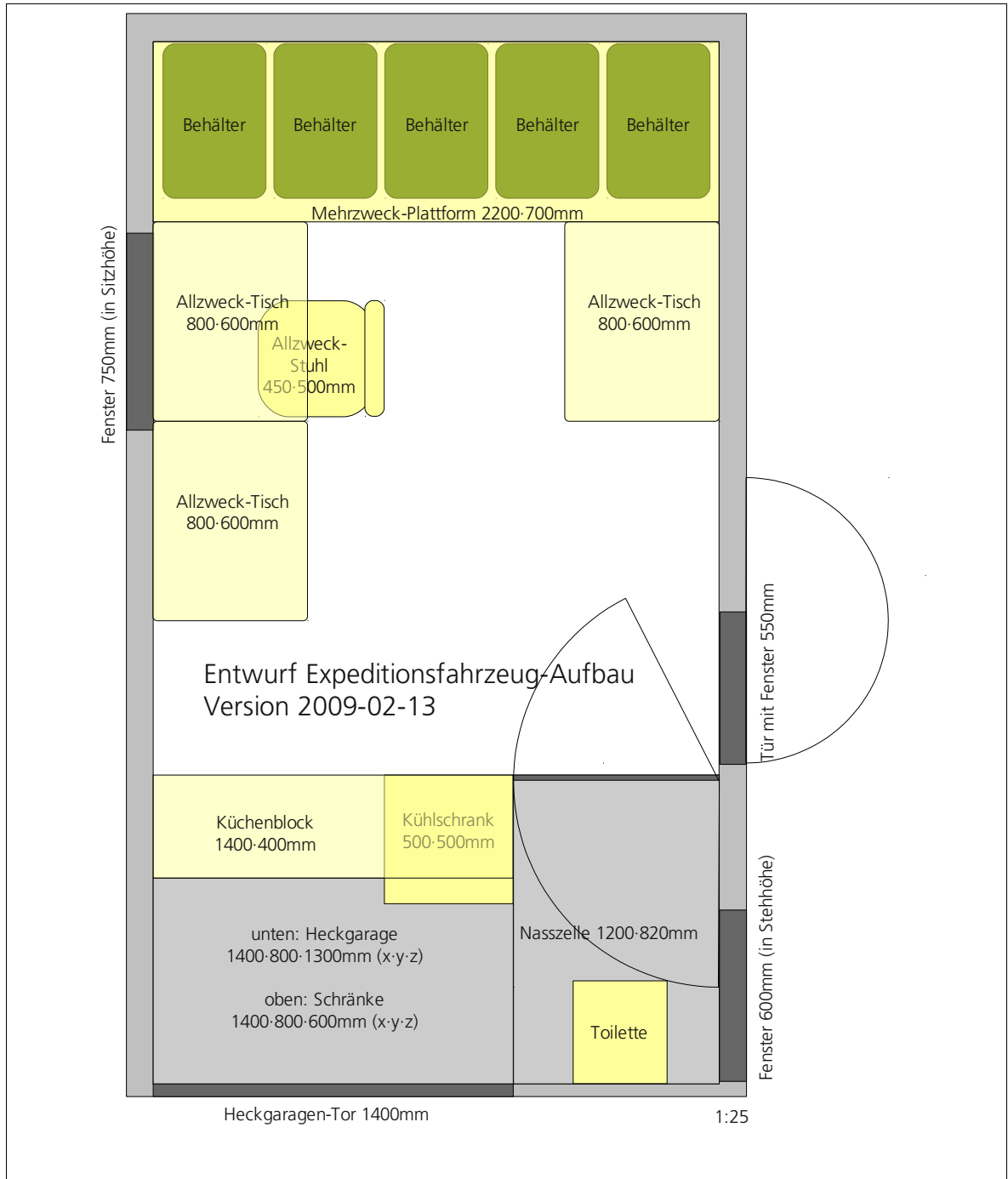
- right tail light

- blue: brake light
- gray: indicator
- brown from the cable: normal tail light
- brown, short cable in the enclosing: ground connection to lamp enclosing
- red: base plate of bulbs (ground)

## 5 Body subsystem documentation

This section documents the systemic aspects of the body, i.e. everything where several parts contribute at once. Individual parts are documented in the chapter "Body parts documentation".

Insert a descriptive, narrative-style text that describes the box body as a system.



There is a new version of the layout drawing in the ExpV.odt.d folder.

Change: The kitchen and storage area should be scaleable and reconfigurable. To that end, various shelf boards with widths 200mm, 400mm and 600mm are needed. From these, all requirable depths (for 400mm and 600mm container depths) can be configured. The shelf boards need to be extremely stable, made from 60mm aluminium square tread, in order to bear also heavy containers. The shelf boards must be freely adjustable in height by using vertically mounted AJ system tread (which also gives better load-bearing than horizontal mounting).

The kitchen sink would be realized by just mounting one of these shelf boards in

workbench height. To have a reconfigurable area here makes it possible to load the truck via the back door (if a friend moves home etc.), to have more living space when living alone in the truck, to have a huge place for sleeping with 6 people in the truck (all the floor, essentially) and to have more luggage space when traveling with more people in the truck.

Translate the interior drawing to English.

Changes: The only main furniture item should be the "Powerschrank" as specified in the Equipment System A-4. At the place where currently the multi-purpose platform resides. The Powerschrank desk will also be used for computer work. To the right of the large back flap (taking some bathroom space) there should be the wood stove, with air supply and chimney going through the back wall. Above the back flap there should be one wall-mounted desk with kitchen equipment. Above the kitchen, at the ceiling, there should be the hot water tank (and cold water tank). Hot water is provided by a copper-connected solar collector immediately above on the vehicle's top, and by a copper connection or heat-exchanger connection to the wood stove. There should be 30l of hot water, with the option to add pressure to that. Or better, There should be no hot water at all!! Somewhere at the wall, there must be a special hook and straps for mounting the A-2 backpack as a shelf.

The Equipment System level A-4 has to be tidied up and written fully into the Equipment System document to know the latest state of decisions.

Planänderung: Küche direkt an der Rückwand, Arbeitsplatte passt gut über die Heckklappe; ggf. Fenster symmetrisch zum Bad anbringen; so dient die Heckklappe weit besser zum Be- und Entladen, was sehr praktisch ist; und es gibt keinen schwer zugänglichen Stauraum mehr; und man kann in zwei Reihen (einmal zwei, einmal drei Leute) auf dem Boden schlafen in Längsrichtung (Kisten dann ins Bad, auf eine Plattform oder nach draußen); evtl. Kann auch jemand noch mit den Füßen im Bad schlafen; die Küche kann Wandschränke (wandmontierte Behälter) an der Rückwand bekommen

## 6 Vehicle parts documentation

This lists the current values only. Possible modifications and history are discussed in other chapters.

For each part, a descriptive name is given, and then several paragraphs, each with a header naming the value to be given ("spec[ification]s", "original [model]", "current [model]", "compatible [models]", "hints" etc.).

Technical drawings, photographs, tables etc. can be included, where applicable. The part database should be ordered alphabetically by part name. At times it will be unordered, and should be searched through then. Prices are not included, as they change frequently. See the shopping protocol for that.

This list also contains internal interface standards, which are used to create an environment where modification and repair is as simple as possible by use of agile, flexible parts.

Move general / overall technical information to the "Main specifications" chapter (2.1).

Sort the sub-chapters in alphabetic order.

Add: available technical documents and where to get them.

- Spiegel Fahrerseite: Ausladung 200-350mm ab Blech
- Hauptspiegel Beifahrerseite: Ausladung 170-320mm ab Blech
- Spiegelverbreiterung Fahrerseite um 80mm, Beifahrerseite um 110mm durch Verstellen möglich, so dass die Ausladung je ab 290mm beginnt
- Aktuelle Spiegeleinstellung ist für den Koffer von 2400mm Breite i.O., keine Verbreiterung nötig.
- Bei vorderem Endmaß "Mitte Ganghebelwelle" ist zwischen Kotflügel und Kofferschürze min. 20mm Luft

### control elements

#### *motor off bowden cable*

outer cable diameter, original: 6 mm

inner cable diameter, original: 1.5 mm

inner cable length, original: 3150 mm (including some allowance)

outer cable length, original: 2650 mm

inner cable material, original: zinc coated steel

installation: outer cable is installed from the end of the switch off lever up to a clamp near the oil filter; from where the inner cable travels alone



approx. 350 mm; the inner cable is mounted with a clamping screw to the switch off lever at the injection pump, and to the control panel lever originally by squashing the tube in hexagonal shape

## model

*manufacturer* Klöckner-Humboldt-Deutz ("KHD")

*type identifier* Magirus 100 D 9 FA

This means: 100 PS, approx. 9 tons permissible overall mass, cab over engine (German: F = Frontlenker), all-wheel drive. Source: vehicle registration document.

The Magirus 100 D 9 FA is exactly the same vehicle as the Magirus 100 D 7 FA (perhaps apart from reinforced springs, dampers etc.)<sup>1</sup>.

*type relationships* This is a "D" type cab over engine vehicle, commonly called "D-Frontlenker" in German. This was a newer line of cab over engine vehicles, introduced in 1963 and built (with various modernizations) until 1977 (and for special customers like firefighting vehicles until 1987).<sup>2</sup> (More specifically, this has a production series 5505 "heavy truck" D-type cabin, which can be recognized by the front lamps being in the bumper.) The MK line took over as the successor, which is the Magirus variant of the "Club of Four" (Viererclub) trucks. They can be recognized by the "M" in the type identifier (such as 130M11FA), and by their equivalent Iveco type identifiers used from 1982 on (such as 110-13).<sup>3</sup>

Add: short introduction to list the similarities and differences to other Magirus trucks, in order to make it easier to utilize this document for their trucks.

*vehicle identification number* 440.0003.271<sup>4</sup> (German: "Fahrgestellnummer", "Fahrgestell Fabriknummer").



There is an added number of unknown meaning next to it: 130570

*cabin identification number* 415.0023-269<sup>5</sup>



<sup>1</sup>user Krücke of allrad-lkw-gemeinschaft.de in <http://www.allrad-lkw-gemeinschaft.de/phpBB2/viewtopic.php?p=119358#119351>

<sup>2</sup> [http://de.wikipedia.org/wiki/Magirus-Deutz#Neue\\_Frontlenker](http://de.wikipedia.org/wiki/Magirus-Deutz#Neue_Frontlenker)

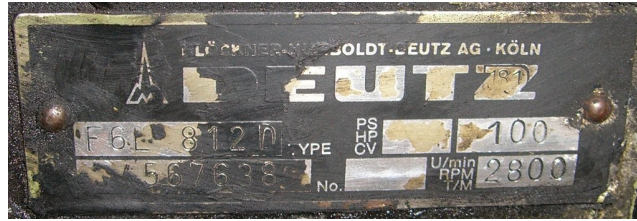
<sup>3</sup> [http://de.wikipedia.org/wiki/Magirus-Deutz\\_MK-Reihe](http://de.wikipedia.org/wiki/Magirus-Deutz_MK-Reihe)

[http://de.wikipedia.org/wiki/Magirus-Deutz#Neue\\_Frontlenker](http://de.wikipedia.org/wiki/Magirus-Deutz#Neue_Frontlenker)

<sup>4</sup> Source: vehicle frame near the trailer coupling

<sup>5</sup> Source: label on the door frame of the left door. This number might have a different meaning.

*engine identification number* 4 567 638<sup>6</sup>



*vehicle registration document number* 34 424 563 (applies to the original "Pappbrief" vehicle registration document)

*production series number: cabin* Baureihe 5505 (German: "Baureihe", "Erzeugnisreihen-Nummer Fahrerhaus")<sup>7</sup>

*production series number: frame* 5139-05/1 (German: "Erzeugnisreihen-Nummer Fahrgestell")<sup>8</sup>



*production series number: body* unknown or not applicable because the original body was a "special" one for the firefighters<sup>9</sup>

*registration date* 1968

(the vehicle type 100 D 9 F was build from 1967-1968)

*original use* fire-fighting vehicle with dry extinguishing equipment used in the factory fire department of Chemische Werke Hüls

## general information

*seats* 2 (currently)

3 (per vehicle registration document, so mounting the third one in between the two is no problem)

*maximum speed* 80kmh<sup>-1</sup> (according to vehicle registration document)

85kmh<sup>-1</sup> (according to own test)

*noise level (standing)* 84dB(A) (DIN-Phon) (according to vehicle registration document)

*noise level (driving)* 89dB(A) (DIN-Phon) (according to vehicle registration document)

## engine

*engine manufacturer* Klößner-Humboldt-Deutz ("KHD")

*engine type identifier* F6L 812 D

This engine is also used in some Deutz tractors. Name's meaning:

**F** vehicle engine (F = "Fahrzeugmotor")

<sup>6</sup> Source: label on the engine block.

<sup>7</sup> Source: from comparing with depictions, see the FAQ section; it should be also on the label at the foot step of the left door, but is not

<sup>8</sup> Source: label at the foot step of the left door

<sup>9</sup> This should be also on the label at the foot step of the left door, but is not.

**6** six cylinders  
**L** air-cooled (F= "luftgekühlt")  
**8** production series no. 8  
**12** cylinder stroke is 12cm  
**D** direct injection (D = "Direkteinspritzung")

*engine type* Diesel

*engine power* 74kW (equiv. 100PS) at 2800Umin<sup>-1</sup>

*engine size* 5068cm<sup>3</sup>

*cylinder mounting* in-line engine

Check that.

*firing order*

Add.

## drivetrain

*drivetrain* 4x4 permanent AWD

According to the vehicle registration document, the drivetrain is 4WD non-permanent. Others say it has probably permanent 4WD, because that's per default with Magirus. Test it by lifting one front wheel and changing into a gear.

*main gearbox*

synchronized gearbox  
five forward gears, one backward gear  
auxiliary drive (in higher than normal position)

Add gear ratios. Add number of revolutions.

*transfer gearbox*

permanent transfer to both axles  
differential lock  
gear reduction switch

Add gear reduction ratio.

Add max. axle torque for every gear (with gear reduction switched on and off).

## masses

*chassis cab mass (i.e. w/o any body)*

Add.

*box body mass, empty*

*empty mass* 8800kg (in original condition with firefighting equipment, including dry extinguishing pulver, per vehicle registration document)

*combat mass*

*permissible overall mass*

9250kg (in original condition with firefighting equipment, per vehicle registration document)  
~6500kg (after licensing as expedition vehicle)

*combat load per axle, front*

Add, by weighing front axle only in combat condition.

*permissible load per axle, front* 3200kg (per vehicle registration document and lettering on the vehicle)

*combat load per axle, rear*

Add, by weighing front axle only in combat condition

*permissible load per axle, rear* 6400kg (per vehicle registration document)

## sizes

*wheelbase* 3150mm

*rear axle leaf spring zero position*<sup>10</sup>

*vehicle frame width* 770mm

*vehicle frame truss width* 70mm

*cabin width, at height of front window / rear-view mirrors* 2180mm

*rear overhang* 1840mm<sup>11</sup>

## wheels

There are multiple systems to give the tire dimensions<sup>12 13</sup>. The dimensions given here are in the "numeric" mode: 14.5/80 R 20 means:

- 14.5 inch nominal tire width (i.e. at widest point)
- 80% ratio of tire side height (not diameter, just the ring height!) to tire width. If missing, the ratio is 82%.
- Radial tire
- 20 inch wheel rim diameter

The second important scheme is "European metric". The difference is just that the tire width is given in millimeters. For a table that lists all measures for usual truck tire sizes, see <sup>14</sup>.

*minimum admissible tire specification front* 8.25 - 20 12PR (according to vehicle registration document)

*tires front*

single tires

offroad tread

model Continental Titan<sup>15</sup>

specification 8.25 - 20<sup>16</sup> 133/131<sup>17</sup> J<sup>18</sup> 14PR<sup>19</sup>

<sup>10</sup> i.e. position of rear wheel top relative to main frame top when the vehicle is fully unloaded (i.e. as chassis cab)

<sup>11</sup> i.e. measure from rear axle to the end of the vehicle. The largest allowable rear overhang in Germany is in general 60% of the wheelbase, here 1890mm; some tolerance is possible here. Source: Mercedes-Benz Aufbaurichtlinien, see <http://www.allrad-lkw-gemeinschaft.de/phpBB2/viewtopic.php?t=13444>.

<sup>12</sup> <http://www.pirelli.de/web/technology/about-tyres/tyre-function/measures/default.page>

<sup>13</sup> <http://www.pistenkuh.de/1/expeditionsfahrzeug---off-road/reifen/>

<sup>14</sup> <http://www.pistenkuh.de/1/expeditionsfahrzeug---off-road/reifen/>

<sup>15</sup> Continental classifies this as an MPT (multi-purpose tire). As an multi-purpose tire, it can be used off-road, for winter service vehicles and on streets, and this tire has a special focus for street usage. Currently (2009-02), the (new) tire is only available in size 10.5 - 20. For all this, see [http://www.conti-online.com/generator/www/de/de/continental/industrie/themen/produkte/aufgabe/mehrzweckaufgaben/gelaende/mpt\\_titan/titan\\_de.html](http://www.conti-online.com/generator/www/de/de/continental/industrie/themen/produkte/aufgabe/mehrzweckaufgaben/gelaende/mpt_titan/titan_de.html).

<sup>16</sup> Yes, this is a diagonal tire. See [http://www.conti-online.com/generator/www/de/de/continental/industrie/themen/produkte/uebersicht/mpt\\_reifen/dimensionen/titan/titan\\_de.html](http://www.conti-online.com/generator/www/de/de/continental/industrie/themen/produkte/uebersicht/mpt_reifen/dimensionen/titan/titan_de.html).

<sup>17</sup> Load index (German *Tragfähigkeitsindex*), 133 is for single tires (2060kg/tire), 131 is for dual tires (1950kg/tire). See [http://www.pneuportal.de/tabele/tabela\\_indeksow\\_nosnosc.asp](http://www.pneuportal.de/tabele/tabela_indeksow_nosnosc.asp), And <http://de.wikipedia.org/wiki/Tragf%C3%A4higkeitsindex>.

<sup>18</sup> Speed index (German *Geschwindigkeitindex*). J=100kmh<sup>-1</sup>, K=110kmh<sup>-1</sup>. See <http://de.wikipedia.org/wiki/Geschwindigkeitindex>.

<sup>19</sup> For meaning of "ply rating", see [http://www.dualport.com/bustech/load\\_tires.html](http://www.dualport.com/bustech/load_tires.html).

100 PSI  
Tube-Type

Add age, profile depth, profile wear.

*minimum admissible tire specification rear* 8.25 - 20 12PR (according to vehicle registration document)

*tires rear*

dual tires  
street tread  
model TOYO Hyparadial ST<sup>20</sup>, M-87<sup>21</sup>, M-87-1W<sup>22</sup>  
specification 8.25 R 20 133/131 K 14PR  
HW-J, Regroovable<sup>23</sup>  
Tube-Type (as no "Tubeless" written on it)

Add age, profile depth, profile wear (original profile depth is 15mm, see [http://www.lesschwab.com/tires/truck/toyo\\_m87.asp](http://www.lesschwab.com/tires/truck/toyo_m87.asp)).

*nominal tire pressure*<sup>24</sup>

- front (Continental Titan):
  - 6.0bar at vehicle's max load of 1600kg/tire<sup>25</sup>
  - 6.9bar (=100 PSI)<sup>26</sup> at tire's max. load of 2060kg/tire.
- rear (Toyo Hyparadial M-87):

Add pressure for current rear tires.

Normally, the correct nominal tire pressure is given by the vehicle manufacturer (dependent on vehicle mass), not by the tire manufacturer.

For a Magirus 130 D 9 FA (model with double cabin, perhaps 1978) with 9 R 22.5 tires (single front, dual rear) the manufacturer recommends 6.5bar air pressure at front, 5.0bar air pressure at rear.<sup>27</sup>

*wheel rims* all 6 rims are:

snap ring type  
8 holes  
size 6.5-20  
manufactured by SUDRAD<sup>28</sup>

Add radius of the holes' circle. Add type of screws to use.

- 
- 20** Means "S/T construction", whatever that might be. It is meant to simplify the regrooving process. See [http://www.lesschwab.com/tires/truck/truck\\_tire\\_brochure.pdf](http://www.lesschwab.com/tires/truck/truck_tire_brochure.pdf). It could mean "S-tread", referring to the shape of the tread rings. This is also referred to as ringtread rib design ([http://www.lesschwab.com/tires/truck/ringtread\\_rib.asp](http://www.lesschwab.com/tires/truck/ringtread_rib.asp)).
- 21** This is a manufacturer-specific profile indicator. M-87 indicates: all position tire, for street usage, esp. for regional trucking and for trailers, S/T construction. See [http://www.lesschwab.com/tires/truck/toyo\\_m87.asp](http://www.lesschwab.com/tires/truck/toyo_m87.asp) and <http://www.reifen-vor-ort.de/reifenhersteller-herst-TOYO-id-1b0e.html>. It has a 5-rib design, and rib design normally means low traction (see the "premium rib" and "premium traction" categorization on <http://www.lesschwab.com/tires.asp>). So, this tire is relatively useless off-road.
- 22** This could be a so-called "LSP code".
- 23** Regrooving information: regrooving depth 3mm, width of cut 7mm, see [http://www.toyo.co.uk/page.php?identity=truck\\_tyres\\_and\\_data\\_info](http://www.toyo.co.uk/page.php?identity=truck_tyres_and_data_info). The original tread depth of the M-87 tire is 19/32"=15mm (see [http://www.lesschwab.com/tires/truck/toyo\\_m87.asp](http://www.lesschwab.com/tires/truck/toyo_m87.asp)).
- 24** Means the minimum tire pressure of a tire, measured when cold.
- 25** Written on the vehicle's mud guard in original condition, i.e. valid for the front axle max. load of 3200kg, as written in the vehicle registration document). Applying the rule of three to 2060kg  $\approx$  6.9bar however would lead to 1600kg  $\approx$  5.4bar.
- 26** See [http://de.wikipedia.org/wiki/Pound-force\\_per\\_square\\_inch](http://de.wikipedia.org/wiki/Pound-force_per_square_inch).
- 27** Betriebsanleitung Iveco Magirus 130 D 9 FA Fahrgestell MKW, page 02-3.
- 28** Rim inscription: SUDRAD 20831SLT 6.5-20 HD DIN 6 67  
Snap ring inscription: SUDRAD DIN HD 10/67 6.5/7.0-20

*tires mountable on rim*

8.25 R 20

9.00 R 20 (improvised)

10.00 R 20 (improvised)<sup>29</sup>

*pressure-dependent max. load*

Add from <http://www.pistenkuh.de/1/expeditionsfahrzeug---off-road/reifen/>.

## equipment

*trailer hitch* Currently none. Originally, per vehicle registration document:

Rockinger 201 G 130. It has a 24V trailer outlet and a trailer brake hose with single-line brake system.

Add the diameter of the trailer hitch mounting hole.

*tank capacity* nominal 100l<sup>30</sup>, exactly 103l<sup>31</sup>

*front hitch* The diameter of the hitch pin is 31.5mm.

## compressed air subsystem

*tire-inflation hose connector*

This is a standardized connector: M16 x 1.5 (meaning 1.5 mm thread pitch). It is standardized in DIN 74326.<sup>32</sup> This seems to be also an international standard: "ISO 3583:1984 Road Vehicles - Pressure Test Connection for Compressed-Air. Pneumatic Braking Equipment Third Edition."<sup>33</sup>

DIN 74326 specifies "form A" and "form B" connectors. Document what is used here.

## electric subsystem

*on-board power supply voltage* 24V

*cable standard*

Cables are created from single cores that are combined into corrugated tube. This allows flexible arrangements and re-arrangements, and simpler buying.

The single cores used are FLRY 1.5 mm<sup>2</sup>, having a maximum outer diameter of 2.4 mm according to ISO 6722. (Of these, 9 or 10 go into 10 mm corrugated tube without friction. This is enough for all vehicle applications, as at most 7 cores are needed, for the left tail lamp.)

Note that both voltage drop and maximum load current is not an issue for all lighting applications: load current can be 11 A for 1 mm<sup>2</sup> and 15 A for 1.5 mm<sup>2</sup><sup>34</sup>, voltage drop is ca. 0.28 V (way below normal 3% or 5%) for a length of 7 m and a load current of 1 A.<sup>35</sup>

From measuring the original cables it seems that 1 mm<sup>2</sup> cross section was used for all lighting etc. applications.

<sup>29</sup> According to <http://www.pistenkuh.de/1/expeditionsfahrzeug---off-road/reifen/>.

<sup>30</sup> engraved on the sheet metal of the tank

<sup>31</sup> Calculated from the outer sizes of 360mm tank diameter and 1000mm tank length, plus approx. 1.5l usable capacity of the filling nose. The tank can be filled up to the very top with its nose.

<sup>32</sup> Source:

[http://www.bbk.bund.de/nn\\_402296/SharedDocs/Publikationen\\_extern/Publikationen\\_20T/Fahrzeuge/T\\_202\\_20Beladeplan\\_20BtLKW\\_201012\\_2002.templateId=raw.properTy=publicationFile.pdf/T%202%20Beladeplan%20BtLKW%201012%2002.pdf](http://www.bbk.bund.de/nn_402296/SharedDocs/Publikationen_extern/Publikationen_20T/Fahrzeuge/T_202_20Beladeplan_20BtLKW_201012_2002.templateId=raw.properTy=publicationFile.pdf/T%202%20Beladeplan%20BtLKW%201012%2002.pdf)

<sup>33</sup> Source: <http://www.metsofts.com/STD/iso.pdf>

<sup>34</sup> Source: <http://www.njumaen.de/t4tt/pdf/kabelquerschnitte.pdf>

<sup>35</sup> Source: <http://www.yachtbatterie.de/cgi-bin/forms/querschnitt.pl>



Instead of using colored single-core cables, it is even more flexible to use cable of a single color (gray or white) and equipment to write permanent numbers on them, as one then can simply stock just one kind of cables. The numbers should start from 1 in every multi-core cable (made from corrugated tube) and can be aligned to numbers that are frequently printed on connector sockets etc.. There are "control cables (flexible)" which provide this functionality,<sup>36</sup> but are not FLY / FLRY standardized.

### *corrugated tube standard*

10 mm nominal width (that is, inner width) for all "normal" purposes. This seems to be the largest "small width" in use. Where needed, larger tube can be used.

### *generator*

Add.

### *batteries*

2 batteries, 12V each

1<sup>st</sup> battery: BMW. Open circuit voltage after 12 continuous months not in use, stored outside: 11.75V.

2<sup>nd</sup> battery: APS. Open circuit voltage after 12 continuous months not in use, stored outside: 12.53V.

Add capacity (Ah), type.

### *feed socket ("Einspeisedose", "Einspeisesteckdose", "Ladesteckdose")*

Socket for plug-in connector with retainer nut, DIN 14960.<sup>37</sup> This is the first generation of feed sockets in German emergency vehicles.<sup>38</sup> The socket is rated 12/24V, 16A max. (384W at 24V), and has to be used with a 2.5mm<sup>2</sup> wire.<sup>39</sup> Because of the low ampere rating, it is not usable for assist-starting; for that, the NATO plug ("NATO-Steckdose", "Schweinenase", normed by VG 96917) can be used, rated 300A. It is recommended to use one such feed socket per battery,<sup>38</sup> but in this vehicle, one is used, serially connected to both batteries.

## tail lamps

*mounting options* The space available within the mounts is width 350 mm, height 150 mm, depth 140mm, but backlights might exceed all three measures. The mounting holes are 150 mm apart (left side: 154 mm), located 103 mm from top edge, 10 mm in diameter. The inner hole is located 104 mm from the inner edge (left side) resp. 97 mm from the inner edge (right side).

*model* Hella tail lamps for Mercedes Actros and Axor and SK<sup>40</sup>, produced 2010-06. Hella item numbers: right: 2VP 007 500-46 (B), left: 2VD 007 500-45 (A). Mercedes Benz item numbers: right: 001 540 63 70; left: 001 540 62 70. New item price 92 EUR per each (2010-09). Measures over all: 139 mm x 525 mm x 80 mm (h x w x d). The exact part is not listed on hella.com (and no part with equivalent pin allocation was found), but close alternatives are there (search for site:www.hella.com "2VP 007 500" and see [http://www.hella.com/hella-de-de/assets/media\\_global/Truck\\_deutsch.pdf](http://www.hella.com/hella-de-de/assets/media_global/Truck_deutsch.pdf)).

<sup>36</sup> Source: <http://www.maggie-deutz.com/iv/index.php?showtopic=10583#entry89206>

<sup>37</sup> Source: <http://www.maggie-deutz.com/iv/index.php?showtopic=10347>

<sup>38</sup> Source of information: Cimolino, Ulrich et al.: "Einsatzpraxis", vol. "Fahrzeugtechnik: Fahrgestell, Auf- und Ausbau", 2005, pp. 146. Official website: [http://einsatzpraxis.org/de/home/buecher/einsatzfahrzeuge\\_-\\_technik.html](http://einsatzpraxis.org/de/home/buecher/einsatzfahrzeuge_-_technik.html). Relevant excerpt: <http://www.feuerwehr-forum.de/s.php?n=371162>.

<sup>39</sup> So according to <http://www.leab.de/zubehoer/steckersteckdosen/steckersteckdosendin14690.html>. Other sources say only 15A.

<sup>40</sup> Source: Micha. The Mercedes Benz SK is the model preceding the Actros. See [http://en.wikipedia.org/wiki/Mercedes-Benz\\_SK](http://en.wikipedia.org/wiki/Mercedes-Benz_SK).

**mounting requirements** The current tail lamps have each two M8 bolts each, mounted 200 mm apart.

**connector** The tail lamps came with a Tyco Electronics part no 1718231-1 socket.<sup>41</sup> According to the Tyco Electronics product line information,<sup>42</sup> this part "meets requirements of DIN 72585". So one can use any 7 pin plug that conforms to DIN 72585 ("DIN Bajonett"), now called ISO 15170. This norm is used by all major truck manufacturers.<sup>43</sup> It is available in 1, 2, 4, 6 and 7 pin variants. Manufacturers include ITT Cannon,<sup>44</sup> AMP / Tyco Electronics<sup>45</sup>, Schlemmer.

**pin allocation** Pin allocation from DIN 72585 connector pins to cable color inside to function:

Add a drawing of the DIN 72585 socket to not need to read the pin numbers in the socket.

- right tail lamp
  - pin 1 – brown - mass
  - pin 2 – green – back light and contour light and side marking light
  - pin 3 – black – reversing light
  - pin 4 – red – blink light
  - pin 5 – yellow – brake light
  - pin 6 - n/a
  - pin 7 - n/a
- left tail lamp
  - pin 1 - brown – mass
  - pin 2 - green – back light, contour light, side marking light
  - pin 3 - black – reversing light
  - pin 4 - red – blink light
  - pin 5 - yellow – brake light
  - pin 6 - white – rear fog-light
  - pin 7 - green - number plate light

**bulbs** Only lamps of types R10W and P21W are used:

- R10W: 10 Watt lamp, here in 24 V variant (there are 12 V variants as well). This lamp has a BA15s base (bayonet holder, single contact, 15 mm diameter).
- P21W: 21 Watt lamp, here in 24 V variant (there are 12 V variants as well). This lamp also has a BA15 base (bayonet holder, 15 mm diameter).

Total amount of bulbs per tail lamp function:

- number plate light: 1x R10W
- contour light: 2x R10W
- back light: 2x R10W
- blink light: 2x P21W
- brake light: 2x P21W
- reversing light: 2x P21W
- rear fog light: 1x P21W

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<sup>41</sup> Called a "1,5MM PIN HSG 5-7 POS" (pin housing with 1.5mm pins). See <http://www.tycoelectronics.com/catalog/pn/en/1718231-1?RQPN=1718231-1>. The closes alternative with description is 1718230-1, looking identical: <http://www.tycoelectronics.com/catalog/products/en?q=1718230-1>.

<sup>42</sup> Document "1.5/2.5/4.0mm Pin Diameter Connector System Product Line Information" on <http://www.tycoelectronics.com/catalog/cinf/en/c/11555/1369?PID=373865&RQS=C~1^M~BYPN^TCPN~1718230-1^RQPN~1718230-1>.

<sup>43</sup> Source: <http://accem.at/pdf/verlaengerungen.pdf>, p. 1

<sup>44</sup> product palette: <http://www.ascome.com/ITT/APD-Cat-26.pdf>

<sup>45</sup> product palette: <http://www.tycoelectronics.com/catalog/cinf/en/c/11555/1369>  
all 1.5 mm system products: <http://www.tycoelectronics.com/catalog/bin/TE.Connect?C=11555&M=FEAT&P=48920&U=&BML=&LG=1>



## usage data

*mileage* 31019km (upon me buying it)

*fuel consumption*

Add.

For a Magirus 100 D7 FA (same vehicle), 17l/100km are reported for overland street driving, with street tires (single).<sup>46</sup>

*tax*

- as truck, approx. 430-500 EUR/a, depending on permissible overall mass (here: 6.4t to 7.4t)
- as motorhome, approx. 350-440 EUR/a, depending on permissible overall mass (here: 6.4t to 7.4t)

*insurance*

Add costs.

*HU*

Add costs.

AU<sup>47</sup> Vehicle needs no AU<sup>48</sup>

## tools and accessory

*tire-inflation hose*

*battery charger*

Suggestion: fritec Ladeprofi XXL, 24V, 10A, DIN 14960 feed plug, 3kg, order no. BV 11910-24, ca. 250 EUR. This is also able to recover sulphated ("defective") batteries. In contrast to alternatives, this is quite lightweight and feature-rich.

A 24V charger can be used for the 2x12V batteries, as the vehicle itself charges also with 24V, and there is only one (24V) feed socket for charging. However, to be able to use the charger's desulphatation function, and to also be able to use the charger for 12V car batteries, the charger should be 12V, or combines 12V/24V.

## manuals

*freely available electronic documents*

- technical documents for a KHD Magirus 120 D 10 AL (has F6L engine, but is not a cab-over engine truck) as PDF files: <http://www.bioenergetik-pur.de/magirus/2894.html>

## 7 Body parts documentation

This section contains data about all the single parts of the body. Not all available data is included, but mostly the data that is relevant for getting spare parts, calculating measures for parts to build etc..

This documents the empty box body with fixed accessoires. Its "contents" (tools, utilities, furniture etc.) is documented by the system equipment A-3 (specs) resp. its implementation docs.

The format is that already used in chapter "Vehicle parts database".

<sup>46</sup> user Krücke of [allrad-lkw-gemeinschaft.de](http://www.allrad-lkw-gemeinschaft.de) in <http://www.allrad-lkw-gemeinschaft.de/phpBB2/viewtopic.php?p=119358#119351>

<sup>47</sup> German *Abgasuntersuchung*

<sup>48</sup> <http://www.allrad-lkw-gemeinschaft.de/phpBB2/viewtopic.php?t=12104>

- box body: outer measure: 4215 x 2410 x 2213 mm (LxBxH, without subframe)
- Add outer height with subframe.
- box body: inner measure: In the morning, there are 4mm space above my head at the lowest place in the room (i.e. in the middle); I wore woolen stockings and hat the feet flat on the floor and my head slightly bown behind (as this increases body size again somewhat).
- subframe
  - height, overall: 130mm
  - tread profile, one frame element: Z-tread
  - width, one longitudinal frame element: 124mm
  - width, subframe, between vertical sides of longitudinal frame elements: 850mm (original condition)
- rear wall: 4x2,5m rechtwinkliges Profil 75x90mm (Innenlänge der Schenkel)
- rear wall opening
  - 219 breit innen
  - 188,2 hoch innen
  - 11 ringsum Wandstärken
- Ansatzmaß der Kühlhausplatte wegen Heckklappe 92,5cm Höhe 139,5cm Breite möglich (ab Innenmaß)
- Getriebeausschnitt im Koffer geht bis 620mm von der Vorderwand außen an
- Kofferschürze endet 102mm unter (oberem) Hilfsrahmenniveau
- Vorderwand Koffer stehtmax. 12mm vor den am Rahmen befestigten Winkeln vor (gemessen bis zu den am weitesten vorstehenden Profilen der Vorderwand). Diese Winkel stehen 28mm vor dem vorderen Ende der Rahmenträger vor.
- Rückwand Koffer (Fläche) endet 53mm nach Mitte letztes Loch des Querträgers

## key cylinders for door and flaps

*back flap* Key number of the original cylinders' key of the back flap: 3910.

*current* ZADI key cylinders for Vespa and Piaggio scooters, cif.it Article 6210-5 "Security Lock (5 cylinders + 2 keys), Vespa PK - PK XL - PX ARCOBALENO"

*specs* The door (Dometic Seitz CaraD Rplus) needs a key cylinder with 35mm installation depth (30mm excluding the non-cylindric nosing at the end). The cylinder must be 17mm in diameter at the front part (hole is 17,5mm) and 13mm at the main cylindric part. This seems to be the Zadi system for campervan doors (the door can be prepared to take either Oberholz, West-Alloy or Zadi).

The back hatch has a hole with width 20mm at the front part, the original cylinder was 16mm in diameter at the front part.

*compatible* STS system key cylinders are compatible with the ZADI system<sup>49</sup>. A similar ZADI key cylinder is used in (and advertised for) scooters and small motorbikes (at least for all Piaggio and Vespa scooters). It is way cheaper. It differs only in the profile of the tail part, but not the sizes, and can be used if the lock can be adapted. The current model comes from this system.

*hint* It seems to be impossible to get ZADI key cylinders for ZADI keys you already have (except perhaps from the manufacturer), so when building the locking system, better get some spare key cylinders for later use.

### *potential sources*

- offer: ZADI key cylinder and additional keys (<http://mcvan.de/artikel.php?kat=2&unterkat=29>) (an eBay auction for this cylinder said it's ZADI; measures of this key cylinder are given per drawing)

<sup>49</sup><http://www.campingplus.de/wbcdirect.php?produktid=214055>

- offer: ZADI key cylinder, <http://www.carafun.eu/artikeldet.php?proid=2958>
- offer: ZADI key cylinder [http://www.campingshop-plus.de/query.php?cp\\_sid=1722152f23d7b&cp\\_dls=wbsfProdukte.tag&cp\\_dlt=5504\\_14&cp\\_pid=5493&cp\\_cat=14&cp\\_tpl=main](http://www.campingshop-plus.de/query.php?cp_sid=1722152f23d7b&cp_dls=wbsfProdukte.tag&cp_dlt=5504_14&cp_pid=5493&cp_cat=14&cp_tpl=main)
- offer: ZADI system (<http://www.frankana.de/navigate.do?kgrpld=7001>)
- offers: <http://www.frankana.de/navigate.do?kgrpld=4311>
- offers: catalog page from reimo.com ([http://www.reimo.com/r31/vc\\_content/daten/firma69/www/pdf\\_import/zubehoerprofi/zbh\\_0286.pdf](http://www.reimo.com/r31/vc_content/daten/firma69/www/pdf_import/zubehoerprofi/zbh_0286.pdf))
- offers: search for "Schließzylinder" on <http://www.fritz-berger.de>
- offers: search for "Schließzylinder" on <http://www.reimo.com> ([http://www.reimo.com/cgi-bin/r31msvcshop\\_anzeige.pl?var\\_hauptpfad=...%2Fr31%2Fvc\\_reimo%2F&var\\_fa1\\_select=var\\_fa1\\_select%7C%7C16%7C&var\\_html\\_folgemaske=r31msvcshop\\_anzeige.html&var\\_suchbegriff=Schlie%DFzylinder&x=0&y=0](http://www.reimo.com/cgi-bin/r31msvcshop_anzeige.pl?var_hauptpfad=...%2Fr31%2Fvc_reimo%2F&var_fa1_select=var_fa1_select%7C%7C16%7C&var_html_folgemaske=r31msvcshop_anzeige.html&var_suchbegriff=Schlie%DFzylinder&x=0&y=0))

## door hinges

*current* Suer "Türscharnier, mit Metaloplast-Buchsen, Gewicht 0,43kg, Nirosta", ArtNo 108071538 (catalogue 1/2008 p. 331)

## frame mounting brackets / supports<sup>50</sup>

*original* 5mm strong

*specs* 6 pieces, for welding to the subframe. The counterpart on the truck frame has a 17mm hole (for M 16 screw), with the center being 35mm away from the side of the frame. So these mounting brackets must share these values.

*current* Suer "Konsole", ArtNo 125141103 (6mm strong, catalogue 1/2008 p. 431)

## screws to mount the box body on the subframe

*original* 14 hex bolts M12x70, steel 8.8, using pre-mounted nuts in the wooden inner frame of the floor

*specs* Carriage bolts need to be at least 124mm long (105mm floor thickness + 4mm subframe thickness + 2,5mm washer thickness + 2,5mm snap ring thickness + 10mm nut thickness). Carriage bolts need to have thread from at least 114 mm on.

*current* 14 carriage bolts DIN 603, stainless steel A2, M 12X130, with washers, snap rings and nuts. Stainless steel A2 has a strength value of 700Nm/mm<sup>2</sup> (if not indicated otherwise), i.e. nearly comparable to steel 8.8 (800Nm/mm<sup>2</sup>).

*hint* One could use hex bolts, lowered into the floor, covered with a welded piece of aluminium. One would use big washers for wood constructions ("R 13.5") then. One should not use stainless steel A4, as it can be five times more expensive, and offers just more corrosion resistance (that's not needed here).

## screws for improvised mounting the subframe on the main frame

*specs* length must be at least 46,5mm (2x2,5mm washer thickness, 10mm nut thickness, 10mm gap between brackets, 6,5mm bracket strength on the truck, 5mm bracket strength on the box body, 10mm addition)

*proposed* 6 hex bolts DIN 933, thread to the head, M 16 x 50, steel 10.9, zinc-coated, with washers DIN 125 A 17 and nuts M 16 steel 10

## windows

*spec* This box body has the following internal standard: the manufacturer may be chosen freely for each window, but the upper corners should be sharp and the lower corners should be rounded. This is a relatively common shape.

### *current*

- small windows: 2 each, out of a Wilk-Caravan (model Safari 510 TL), model: Planet PPB-X D 553, outer size 63,5 x 31cm
- large window: model: Langlotz SG / D 467, outer size: 77 x 55,5 cm, inner size: 53,5 x 75 cm, depth (inner side to rubber): 2,5 cm

## door

### *specs*

Insert dimensions of the door frame.

*current* Manufacturer: Dometic Seitz<sup>51</sup>. Model: CaraD-Rplus, right-hand version (hinges on right side, as seen from outside).

- product number: 77215
- manufactured according to M1 (norm for motorhomes, not caravans)
- detail page: <http://www.dometic.com/enuk/Europe/United-Kingdom/Caravan/Doors/product/?productdataid=77215>
- reimo.com detail page: [http://www.reimo.com/de/350231-eingangstuer\\_mit\\_schwenkfenster/](http://www.reimo.com/de/350231-eingangstuer_mit_schwenkfenster/)
- German listing: <http://www.dometic.com/de/Europe/Germany/Service-Center/Search/?pcid=64>
- cut-out dimensions: 194,2 x 58,0 cm
- sold for 1439 EUR at reimo.com ([http://www.reimo.com/r31/vc\\_content/daten/firma69/www/pdf\\_import/zubehoerprofi/zbh\\_0285.pdf](http://www.reimo.com/r31/vc_content/daten/firma69/www/pdf_import/zubehoerprofi/zbh_0285.pdf))
- fitting mounting kit: [http://www.reimo.com/de/M35025-montagesatz\\_35023\\_350231/](http://www.reimo.com/de/M35025-montagesatz_35023_350231/)

## door bolt locking tread

*specs* The door (Dometic Seitz CaraD Rplus) bolt's diameter is 10mm at the thin and 15mm at the thick (end) part. In the fastening process, it moves 8mm vertically, and during that vertical movement phase, 9mm horizontally.

*current* self-made model

## subframe

*width*<sup>52</sup> 770mm (originally 860mm)

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<sup>51</sup> Dometic GmbH - In der Steinwiese 16 - D-57074 Siegen - Tel +49 (0) 271 692-0 - info@dometic.de

<sup>52</sup> Measured from sidewall to sidewall (their strength inclusive), not from edge to edge. This is a difference, as the subframe is made from Z-tread.

## 8 FAQ

### 8.1 Operating a truck

#### What mandatory accessory has to be on a truck in the European Union?

Data version: valid as of 2010-09.

1. breakdown triangle (de: "Warndreieck")<sup>53</sup>
2. warning blinklight (de: "Warnleuchte", "Warnblinkleuchte"), mobile, with orange flashlight<sup>54</sup>
3. warning vest (de: "Warnweste")
4. first aid kit

Add [http://www.lkwrecht.de/Verhalten\\_im\\_Strassenverkehr/LKW\\_Maengel\\_Abfahrtskontrolle\\_Praktische\\_Tipps](http://www.lkwrecht.de/Verhalten_im_Strassenverkehr/LKW_Maengel_Abfahrtskontrolle_Praktische_Tipps) at "LKW Fahrzeugausrüstung". this.sources:

#### What warning blinklight that is licenced in Europe can be recommended?

There are models with normal light bulbs, and newer models with LEDs. Here, only the LED models are considered, as LEDs are more reliable. Also, there are models that depend on the car electrical system, and those that do not. Trucks heavier than 3.5 t admissible overall mass need one that does not depend on the car electrical system,<sup>55</sup> so we do only consider these here.

As a general rule, all lamps using 5 D-cell batteries are not LED models.

Overview of (probably all of) the available models as of 2010-09, the most recommendable first:

- LEINA LED-Warnblinkleuchte, <http://www.leina-werke.de/produkte/d-33-139-6.html#p259>. Approx. 20 EUR. This is the smallest licenced warning blinklight as of 2010-09 (licence: §53 Abs. 1 StVZO TA Nr, 19, licence K 452). It has intrusion protection IP54. It got recommended in <http://www.sondersignalanlagen.com/showthread.php?t=10597>.
- ULO LED-Warnleuchte. Information: <http://www.sondersignalanlagen.com/showpost.php?p=121400&postcount=2>, for sale: [http://www.campingshopwagner.de/product\\_info.php?info=p11195](http://www.campingshopwagner.de/product_info.php?info=p11195). Approx. 30 EUR. This seems to be a lamp used in MAN trucks,<sup>56</sup> so it probably has a licence as "Warnleuchte according to §53a StVZO".
- Eflare LED-EF510 Profi-Blitzleuchte. [http://www.helpi-shop.de/start.php?d\\_75990.php](http://www.helpi-shop.de/start.php?d_75990.php). Approx. 60-150 EUR depending on model. A professional product (technically the best here). Also, there is much accessory available.<sup>57</sup> However, it seems that it does not yet have the licence as "Warnleuchte according to §53a StVZO": it was developed together with the Australian police, and there are hints that a StVZO licencing is not yet granted (but applied for).<sup>58</sup>

<sup>53</sup> Source: StVZO §53a (2) 2, [http://www.verkehrsportal.de/stvzo/stvzo\\_53a.php](http://www.verkehrsportal.de/stvzo/stvzo_53a.php)

<sup>54</sup> Source: StVZO §53a (2) 2, [http://www.verkehrsportal.de/stvzo/stvzo\\_53a.php](http://www.verkehrsportal.de/stvzo/stvzo_53a.php)

<sup>55</sup> Source: StVZO §53a (2) 2, [http://www.verkehrsportal.de/stvzo/stvzo\\_53a.php](http://www.verkehrsportal.de/stvzo/stvzo_53a.php)

<sup>56</sup> Source: <http://www.sondersignalanlagen.com/showpost.php?p=121400&postcount=2>

<sup>57</sup> Source: <http://www.waseg.ch/pdf/polizei.pdf>, pp. 4-5. And see offers in <http://www.gfd-katalog.de/>.

<sup>58</sup> Source: "Zulassung StVZO anhängig. Explosionsgeschützt, ATEX anhängig." on [http://www.sd-pro2ls.de/shop/index.html?d\\_DPEF510\\_LED\\_Profi\\_Blitzleuchte51731.htm](http://www.sd-pro2ls.de/shop/index.html?d_DPEF510_LED_Profi_Blitzleuchte51731.htm). So also on <http://www.fachausstatter.de/57.0.html>. However, on <http://www.gfd-katalog.de/> they say "ATEX-Zulassung beantragt, StVZO-Zulassung" in the eFlare lamp article pages.

- Energizer Wanrblinkleuchte LED. See [http://www.amazon.de/dp/B001641MII/ref=asc\\_df\\_B001641MII923677](http://www.amazon.de/dp/B001641MII/ref=asc_df_B001641MII923677). It is however not obvious that this is licenced as as "Warnleuchte according to §53a StVZO" (it probably is not).

Good searches:

- LED Lkw (warnleuchte or warnblinkleuchte)

### Where to get help for 4x4 truck, Magirus and expedition topics?

- <http://allrad-lkw-gemeinschaft.de>. Largest German 4x4 truck community.
- <http://www.maggie-deutz.com>: predecessor of allrad-lkw-gemeinschaft.de, still available as archive. The most valuable entry points:
  - See this index of truck electric related threads: <http://www.allrad-lkw-gemeinschaft.de/phpBB2/viewtopic.php?t=138>
- <http://www.expeditionportal.com/> (English, mainly about off-road cars)
- <http://www.offroad-forum.de> (German, mainly about off-road cars)
- <http://www.deutzforum.de> (German, mainly about Deutz tractors and KHD engines that are also used in Magirus trucks)

### How to maximize the mileage of truck tires?

Here's a table indicating what mileage a tire will reach dependent on if it's inflated correctly or not:

Tire inflation	100%	80%	71%	64%	56%	45%
Tire mileage	normal	70%	50%	39%	32%	25%

The correct inflation depends on the load: the higher the load, the more pressure you need to carry it. The nominal minimum inflation always refers to the maximum load per tire. If your load is lower, decrease the air pressure in proportion to that. Example: you have an axle load of 3630kg on the front axle, that's 1815kg per tire. The manufacturer says: 6.9bar air pressure, meaning, at the tires max. load of 2000kg. So you need:  $6.9\text{bar}/2000\text{kg} * 1815 = 6.26\text{bar}$ .

So this is a reason to know your load per axle when the vehicle has its combat weight. Determine it by weighing per axle.

A tire that is driven at 80% of the correct inflation reaches only 70% of its normal mileage,

Source: [http://www.lesschwab.com/tires/truck/truck\\_tire\\_brochure.pdf](http://www.lesschwab.com/tires/truck/truck_tire_brochure.pdf), page 6, right lower corner.

### How to get around temperature-induced oil changes?

Use multigrade oils. Like SAE 15W / 40, which can be used from -13°C to 50°C ambient air temperature. The oil change intervals are the same with multigrade oils.

Source: Betriebsanleitung Iveco Magirus 130 D 9 FA Fahrgestell MKW, page 14-3.

### How to mix my own cleaning agent for the windscreen washer system?

Use water, cleaner, and in the winter time, 25% denaturated alcohol<sup>59</sup> (which gives freeze proofness till -12°C).

Source: Betriebsanleitung Iveco Magirus 130 D 9 FA Fahrgestell MKW, page 04-4.

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<sup>59</sup>Which probably should mean that both are applied for.  
<sup>59</sup> methylated spirit, German *Brennspiritus*.

## How to maximize the life span of car batteries?

The most common cause of death for lead batteries is "sulphatation" of the lead plates. This starts when the battery is in deep discharged condition for some days. Deep discharge means probably an open circuit voltage of 7V or less per 12V/24V battery.<sup>60</sup> To avoid this condition, it is a good idea to keep the battery regularly (or permanently) connected to maintenance charging from a battery charger, photovoltaic system or the like.

Sulphatation can sometimes be reversed with special chargers which run several de-sulphating loops with voltages that are higher than charge voltages (28V instead of 14.4V for 12V batteries, 33V instead of 28.8V for a 24V battery).<sup>61</sup> Perhaps some chemical or mechanical process is possible also to repair sulphated lead batteries.

How-to information with ingenious ideas for little repairs and improvements, like, what agent to use for cleaning what part etc..

Add a link collection regarding help for maintaining Magirus vehicles.

Add a world-wide tip list with individuals and companies who are capable of repairing this vehicle.

Add a world wide tip-list with good sources of getting spare parts, tires, parts for modifications etc..

## 8.2 Maintaining this expedition vehicle

### Where to get manuals for this vehicle?

- You might get a digital workshop manual for the Magirus 170 D 11 via: <http://www.allrad-lkw-gemeinschaft.de/phpBB2/viewtopic.php?t=22936>.
- There are manuals for hood trucks (Magirus D9-D12(A)) on <http://www.dieseltreter.de/handbuch/>.
- There are offers on eBay from time to time.
- There are many manuals on <http://www.alte-laster-listen.de>, but quite expensive.
- There are sometimes manuals on <http://agrimanuals.com/>.
- Some more documents might be available via <http://www.allrad-lkw-gemeinschaft.de/phpBB2/viewtopic.php?p=105424#105424>. There is no RapidShare link anymore, but getting it as a "private copy" is possible, and legal in Germany.

## 8.3 Modifying this expedition vehicle

How-to information for performed and planned modifications (single tires, ...), as this information cannot be found in the vehicle's manuals; this is also to collect relevant information in the planning stages.

Add a link collection regarding general information on building expedition vehicles.

### What offroad tires can I use, and how to mount them?

If using offroad tires, people suggest for MD 130 D11 FA the following sizes: 12.00 R

<sup>60</sup> Source:

[http://www.fritec.de/site\\_de/prod\\_batterie/anleitungen/fritec\\_Ladeprofis\\_BV11910-12.pdf](http://www.fritec.de/site_de/prod_batterie/anleitungen/fritec_Ladeprofis_BV11910-12.pdf), section "Funktionsbeschreibung".

<sup>61</sup> Sources: fritec Ladeprofis XL / XXL manual

([http://www.fritec.de/site\\_de/prod\\_batterie/anleitungen/fritec\\_Ladeprofis\\_BV11910-12.pdf](http://www.fritec.de/site_de/prod_batterie/anleitungen/fritec_Ladeprofis_BV11910-12.pdf)) and website ([http://www.fritec.de/site\\_de/index.php?page=http://www.fritec.de/site\\_de/prod\\_batterie/ladeprofis\\_xl.php](http://www.fritec.de/site_de/index.php?page=http://www.fritec.de/site_de/prod_batterie/ladeprofis_xl.php)).

20 or 14.5 R 20<sup>62</sup>. The radius of a 14.5 R 20 tire is 130mm larger than that of the originally mounted 8.25 R 20 tire (calculation:  $(14.5-8.25) * 25.4 * 82\% = 130\text{mm}$ ). So one needs to check if there's enough space for that.

A tip for tires is: Continental MIL (i.e. probably military profile) 14.00 R 20. Used for approx. 100 EUR a tire.

### **What's the matter with the different European approval signs on vehicle parts?**

For an overview, see [http://home.arcor.de/vwchris/service-info\\_zulassungskennzeichen.htm](http://home.arcor.de/vwchris/service-info_zulassungskennzeichen.htm). In short, all parts with circled "E" plus a number or squared "e" plus a number are European approval signs. They do not need an added national approval, and do not need being entered into the registration certificate.

### **What regulations have to be met about vehicle lighting?**

For a great overview of the regulations (in 2003), see:

[http://www.michael-flammer.de/mf\\_schimmel/Lichttechnik.pdf](http://www.michael-flammer.de/mf_schimmel/Lichttechnik.pdf)

In Germany, the full regulations are contained in the StVZO:

<http://www.gesetze-im-internet.de/stvzo/>

From these sources, the following applies to this vehicle:

- The vehicle is longer than 6m, so it needs orange side reflectors.
- The vehicle is longer than 6m but was first licensed before 1994, so it does not need orange side marker lights.

### **What's the meaning of the different bayonet lamp holder base standards?**

- BA15s: bayonet holder with a single contact at the tip, 15 mm bulb base diameter, bayonet pins 180° apart
- BAU15s: bayonet holder with a single contact at the tip, 15 mm bulb base diameter, bayonet pins 150° apart ("indexed")
- BAY15d: bayonet holder with a dual contact at the tip (bright and dim light), 15 mm bulb base diameter, bayonet pins 180° apart
- BAZ15d: bayonet holder with a dual contact at the tip (bright and dim light), 15 mm bulb base diameter, bayonet pins 150° apart ("indexed", to prevent confusing bright and dim light)
- BA9s: bayonet holder with single contact at the tip, 9 mm bulb base diameter, bayonet pins 180° apart
- BAX9s: bayonet holder with single contact at the tip, 9 mm bulb base diameter, bayonet pins 150° apart

Source incl. drawings: <http://autolumination.com>

### **How to calculate what cable cross section to use for what application?**

The ampere rating of isolated cables is regulated in DIN 57100 part 523 resp. VDE 0100 part 523.6-81. The results are shown in a table on <http://www.njumaen.de/t4tt/pdf/kabelquerschnitte.pdf>.

In addition, one should use an even larger cross section if the voltage drop is else too big. To calculate that:

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<sup>62</sup> <http://www.allrad-lkw-gemeinschaft.de/phpBB2/viewtopic.php?p=26798>



$$A = \frac{0.018 \Omega \text{ mm}^2 \text{ m}^{-1} \cdot L \cdot I}{\Delta U} \quad \text{with} \quad [A] = \text{mm}^2$$

Where:

- $A$  is the cross section recommended because of acceptable voltage drop.
- $I$  is the electrical current, to be obtained from the
- $L$  is the length of the cable. One has to use the double length of the cable, as the electric current needs to go back also (normally via mass), where also some voltage drop occurs.
- $\Delta U$  is the acceptable voltage drop. It should be 0.25V for battery load cables, and 0.8V for all normal applications. (Or even more, as these values probably apply to 12 V).

How to arrive at this formula: we start from the resistance of a cable, which is:

$$R_c = \frac{\rho \cdot L}{A} \Leftrightarrow A = \frac{\rho \cdot L}{R_c}$$

Now we insert  $R_c = \frac{U_c}{I_c} = \Delta \frac{U}{I}$  and get:

$$\Rightarrow A = \frac{\rho \cdot L \cdot I}{\Delta U}$$

Here,  $\rho$  is the electrical resistivity, which is for copper  $\rho_{Cu} = 1.678 \cdot 10^{-8} \Omega \text{ m} = 16.78 \cdot 10^{-3} \Omega \text{ mm}^2 \text{ m}^{-1}$ . This applies to standard conditions, whereas in the formula above a resistivity value for 30°C was used.

Sources:

<http://www.schaltungsbuch.de/norm054.html>

<http://www.allrad-lkw-gemeinschaft.de/phpBB2/viewtopic.php?t=2346>

<http://www.yachtbatterie.de/cgi-bin/forms/querschnitt.pl>

[http://de.wikipedia.org/wiki/Spezifischer\\_Widerstand](http://de.wikipedia.org/wiki/Spezifischer_Widerstand)

[http://en.wikipedia.org/wiki/Voltage\\_drop](http://en.wikipedia.org/wiki/Voltage_drop)

### Where can I find necessary electrical formulae?

Moeller Schaltungsbuch: <http://www.schaltungsbuch.de/norm050.html>

[http://de.wikibooks.org/wiki/Formelsammlung\\_Elektrotechnik:\\_Grundlagen\\_Elektrotechnik](http://de.wikibooks.org/wiki/Formelsammlung_Elektrotechnik:_Grundlagen_Elektrotechnik)

### What cables have to be used for electrical installations in cars?

There is a standard designed for chemically aggressive, high-temperature environments like cars and similar purposes: FLY and FLRY (reduced insulation thickness) cables according to that is ISO 6722 (that is also DIN/ISO 6722).

FLY cables have normal wall thickness, FLRY cables have reduced wall thickness. ISO 6722 standard refers to eight temperature classes (A to H). In addition, there are two cable types (FLY-A and FLY-B resp. FLRY-A and FLRY-B) on sale, which refer to the conductor make-up from its single wires (symmetrical for type A with concentric rings of wires (also called FLK-R), unsymmetrical for type B (also called FLK-D)).<sup>63</sup>

<sup>63</sup> Source: <http://www.hitechcontrols.com/cables/vehicle-cables/vehicle-cables/vehicle-cable-flry.html>

The ISO standard document ISO6722:2006(E) is available from:

[http://www.iso.org/iso/catalogue\\_detail.htm?csnumber=39709](http://www.iso.org/iso/catalogue_detail.htm?csnumber=39709)

<http://sns.cio360.net/filesare/index.php?op=Download&FileID=28465> (PDF)

It also details the requirements for outer diameters. A quick overview:

- single core FLRY 1 mm<sup>2</sup>: 2.1mm max. outer diameter
- single core FLY 1 mm<sup>2</sup>: 2.7 mm max. outer diameter
- single core FLRY 1.5 mm<sup>2</sup>: 2.4 mm max. outer diameter
- single core FLY 1.5 mm<sup>2</sup>: 3.0 mm max. outer diameter

For more cable type identifiers, see:

[http://www.leoni.com/uploads/tx\\_downloadleoni/en\\_asc.pdf](http://www.leoni.com/uploads/tx_downloadleoni/en_asc.pdf)

### **How many cores fit into 10 mm corrugated tube?**

According to own tests, the following amount of single-core cables fit into corrugated tube of 10 mm nominal width so that the cables still move freely (without feeling resistance due to friction):

- 8 single-core cables of 2.55 mm diameter (forming a kind of symmetrical buildup with one core in the center and a ring of 7 cores around)
- 12 single-core cables of 2.25 mm diameter

This only applies when using tube couplings that are put around, not inside, the tube. Those that are put inside of it sometimes only have a light cross-section of near-rectangular 5.5 x 7.7 mm. There are however tube couplings around that are put around the tube, with screw caps.

### **What suppliers can be recommended for necessary general truck parts?**

The requirements here are: the supplier must allow shipment to private customers; there should not be a mean order value or addition for ordering small amounts.

- nuts and bolts:
  - Wegertseder GmbH, <http://www.wegertseder.com>
  - <http://www.inox-schrauben.de>
  - Company Manfred Machholz, <http://schraubenhandel24.de>
  - CM Großhandel, <http://schraubenbude.de>
- cables, cable connectors
  - Kalitec Industrievertretung, <http://www.kalishop.de>
  - AIS GmbH, <http://www.steckermarkt.de>
  - L&W Steckerladen GmbH, <http://www.steckerladen.de> (but they charge an addition for minimum orders)
- cables, connectors etc. specially for cars:
  - Kabel Schmidt: <http://www.kabel-schmidt.com/>
  - eBay Shop kfz-stecker, <http://stores.shop.ebay.de/kfz-stecker>, also at [kfzstecker.de](http://kfzstecker.de)
  - eBay Shop Welt der Kabel, <http://stores.ebay.de/Welt-der-Kabel>
  - eBay Shop Truck-Shop&KFZ Elektrik, <http://stores.ebay.de/Truck-Shop-KFZ-Elektrik>

- Autoteile Plauen, [http://www.autoteile-plauen.de/kfz\\_elektrik/](http://www.autoteile-plauen.de/kfz_elektrik/)
- LED illumination: revoArt, <http://www.leds24.com>
- electronics:
  - voelkner, <http://www.voelkner.de>
  - Conrad Electronics, <http://www.conrad.com>
- army stuff: parts for vehicles, transport boxes, tools etc.
  - <http://www.armeeteeile.de>

### What suppliers can be recommended for Magirus spare parts?

- Hermann Pils GmbH Teiledienst: [http://www.pils-zeven.de/index.php?option=com\\_content&view=article&id=53&Itemid=48](http://www.pils-zeven.de/index.php?option=com_content&view=article&id=53&Itemid=48)
- documents: Alte Laster-Listen, Reinhard Tauchert, <http://alte-laster-listen.de>
- JFW Historische LKW eK, <http://www.lkw-restauration.de/ersatzteile/ersatzteile.htm>
- there are approx. 50% standardized parts in Magirus trucks and their KHD engines,<sup>64</sup> so one can use parts from suppliers of standardized parts

### What suppliers can be recommended for repairing oldtimer truck parts?

- JFW Historische LKW eK, <http://www.lkw-restauration.de/instandsetzung/instandsetzung.htm>

### Whats the meaning of production series numbers of Magirus cabins?

The German term is "Baureihen-Nummer". It seems like this:

- Baureihe 5505: D-type cabin on Magirus D 7 – D 34. This is the "heavy truck" type D cabin, which can be recognized by the front lamps being in the bumper.
- Baureihe 5507: D-type cabin on Magirus D 6 – D 8. This is the "Eicher type" (light truck) D cabin, which can be recognized because the front lamps are in the radiator grille.<sup>65</sup>
- Baureihe 5511: MK-type cabin on Magirus M 06 – M 13. This is the cabin of the MK series ("Viererclub" vehicles).

### What is the standard for 24 V DC power supply?

This is standardized in the German National Norm DIN 19240. This standard requires a direct current with >21.5 V and <28.0 V.

There has to be a related standard for 12 V that requires < 13.8V.

### Are grease gun parts interoperable?

Most grease guns at least in Germany should have (some) interchangeable parts, as there are standards:

- DIN 1282 - Grease guns; push type-hand gun; German National Standard; 1990-11-01; 2 pages
- DIN 1283 - Grease guns; lever type-hand guns and accessories, German National Standard, 2990-11-01, 6 pages

<sup>64</sup> Source: <http://www.allrad-lkw-gemeinschaft.de/phpBB2/viewtopic.php?p=245411#245411>

<sup>65</sup> Source: [http://www.oldiveco.de/fz\\_profile/09\\_Eicher/fz\\_profil\\_09.htm](http://www.oldiveco.de/fz_profile/09_Eicher/fz_profil_09.htm)

- DIN 1284 - Grease guns; grease cartridges for lever type-hand gun; main dimensions; German National Standard; 1990-11-01, 2 pages

## 9 Shopping protocol

All things related to the expedition vehicle and its accessories that cause costs are recorded here. However, costs for the box body's interior are not included, as this equipment is removable and usable independent from the vehicle. (Technically speaking, this list includes the cost of the author's system equipment level A-4 minus costs for levels A-1 to A-3.) Tool costs are included if the tool was bought during the vehicle buildup process, even though it will get used for other purposes later on.

From this protocol, one can calculate maintenance, buildup costs, total cost of ownership etc.. Items are recorded at the date of purchase, not the date of payment. From the items and usage listed here, one can also infer the activities at that time.

Date	Items and usage	Price	Source
2008-02-15	freezer box body	350,00 EUR	company in Neuwied, Germany, via mobile.de
"	fuel for carrying the box body home	20,00 EUR	"
~2008-02-28	large caravan flap, ~1400x800mm	50,00 EUR	private contact
"	3 sheets of aluminium, 2500x500x2.5mm each, used	45,00 EUR	Ferrum Recycling, Gießen, Germany
2008-04-19	1 Langlotz caravan window, incl. shipment, ~700x500mm	61,50 EUR	ebay.de
2008-05-06	PUR insulation element 3550x1100x65mm, varnished flat steel metal on both sides, used	115,00 EUR	Bernhard Malm Umwelttechnik, 35423 Lich, Germany
~2008-05-10	3 cartridges Terolan, bright	36,00 EUR	Profi Parts, Gießen, Germany
"	100 carriage bolts, M8x80	14,00 EUR	Praktiker Baumarkt, Gießen
"	100 nuts, M8	4,00 EUR	"
"	5 cutting disks, 180x3mm	9,00 EUR	"
"	100 steel plain washers, M8	4,00 EUR	"
"	5m 40x40mm steel tread, zinc-coated	50,00 EUR	private contact
2008-05-11	1 caravan door Seitz CaraD-Rplus, incl. shipment	80,00 EUR	ebay.de
2008-05-27	2 Wilk caravan windows, incl. shipment, ~500x300mm	57,00 EUR	ebay.de
~2008-07-30	25 cutting disks, 125x1mm	42,00 EUR	Profi Parts, Gießen, Germany
"	2 truck door hinges, stainless steel	50,00 EUR	"

Date	Items and usage	Price	Source
"	3 cartridges Terolan bright	39,00 EUR	"
"	1 cartridge Sikaflex white	12,00 EUR	"
"	bending and cutting of aluminium sheets for window and wall treads	42,00 EUR	Stahlmöbelbau Ludolf, Lollar, Germany
2008-11-27	truck Magirus 100 D 9 FA	2000,00 EUR	via autoscout24.de
"	fuel for driving truck home	50,00 EUR	-
~2009-01-19	3 carriage bolts, 7x120mm, for mounting the door, zinc-coated	3,50 EUR	Praktiker Baumarkt, Gießen, Germany
2009-01-20	2 caravan window bars, incl. shipment	12,15 EUR	eBay.de
2009-01-22	Deutz Engine F3-6L 812 Operation Manual, English, incl. shipment	28,00 EUR	agrimanuals.com
2009-01-23	sheets: Magirus engines data and adjustments, German, incl. shipment	12,00 EUR	ebay.de
2009-01-24	workshop manual for engine F6L 812, digital version	13,49 EUR	www.normagfreund.ws24.cc
2009-02-01	5 ZADI Vespa / Piaggio scooter lock cylinders, 35x13mm, incl. shipment	28,00 EUR	rollershop.de
2009-02-07	1 brush, round, 30mm	2,87 EUR	Praktiker Baumarkt, Gießen, Germany
"	1 wrench and flange for angle grinder	4,23 EUR	"
"	1 cutting disk, aluminium, 125x1.6mm	1,99 EUR	"
"	4 cutting disks, steel, 125x1mm	7,62 EUR	"
"	1 cutting disk, steel, 180x3mm	1,99 EUR	"
"	1 roughing disk, 125x6mm	2,07 EUR	"
"	1 roughing disk, 180x6mm	2,55 EUR	"
2009-02-12	14 carriage bolts DIN 603, stainless steel A2, M 12X130	33,04 EUR	inox-schrauben.de
"	14 washers DIN 125, stainless steel A2, diameter 13,0	1,12 EUR	"
"	14 snap rings DIN 127, stainless steel A2, B 12	0,98 EUR	"
"	14 nuts DIN 934, stainless steel A2, M 12	2,52 EUR	"
"	shipping costs	6,00 EUR	"
2009-02-16	3 cans Teroson Terotex	28,20 EUR	Profi Parts, Gießen,

Date	Items and usage	Price	Source
	Record2000HS underbody coating, black, for spraying		Germany
"	6 frame support brackets (German <i>Konsolen</i> ), Suer catalog p. 431 ArtNo 125141103	16,60 EUR	"
"	express shipment for frame support brackets	15,51 EUR	"
2009-03-19	1 can universal dilution, 1l	3,99 EUR	Praktiker Baumarkt, Gießen, Germany
"	1 can Nigrin fiberglass filler, 250g	5,49 EUR	"
"	1 tube of Nigrin metal polish	3,49 EUR	"
"	1 energy cost meter, digital	11,24 EUR	"
"	1 first aid kit, for cars	13,99 EUR	"
"	1 can grease spray for motorbike chains, 400ml	9,99 EUR	"
"	1 can WD-40 oil spray	4,79 EUR	"
2009-03-20	1 first aid kit boxes, used, from German army, including shipment	7,49 EUR	eBay.de
"	1 chirurgical scissors, for first aid kit, including shipment	3,75 EUR	"
2009-03-22	6kg V4A stainless steel mixed stuff like screws,nuts, washers etc., all new, incl. shipment	32,40 EUR	"
"	50 pack stainless steel screws, nuts, washers etc. (special item), all new, incl. shipment	23,40 EUR	"
2009-03-25	1 tube Nigrin hardener for fiberglass filler, 30g	3,49 EUR	Real, Gießen, Germany
2009-03-31	1 pair of gloves, waterproof, size 8-8.5	2,49 EUR	"
2009-04-07	1 pair of gloves, waterproof, size 9-9.5	0,70 EUR	tegut, Gießen, Germany
2009-04-28	1 flood light bulb, Concentra 80W, E27 tread	9,99 EUR	Praktiker Baumarkt, Gießen, Germany
"	1 bulb, warmwhite light temperature, 40W, E27 tread	2,19 EUR	"
2009-05-02	1 triple socket with cord	2,49 EUR	Real, Gießen, Germany
2009-05-23	1 rotating brass plate brush, for power drill	4,79 EUR	Praktiker Baumarkt, Gießen, Germany
2009-07-07	8 cartridges sealing agent	58,78 EUR	Profi Parts, Gießen,

Date	Items and usage	Price	Source
	Sikaflex 221 white		Germany
2009-07-07	1 hand riveter	33,99 EUR	OBI, Gießen, Germany
2009-07-09	1 bottle PU mounting foam, 500ml	6,60 EUR	Drescher Eisenwaren, Lahnu, Germany
"	100 pcs. aluminium rivets, 5x30mm, small head	13,35 EUR	"
"	5 cutting disks, 125x1mm, for stainless steel	7,50 EUR	"
2009-07-10	7 cartridges sealing agent Sikaflex 221 white	51,43 EUR	Profi Parts, Gießen, Germany
"	5 cutting disks, 125x1.6mm, for aluminium	8,19 EUR	"
2009-07-15	2 drag shoes, used, from German Army, incl. shipment	21,50 EUR	Heiko Hansen (Blackbird Armystore), Reesendamm, Germany
2010-09-07	2 quasi-new Actros / Axor backlights, incl. shipment	70,00 EUR	eBay.de
2010-09-08	250 blind rivets, aluminium, flat head, 5x20mm	16,50 EUR	wegertseder.com
"	16 carriage bolts, DIN 603, M12x130, steel 8.8, zinc coated	53,22 EUR	"
"	50 washers, DIN 125 A, zinc coated, A13	5,80 EUR	"
"	50 nuts, DIN 982, with nylon inset, high variant, steel 8, zinc coated, M12	12,25 EUR	"
"	1 tool holder for thread cutters M5-M12	9,74 EUR	"
"	1 set of three thread cutters, M8x1.25	8,00 EUR	"
"	30 bolts ISO 7380, flat head, stainless steel A2-50, M8x35TX	9,91 EUR	"
2010-09-13	1 hard plastic sheet, beige, ca. 120 cm x 220 cm x 12.5 mm	8,00 EUR	Jugendwerkstatt Gießen - Bauteilbörse, Gießen, Germany
2010-09-17	2 cap 180° for corrugated tube 10 mm, AMP art no. 0-0965786-1	1,38 EUR	kalishop.de
"	20 single core sealing for AMP ISO 15170 plug, 1.0-2.5 mm <sup>2</sup> , white, AMP art no 0-00828905-1	1,40 EUR	"
"	20 plug contact for AMP ISO 15170 plug, 1.5 mm system, for 1.0-2.5 mm <sup>2</sup> , AMP art no 0-0962999-1	4,00 EUR	"

Date	Items and usage	Price	Source
"	2 AMP ISO 15170 connector socket, 7 pin type, AMP art no 0-0967650-1	5,10 EUR	"
"	2 cap 90°, flexible cable mounting, AMP art no 0-0965576-1	1,10 EUR	"
"	shipment costs	6,90 EUR	"
2010-09-20	10 m corrugated tube, black, nominal width 10 mm, incl. shipment	17,90 EUR	eBay Germany
2010-09-21	1 bolt with bolt loop ("Grendelriegel"; for door's window), stainless steel, Vormann article no. 091948000, EAN 4003984510158, incl. shipment	3,49 EUR	eBay Germany
2010-09-23	"	3,49 EUR	eBay Germany
2010-09-27	spare parts list Magirus cabin, production series 5005, incl. shipment costs	19,30 EUR	Reinhard Tauchert, alterlaster-listen.de, Germany
2010-09-21	8 mounting clip for tubes, nominal width 10 mm, Schlemmer part no. 9805407, à 1.75 EUR	14,00 EUR	Handel & Forstservice Stefan Wensauer, eBay shop kfz-stecker
"	2 replacement ignition key for oldtimer trucks, 5mm diameter, Hella part no. 150 0293, à 9.96 EUR	19,92 EUR	"
"	FLRY cable, 1.5mm <sup>2</sup> , 10m, green	5,48 EUR	"
"	FLRY cable, 1.5mm <sup>2</sup> , 10m, yellow	5,48 EUR	"
"	FLRY cable, 1.5mm <sup>2</sup> , 10m, brown	5,48 EUR	"
"	FLRY cable, 1.5mm <sup>2</sup> , 10m, black	5,48 EUR	"
"	FLRY cable, 1.5mm <sup>2</sup> , 10m, white	5,48 EUR	"
"	FLRY cable, 1.5mm <sup>2</sup> , 10m, red	5,48 EUR	"
"	shipment costs	4,51 EUR	"
2010-09-27	2 pouches for tire inflation hoses, from German Bundeswehr, incl. shipment	15,80 EUR	eBay Germany, shop Landei-Laden (landei-laden.de)
2010-10-03	1 FLACO grease gun, hand operated, used, from Deutsche Bundeswehr, incl. shipment	26,94 EUR	eBay



Date	Items and usage	Price	Source
2010-09-21	LED warning blink light, LEINA art no. 290021, incl. shipment (twice due to DHL error)	33,80 EUR	eBay
2010-10-09	1 stainless steel drill, 5.0 mm	3,99 EUR	OBI, Gießen, Germany
"	2 batteries D-cell, for warning blink light	6,49 EUR	"
"	1 gas cartridge	1,79 EUR	"
"	8 carriage bolts, M4x40, zinc coated	1,89 EUR	"
2010-10-09	ca. 80 rivets, aluminum, mixed length, sealed	2,50 EUR	flea market, Weststadt, Gießen, Germany
"	1 file, round, new	2,00 EUR	"
"	1 compressed air gun, with adapter hose	4,00 EUR	"
"	1 handle, for ¼" nuts	0,50 EUR	"
"	2 wrenches, 1x15mm, 1x17/19mm, chrome vanadium steel	2,00 EUR	"
	<b>Summe:</b>	<b>4132,92 EUR</b>	

## 10 Fueling protocol

Integrate this with the shopping protocol by moving them to a spreadsheet, creating a single table for all expenses, and another table with cost and consumption statistics drawn from the first table. And a third table as the maintenance protocol, with statistics.

This should be a refueling statistic, with commented consumption calculation, with cost calculation, and oil consumption statistic.

Style of intended fueling protocol: <http://www.pistenkuh.de/1/expeditionsfahrzeug---off-road/tankbuch/>.

## A Labels

Sheets with labels to print out and glue to the car dashboard, to cables etc..

## B Inbox

- eBay seller at eBay Germany who offers Deutz engine spare parts: Partscenter24 (<http://stores.ebay.de/Partscenter24>).
- cylinder head gasket set for deutz FL 812 engine:
  - name: Deutz Zylinderkopf-Dichtungssatz FL 812

- parts number: TN 02910165
- article number: AH 02910165
- price: varies, but more than 15 EUR is expensive
- spare parts for Deutz engines: <http://traktorteile-shop.de>
- spare parts lists on CD-R, for a small transaction fee: <http://www.normagfreund.ws24.cc>
- more than 3000 technical documents for old trucks etc.: <http://www.alte-laster-listen.de>
- door hinges used for entrance door: „Möbelscharnier 108.071538“, stainless steel, 23,90 per each from Profi Parts GmbH, Gießen, Germany.
- U-profile tread used for the window frames of the box body: aluminium U-tread, width 103mm (inner measure), branch height 45mm (inner measure)
- L-profile tread used for the outer enclosing of the rear wall: aluminium L-tread, 75x90mm (inner measure)
- Automobile insurance offer from HUK24: 416,83 EUR annually. The considered data for this are: campervan vehicle type, value 3000 EUR, admissible overall mass 7.4t, date of first registration 1968-01, annual payment, 100% fee, no full or partially comprehensive insurance. Source: calculation on <http://www.huk24.de>.
- Automobile tax 2009 for this vehicle in Germany, according to calculations on <http://www.kfz-steuer.de>:
  - 7490kg, typed as general truck: 500 EUR p.a.
  - 6400kg, typed as general truck: 406 EUR p.a.
  - 6000kg, typed as general truck: 375 EUR p.a.
  - 7490kg, typed as campervan: 745 EUR p.a.
  - 6400kg, typed as campervan: 655 EUR p.a.
  - 6000kg, typed as campervan: 625 EUR p.a.
- box measures
  - inner width, at front wall, at floor: 2200mm (wall to wall, without treads)
  - inner width, at front wall, at ceiling: 2200mm (wall to wall, without treads)
  - inner length, at floor: 4094mm (front wall to end of box, i.e. before building the rear wall)
  - inner length, at floor: 4008mm (front wall to original rear door)
  - inner height, at front wall: 1895mm (floor to ceiling, without treads)
  - outer width: 2410mm
  - outer height, edge to edge, without subframe: 2213mm
  - outer length, front edge to rear wall surrounding tread: 4195mm
  - outer length, front edge to rear edge, incl. new rear wall: ~4215mm

- Get this measure.

  - tread width, rear wall surrounding stainless steel tread: 110mm
  - wall thickness, original rear door: 95mm
  - wall thickness, side walls: 105mm
  - wall thickness, front wall: 105mm
  - wall thickness, ceiling: 105mm
  - wall thickness, floor: 105mm
- Husqvarna cross motorbike measures (250cm<sup>3</sup>?)
  - height: 1300mm
  - width: 500mm (without handlebar)
  - length: 2300mm
- Blechstärken Hilfsrahmen: Längsträger 4mm, alle Querträger 5mm
- Bodenaufbau: Gesamtstärke 105mm, aus: Aluminium-Riffelblech 2mm (exkl. Riffelung), Multiplex-Platte 25mm, blaues PUR 70mm, Multiplex-Platte 6mm, Kunststoff-Versiegelung 2mm
- insulation equivalence (according to Bernhard Malm, Malm Umweltschutz-Technik, Lich): my 10,5cm PU foam is equivalent to 21 cm styropor and 42 cm house wall
- Heckklappe kopfüber montieren, verwendbar als Außentisch, ganz zu öffnen

durch aushängbare Haltebügel die sonst bis ganz zu den Ecken reichen, aus Stahldraht bestehen und sich selbst aufrollen. Spart auch die anfälligen und teureren Gasdruck-Stoßdämpfer.

- Magirus Website: <http://www.magirusdeutz.co.uk>.
- <http://www.allrad-lkw-gemeinschaft.de/phpBB2/viewtopic.php?p=130711#130711> , regarding the use of FI 912 / 913 special tools for the FL 812 engine: »Zu dem angebotenen Werkzeug Kann ich leider nicht sagen , wie Sinnvoll das für einen anderen Motor ist. Allgemein hab ich die Erfahrung gemacht , daß man auch ohne Spezialwerkzeug recht weit kommt, auch bei Arbeiten am Motor. Manche sachen sind sicher mit den Spezialwerkzeugen leichter zu erledigen und vielleicht möglicherweise einige wenige überhaupt nicht ohne dieses Werkzeug. Aber wo ein Wille da auch ein Weg. Diese Werkzeugsätze werden schon sehr lange angeboten allerdings waren die schon viel teurer, ich glaub so um die 300€ und da wurden sie vermutlich nicht gekauft , daher jetzt in der Auktion.«
- Tank-Einfüllsutzen reicht bis 12 cm über Haupttrahmenniveau
- Die Geschichte von Magirus Deutz: <http://www.truckerlinks.dk/tysk/magirus.htm>.