VERBAND DER IN DEUTSCHLAND TÄTIGEN
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GUIDELINE
for Correct Design of Vehicle Electrics and Maintenance of Power Units for Tailgate Lifts

Due to a great number of equipment in today's vehicles, the number of consumers has increased a lot in recent years. The original standard equipment consisting of starter, ignition and generator has been extended step by step to include electronic ignition and injection systems, comfort systems with a great number of electric motors, and additional safety systems.

The electric motors, generator, battery and all consumers of a vehicle need to be regarded as a cooperate system. When deciding the sizes of the generator and battery all consumers influence on the vehicle supply system as well as the operating and driving conditions have to be observed.

The vehicle makers calculate the battery capacity and generator size so as to comply with the built-in consumers under normal driving conditions. The actual situation, however, may clearly differ from these assumptions since the vehicle owners often add more consumers, or else the operating conditions are totally different.

On the market there is a lot of bad information about how to properly design the batteries, fuses and cables which are meant to ensure trouble free operation of a tailgate lift even beyond the customary guarantee terms. The following report has been made to provide the truck makers and bodybuilders as well as buyers and sellers with a summary of important information.

Under voltage is dangerous for the operation of any tailgate lift because the motors as well as start relays and batteries may get damaged. Any incorrect design of the equipment rises a big risk of fire in the cable tree and power unit, and increases the possibility of total loss of power which may cause tremendous costs.

Permitted under voltage with:	**12 V units**	**min.**	**9 V**
	24 V units	**min.**	**18 V**

Not even for a short time must the minimum voltage be lower than the above values. To ensure this even under roughest operational conditions, the following figures have to be observed. All of them are based on experience and have been put together by truck manufacturers, body builders, tailgate lift manufacturers and battery producers.

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Basically there is a difference between “light-duty” and “heavy-duty” operation:

Light-duty operation comprises of:

- occasional use of hired vehicles
- long-distance travel with few loading / unloading stations
- tailgate lift mainly used for unloading

Heavy-duty operation comprises of:

- industrial transportation
- frequent short-distance travels and numerous load cycles
- multi-shift use
- frequent night travels with extensive use of additional options such as strong lamps, turn signal lamps, auxiliary heating, air condition, etc.
- frequent use at temperatures below zero
- frequent loading cycles via tailgate (beverage empties)

1. Minimum Size of Battery Capacity:

	motor Ø mm	motor kW	adm. load kg	allowed vehicle total weight max. to	light duty Ah	heavy duty Ah	batteries
12 V - battery	80	0,8	up to 500	3,50	88	110*	one each
	80	0,8	500 - 1000	5,99	110	not recommended	
	112	1,5	up to 1000	7,49	110	143*	
	112	1,5	1000 - 1500	7,49	143	180*	
24 V - battery	80	1,2	up to 750	5,99	66	88	two each
	80	1,2	750 - 1000	7,49	88	110	
	112	2,0	up to 1000	12,0	88	110	
	112	2,0	1000 - 1500	15,0	110	143	
	112	2,0	1500 - 2000	> 15,0	143	170	
	125	3,0	up to 2000	> 18,0	170	200	
	125	3,0	2000 - 3000	> 18,0	200	200	

* **Important Note***:*

Trucks with total weight > 3,5 t [4,6 t] and 12 Volt supply system are not suitable for heavy-duty operation.

With a truck and trailer unit the capacity and version of the batteries in truck and trailer have to be the same.

The values apply to batteries in good condition, with a correct liquid level and approx. 1.26 to 1.28 kg/dm^3 acid density with an acid temperature of 20°C (corresponds a freezing point at approx. –68°C; an empty battery with 1.12 kg/dm^3 acid density is freezing already at –3°C). These values only apply further to batteries that are not pre-damaged by total discharge and heavy shocks.

Measuring the terminal voltage of a non-loaded battery, however, does not indicate its charging condition because even an almost flat battery has an off-load voltage of 12 or 24 V. This fact is not often well known and therefore not taken into consideration when the battery is ready to change. On the market there are measuring instruments available for this measuring action, which simulate such load and indicate the exact condition of the battery.

2. Accommodation of Generator Capacity:

When purchasing the truck, the customer should pay attention to the number of consumers when ordering the size of generator. It is important to get sufficient charging capacity for the batteries on the truck and trailer even if the common serial consumers and optional features are operated simultaneously. Already from the beginning some extra reserve should be provided for additional use of power consumers such as fan heater, cold boxes etc.

For charging 24 V batteries fully, generators are required which guarantee 26 to 27 V and approx. 20 A at the batteries. For 12 V units, those figures are 13 V and 20 A as well. The value of 20 A is based on experience from the battery industry. Basically, this figure always depends on the real charging time.

Recommended generator size:

			operating		
			solo operating	trailer	
12 V battery system:	min 14 V	and	45 A	65 A	with light-duty
			80 A	90 A	with heavy-duty*
24 V battery system:	min 28 V	and	35 A	55 A	with light-duty
			55 - 80 A	100 A	with heavy duty

These figures depend on the number of consumers and battery charging time.

* **Important Note***:*

Trucks with total weight > 3,5 t [4,6 t] and 12 Volt battery system are not suitable for heavy-duty operation.

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3. Main Circuit Cable:

Depending on the cable section and length, the vehicle wires alone gives such values of resistance that it may considerably reduce the voltage at the cable end.

For example, there will be a 2 V loss of voltage in a main circuit cable, which consists of an 8 m plus and minus cable each, 25 mm^2 cable section (copper core section) and 170 Amp. To be on the safe side regarding the start switch and hydraulic unit, the following figures are recommended.

	motor		pump	cable length	cable section
	Ø mm	kW	up to cm^3/U	m	mm^2
12 V - battery	80	0,8	0,7	up to 10	25
	112	1,5	1,2	up to 8	25
	112	1,5	2,0	up to 8	35
	112	1,5	2,0	8 - 12	50
24 V - battery	80	1,2	0,7	up to 10	16
	80	1,2	0,7	10 -15	25
	112	2,0	2,6	up to 12	25
	112	2,0	2,6	12 -15	35
	125	3,0	3,0	up to 10	35
	125	3,0	3,0	10 -15	50

4. Charging Cable:

In normal operation there is just 20 A flowing through the charging wire, but still there is an important voltage loss because the charging wire mostly is very long. A 12 m charging wire of 2 x 6 mm^2 cable section (each with the plus and minus cable), for example, causes a voltage loss of 0.75 V. Therefore it is obvious that even in this case some guide values have to be observed in order to ensure the efficient charging of the trailer batteries.

The following is recommended for charging wires:

2 x 6 mm^2 for plus wire

2 x 6 mm^2 for minus wire

1 x 1,5 mm^2 wire for indicating of closed driving position for tailgate lift back to the cab according to EN 1756-1/-2.

Beside the right wire dimension it is important to use max. 2 plug connectors with corresponding cross section to the wires. Certain vehicle combinations require the use of spiral cable. Since this spiral cable has another considerable amount of resistance, only the strongest cable (which is available at the market at the moment) has to be used.

At the moment it is possible to use only the 7 x 1.5 mm^2 thick cable (3 wires each for the plus/minus connections and one wire for the indicating signal) or the 6 x 1.5 mm^2 + 1 x 2.5 mm^2 thick cable (1 x 2.5 mm^2 + 1 x 1.5 mm^2 for the minus connection, 4 x 1.5 mm^2 connected with 2 pins for the plus connection and 1 x 1.5 mm^2 for the indicating signal).

5. Connections:

As plug connectors (Amp, Kostal, DIN…) cause losses, too, they need to be kept clean and checked for corrosion regularly. If oxidation has started, the connectors have to be cleaned with a contact spray if necessary.

6. Fuses:

The charging wire requires a fuse to protect it against short circuit. The fuse should be located as close as possible to the battery to avoid any non-protected wire sections. This applies likewise both for truck and trailer.

7. Carbon Brushes:

Carbon brushes wear out during operation, and especially during the running in period over the first few months a lot of carbon dust is generated. This carbon dust may cause a short circuit. The insulation value decreases due to the carbon dust and the brushes may possibly get stuck which results in a burnt collector. The recommendation is to open the motor and blow out the carbon dust at least once a year, in heavy-duty operation preferably every six months.
Information about this operation has to be worked out by the motor producers and will be found in the service manual of the tailgate lifts.

8. Battery:

The liquid level, correct position of the lead plates and acid density (1,26 to 1,28 kg/dm²) should be checked every 3 months. Used batteries should be replaced immediately so that they cannot cause any problem for the whole power unit.

These declarations do not apply for maintenance free batteries.

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9. Oil Change:

During operation oil is absorbing water and moisture from the air, and than it loses its lubricating and anti-corrosive quality. When freezing, this water causes production of ice crystals which will jam valves and filters. Therefore it is important to change oil in the system once a year, preferably before the cold season. After draining the oil, the suction filter should visually be checked for damages and dirt in order to be cleaned or replaced, if required.

Note:
Reduced running time (thermal protector cuts out) mostly is the sign of a dirty suction filter.

10. Thermal Protector:

The thermal switch is an overload protector for the motor (fire risk) and should be connected to the start relay.

11. Guarantee:

The max. warranty time depends on the number of running cycles:

2	years	max.	7.000	cycles/year
1,5	years	max.	10.000	cycles/year
1	year	over	10.000	cycles/year

There is no right for warranty if the guidelines are not followed.

Note:
This good idea, however, is not really practicable without a counter on the tailgate lift.