

TOW BEFORE FLIGHT



AIRCRAFT TUG TF4



OPERATING MANUAL

VERSION 20-06



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1. INTRODUCTION

1.1 YOUR AIRCRAFT TUG

The TowFLEXX TF4 is a product of long development and offers the best possible safety, economy and comfort when towing aircraft. It is up to you to maintain these characteristics for a long time and to use the resulting advantages.

This operating manual shows everything worth knowing about commissioning, towing with the TowFLEXX TF4 and maintenance. Inspection and maintenance work must be carried out regularly and with the operating materials and aids provided. Expert knowledge, special tools and measuring instruments are required for maintenance and repair work not described here. Please contact your dealer or the manufacturer. Maintenance may only be carried out by qualified and certified persons.

1.2 NOTES ON THE OPERATING INSTRUCTIONS

For safe operation of the aircraft tug, basic knowledge is required, which is learned and provided by these operating instructions. All information presented clearly and informatively. All chapters are numbered and the page numbers are marked.

As we are constantly advancing the further development of our aircraft tugs, we reserve the right to make changes in form, color, equipment and technology. Thus, from the content these operating instructions do not derive any claims to certain characteristics of the aircraft tug.

1.3 TARGET GROUP AND PREVIOUS KNOWLEDGE

These operating instructions are intended for all persons involved in the work process of towing aircraft and helicopters with the described aircraft tug. This includes the following groups of persons:

- end customer, user
- aircraft tug maintenance personnel
- dealer

The following knowledge is required for commissioning, installing and operating electric aircraft tugs:



- *Basic knowledge of mechanical and electrical engineering (according to training)*
- *Reading these operating instructions*

1.4 SCOPE OF DELIVERY

Always included:

- TowFLEXX TF4 aircraft tug
- Remote Control incl. charger and spare batteries
- Integrated charger incl. charging cable
- Operating Instructions

1.5 USE OF SYMBOLS IN SAFETY INSTRUCTIONS

This operating manual contains safety instructions with symbols that indicate possible hazards or residual risks. These safety instructions and symbols have the following meanings:



Risk: This safety note indicates the imminent danger to the life and health of persons! Failure to comply with these instructions can result in a health risk for life-threatening injuries and property damage.



Attention: This safety note indicates possible hazards due to electric current! Failure to comply with these instructions can result in a health risk for life-threatening injuries and property damage.



Danger: This safety note indicates possible hazard of crushing, which exists in exceptional cases. Failure to comply with these instructions can result in a health risk for life-threatening injuries and property damage.



Note: Note the Obligation to Read the Operating instructions!

1.6 SAFETY INSTRUCTIONS

These operating instructions contain safety instructions that point out possible hazards and thus enable safe operation of the electric aircraft tug. Please follow these safety instructions at all times!

In this section you will find general safety instructions which do not refer to any specific work step. Special instructions can be found in the specific sections.

1.6.1 GENERAL SAFETY INSTRUCTIONS



Before the aircraft tug is put into operation, it is imperative to read the operating instructions, understand them and make them available to other users!



Never open the motor control unit or other covers! There is a hazard due to electric current flowing.



The motor control unit may only be operated with the 24V DC nominal voltage which is specified on the type plate!



It must always be ensured that no connections or switches are damaged. It is prohibited to operate the aircraft tug with damaged components!



In the event of a malfunction (e.g. if the engine control unit continues to drive by itself, if a direction button is stuck) immediately activate the emergency stop switch on the radio remote control, or one of the two battery disconnect switches on the aircraft tug!



All electrical components must be protected from moisture, dripping and splashing water!



The electric aircraft tug may not be operated in a potentially explosive atmosphere!



When towing aircraft, there is a hazard of crushing. Care must therefore always be taken to ensure that no objects or persons are in the danger area and not reached into it.



Modifications or alterations to the engine control unit, operating elements, mechanics and switches are prohibited and result in the immediate void of warranty and damage claims!



This device may only be used by persons who have successfully completed training (whether in-house or by TowFLEXX personnel).

1.6.2 IMPORTANT SERVICE NOTE



Only original accessories are approved! These may only be installed by qualified service personnel! Otherwise, warranty and guarantee claims will be void!



Only cables with plug connections may be replaced by the user. Further modifications must be carried out by specialist companies or official TowFLEXX personnel.

1.7 STORAGE OF THE OPERATING INSTRUCTIONS

This manual must remain somewhere close to the aircraft tug accessible for all users at any time. You can download a digital copy via the following QR code:



1.8 COPYRIGHTS

TowFLEX GmbH
Wöstendöllen 95-96
49429 Visbek
Deutschland

 +49 4445 988-144
 info@towflexx.com

2. RISIK AND SECURITY STATEMENTS

2.1 INTENDED USE

The aircraft tug may only be used for its intended purpose. It is used to move aircraft via the nose wheel. The load capacity of the carrier must be taken into account (max. load).

Damaged or defective tugs may not be operated until they have been properly repaired. Safety switches, brackets and safety devices must not be removed or disabled. Specified settings must not be changed without the manufacturer's written consent.

2.2 USE UNDER EXTREME CONDITIONS

Using the aircraft tug under extreme conditions can lead to malfunctions and accidents.

- For operations under extreme conditions, especially in highly dusty or corrosion-causing environments, the aircraft tug requires special equipment and approval.
- Use in potentially explosive areas is not permitted.



- In case of storms (storm, lightning strike) the aircraft tug may not be operated outdoors or in endangered areas. Particular attention must be paid to the maximum crosswind component of the towed aircraft. Excessive crosswind loads can lead to loss of traction and thus to loss of control of the tug.

2.3 DANGER AREA

A danger zone is defined as the area in which persons are endangered by movements of the tug with and without the aircraft being towed. No persons may stay in the hazardous area of the tug. The manufacturer recommends a safety distance of at least 2 metres. In addition, the user must always keep his surroundings in view and be aware of other potential sources of danger.



WARNING: Risk of accident/injury when staying in the danger area of the aircraft tug.

2.4 SLOPE AND INCLINE

Incline and / or slope must not exceed the stated values on the dataplate and must have a sufficiently rough surface. At the top or bottom end, level and smooth transitions should prevent the tug from touching down or damaging it. Follow all applicable technical data per specific aircraft technical order.

Full traction can only be achieved on a flat surface. The higher the incline, the weaker the traction. Slopes and inclines affect the maximum towing capacity enormously. If the tug is operated continuously (for more than five minutes) on a slope, it may cause the main fuse to blow. This protects the electronics and does not damage the device.

The tug should not be operated in case of a too steep down grade, because under certain circumstances the braking force of the motors may not be sufficient anymore.



WARNING! If slopes or inclines are ignored, there is danger to life. Your aircraft and tug could be damaged! Maximum towing capacity can only be granted on flat surfaces.

The EU Directive 89/654/EEC (Minimum Requirements for Safety and Health at Work) in its current version must be complied with. For countries outside the EU, the national regulations apply.

2.5 ROUTES AND PARKING

Driveways must be adequately secured, leveled and free from objects. The driveways must be clearly visible to the operator. Guide rails of hangar gates, drainage channels or similar must be leveled in such a way that they can be driven over without shocks. Maximum area and point-loads must not be exceeded.

2.6 OBLIGATIONS OF THE OPERATOR

For the purposes of these operating instructions, an operator is any natural or legal person who uses the aircraft tug himself or is employed on his behalf. In special cases (e.g. leasing, rental), the operator is the person who, in accordance with the existing contractual agreements between the owner and operator of the aircraft tug, must carry out the mentioned operational duties.

The operator must ensure that the aircraft tug is only used for its intended purpose and that dangers of any kind to the life and health of the operator or third parties are avoided. In addition, the operator must ensure that the accident prevention regulations, other safety regulations and the operating, maintenance and repair guidelines are observed. The owner/operator must ensure that all operators have read and understood this operating manual.



Failure to comply with this manual will void the warranty. The same applies if the customer and / or third parties have performed improper work on the tug without the manufacturer's consent.

2.7 ATTACHMENTS OR ADDITIONAL EQUIPMENT

The installation or attachment of additional equipment to affect the functions of the aircraft tug, or to supplement the functions of the aircraft tug, is only permitted with the written approval of the manufacturer. If necessary, approval must be obtained from the local authorities. However, the approval of the local authorities does not replace the approval of the manufacturer.

2.8 IMPROPER USE

Any use for which the tug is not approved is the responsibility of the operator or driver and not the manufacturer. The following list is only an example and does not claim to be exhaustive. The tugs not approved for:



- Riding on the tug unless the tug is specially equipped for this purpose
- Use in fire or explosion-hazard areas unless it has special certification for this
- Exceeding the maximum capacity
- Exceeding the restricted speed at max towing



DANGER: Improper use can result in serious injuries or even death.

2.9 RESIDUAL RISKS

Despite observance of all listed safety instructions, certain residual risks can not be excluded. When operating the aircraft tug, maximum attention must be paid to the tug, environment and aircraft.

2.10 PROTECTIVE MEASURES

In order to prevent injuries, the operator must be equipped with sufficient protective clothing. In general, the operator must wear safety shoes when towing. If you are working on the apron in low light / no light condition you must also provide safety vests for every person involved in the operation.

If the above protective measures are not provided by the operator, the operator must refrain from operating the aircraft tug.

2.11 DRIVING PERMIT

The aircraft tug may only be used by persons who are trained by officially certified personnel and who have demonstrated to the operator or his agents their ability to tow aircraft and have subsequently been expressly assigned to operate the aircraft tug. If necessary, the national regulations must be observed.



The manufacturer strongly recommends product training for all operators. Alternatively, a train the trainer program is available. For further questions please contact your dealer or the manufacturer.

2.12 RIGHTS, OBLIGATIONS AND RULES OF CONDUCT

The operator must be informed about his rights and obligations, instructed in the operation of the aircraft tow tug and familiarized with the contents of this operating manual.

2.13 PROHIBITION OF USE BY UNAUTHORIZED PERSONS

The operator is responsible for the aircraft tug during the period of use. The operator must forbid unauthorized persons to drive or operate the tug. No persons are allowed to be transported on the TowFLEX equipment or support equipment being towed.

2.14 DAMAGE AND DEFECTS

Damage and other defects to the aircraft tug or its attachments must be reported immediately to the supervisor. Tugs that are unsafe to operate (e.g. worn wheels or defective brakes) must not be used until they have been properly repaired.

2.15 REPAIRS AND MAINTENANCE

The operator must not carry out any repairs or modifications to the aircraft tug without written authorisation and without special training. Under no circumstances may the operator disable or block safety devices or controls.

2.16 FIRE PROTECTION

At no time escape routes or other fire protection equipment must be blocked by the aircraft tug or its attachments or accessories. Explosion-hazardous areas may not be entered and should be avoided at a safe distance.

There must be no flammable materials or sparking equipment within a distance of at least 2 metres to the aircraft tug parked for charging. The room must be ventilated and fire protection equipment must be provided in sufficient quantity.

The operator must ensure that sufficient fire protection. If necessary, additional fire protection must be provided on the tug. If there is any uncertainty, the responsible supervising authority will provide information.



Risk of burns due to the use of unsuitable fire protection. In case of fire, reaction with battery acid may occur when extinguishing with water. This can lead to acid burns.

- Never extinguish burning batteries with water.

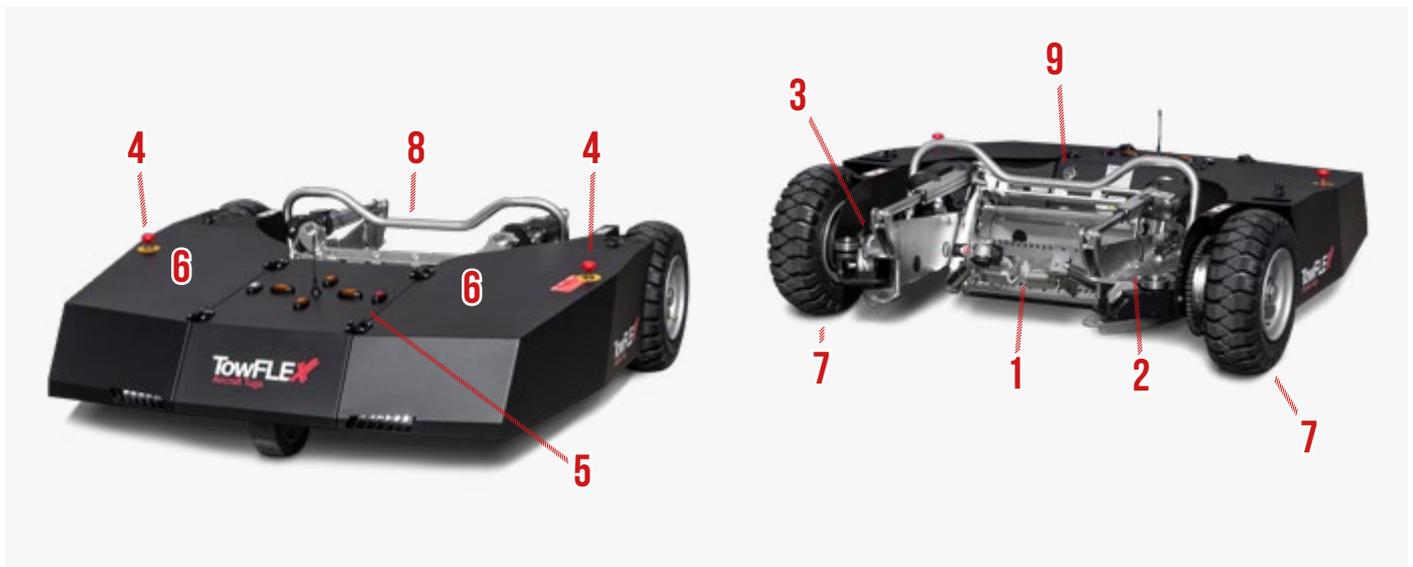
3. VEHICLE DESCRIPTION

3.1 APPLICATION

The TowFLEXX TF4 is an all-electric, towbarless aircraft tug designed for towing and manoeuvring aircraft.

The aircraft tug can be operated both in the hangar and on the apron and allows several towing operations per day, depending on the weight without intermediate charging. Weight restrictions and maximum capacities are indicated on the type plate.

3.2 ASSEMBLIES AND FUNCTIONS



1	Nose Wheel Mount
2	Turntable
3	Turntable locking Pin
4	Battery Disconnect Switch (e-Stop)
5	Direction Indicator- & Status-LEDs
6	Hinged Hood
7	Drive Wheels (air-filled)
8	Nose Wheel Safety Bar
9	Multifunctional Display (MDI)



3.3 GENERAL VEHICLE DESCRIPTION

The frame of the aircraft tug is a steel construction and is finished with a surface coating, making it fully weatherproof. Two individually driven wheels together with the fixed castor make the aircraft tug extremely manoeuvrable so that it can be turned 360 degrees on the spot without any restrictions.

The charger and the remote control is located in the left side storage compartment. The right side storage compartment contains the socket for a ground power cable. All functions of the tug are electronic or mechanical. This means that the aircraft tug does not have any hydraulics at all.

3.4 DRIVE

Two 2.2kW 24 VAC motors serve as drive. By the flanged spur gear and the power transmission by chain drive we achieve the high required tractive forces. For optimal power transmission, two 18" air-filled tires are mounted as drive wheels.

3.5 LIGHTING

The lighting system includes:

- two front headlights
- Direction indicators and status LEDs
- Flashing- or rotating beacon (optional)

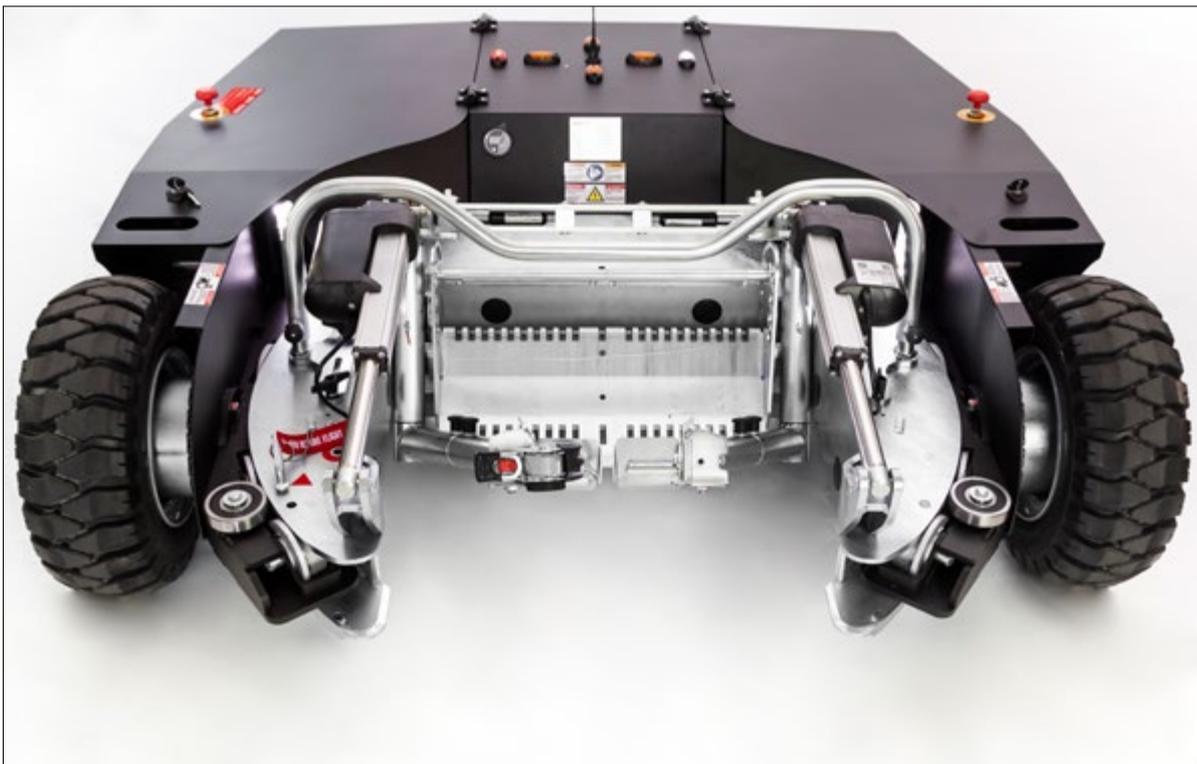
3.6 BRAKE

In general, the aircraft tug is braked via energy recovery. The motors work like generators and feed the batteries slightly with the regenerated energy. If this normal deceleration is not sufficient enough, the deceleration can be increased by an opposite control command.

When the vehicle is at a standstill or on slopes and inclines, the magnetic brake is engaged as soon as no driving command is given. It is released automatically as soon as a new driving command is executed.

3.7 NOSE WHEEL MOUNT

By two swivel arms the nose wheel is first enclosed and then lifted. The mount moves the nose wheel under the safety bar and thus offers an optimal fit of the nose wheel in the mount. The entire mount is attached to a turntable that can be rotated by 360°, allowing free movement underneath the aircraft.



WARNING: If the nose wheel mount is open, none of the two arms should touch the ground, but should hover a few centimetres above the ground. If this is not the case, first check the air pressure of the air-filled tires, otherwise check the chapter: „Adjust the Mount“, or contact the support!

3.8 CONTROL UNIT

All electronic components and controls are located on one board. This allows easy maintenance and replacement in case of a defect or later modernization of the electronics.

The board can also be replaced with a few simple steps in order to incorporate any innovations in the control systems. This forms the heart of the aircraft tug.

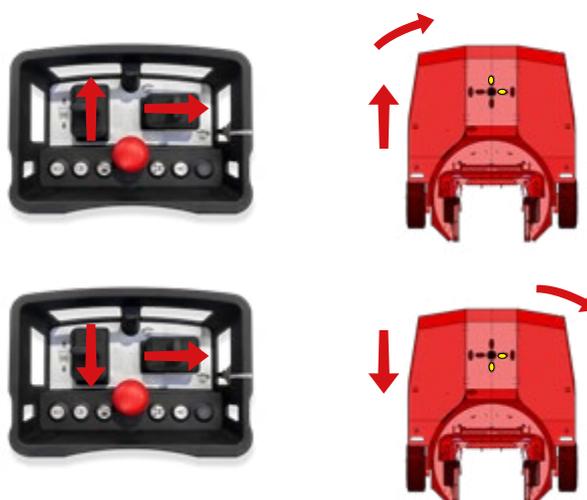


WARNING: Work on the control unit may only be performed by TowFLEXX personnel. If any works are carried out without written confirmation from the manufacturer, all warranty claims will be voided!

3.9 CONTROL STATEMENT

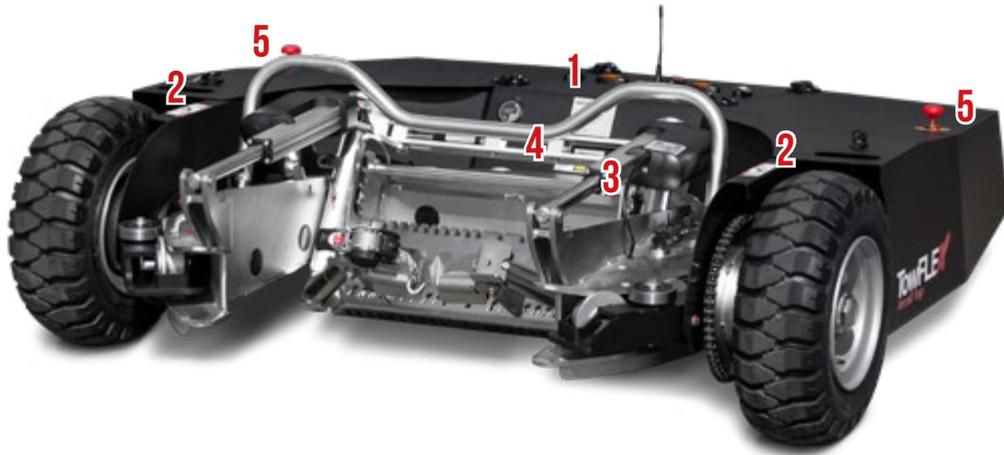
The aircraft tug is controlled by two differentially driven wheels. Together with a fixed castor in the front of the aircraft tug, this enables it to turn on the spot.

The directional indicators of the aircraft tug show the direction in which the nose of the tug is moving.



This is only an extract of the possible control variants.

3.10 WARNING SIGNS AND TYPE PLATES



TowFLEX Aircraft Tugs	
Weight /kg _____	
Weight /lbs _____	
PN _____	
SN _____	Max. tow. cap. /kg _____
MFD _____	Max. tow. cap. /lbs _____
Bat. Type _____	Inspection _____
Bat. Rating _____	
Manufactured at TowFLEX GmbH Wostropfen 66-66 D-49429 Vissbek	
CE	



1

2

3

4



5

1	Type Plate
2	Warning Sign - Danger - Crush Hazard
3	Warning Sign - Danger - Hazardous Voltage
4	Attention - Read Manual
5	Battery Disconnect Switch (eStop)



3.11 EC-DECLARATION OF CONFORMITY

MANUFACTURER AND DISTRIBUTING COMPANY

Name: TowFLEXX GmbH
Street: Wöstendöllen 95-96
City: D-49429 Visbek
Country: Deutschland
Phone: +49 (0)4445-988144
E-Mail: info@towflexx.com



Hereby declare that the device described below in the version we have placed on the requirements of the EC Directives listed below. In the event of a change or improper use not agreed with us, this declaration shall be invalid.

DESIGNATION OF THE DEVICE

Towing tractor for aircraft, trailers or other non-self-propelled rolling devices.

Device-Type: TowFLEXX TF4 - Aircraft Tug up to 14.000kg towing capacity
Identification No.: TF42001XX - ...

APPLIED DIRECTIVES AND STANDARDS

Machinery Directive 2006/42 EG in the last Version, EMC Directive 2004/108 / EC in the latest version for industrial trucks implemented in the harmonized standard EN 12895, Applied standards and specifications: *

DIN EN ISO 12100- (3/2011) Safety of machinery, general principles of design risk - division u.
Risk reduction.


Axel Schickling
CEO

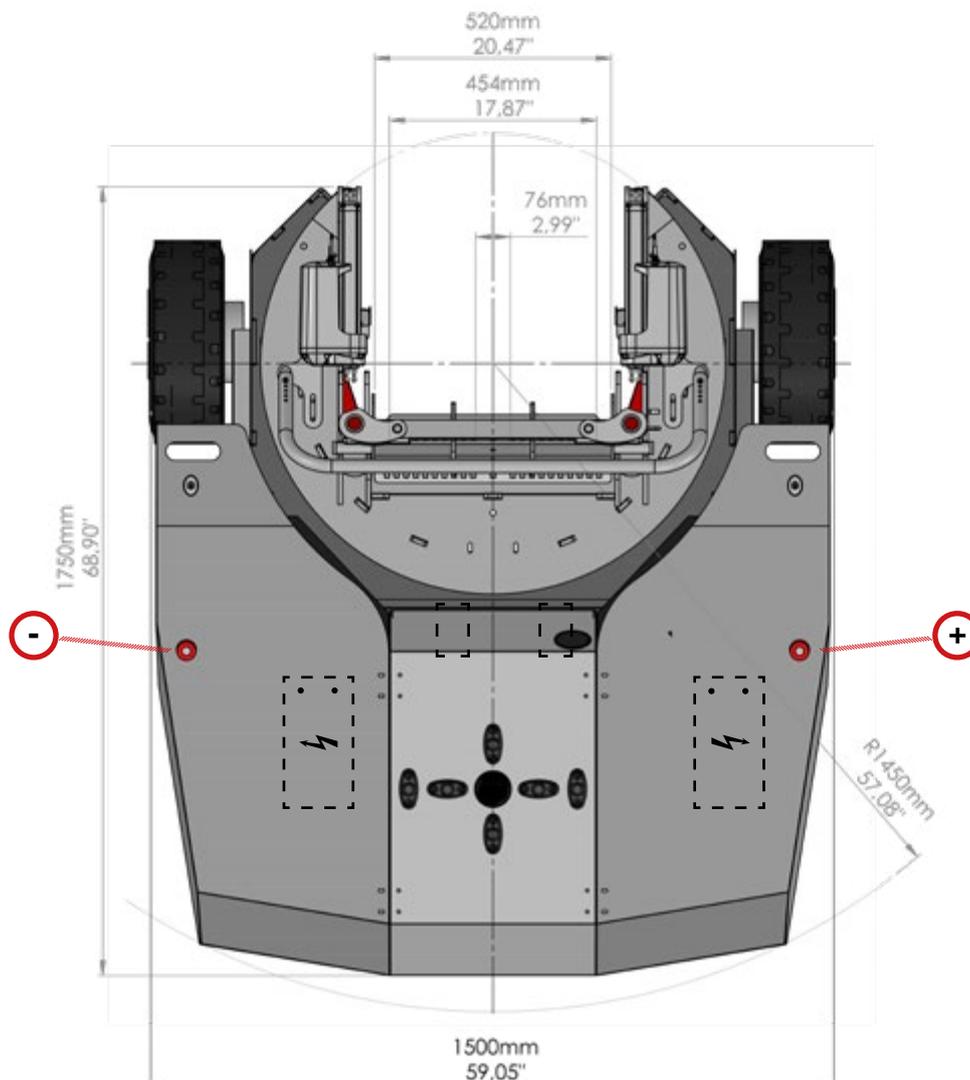
* The valid version of the standards/specifications on the date of issue of this declaration always applies.

3.12 OTHER CERTIFICATIONS

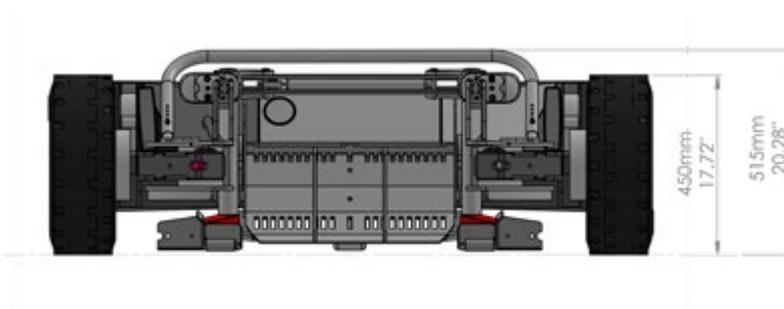
- EN 292-1
- EN 292-2
- EN 60204-1
- EN 50178
- IEC 801 (2-4)
- EN 50142
- EN 55011
- EN 50081-2,
- EN 50082-2
- IEC 68-2 (-1, -2, -3, -6, -27)
- EN 60529
- EN 300-220-3 1.1.1
- EC Machinery Directive (89/392/EEC)
- EC Low Voltage Directive (73/23/EEC)
- EC Directive of Electromagnetic Compatibility (89/336/EEC)
- EC Directive R & TTE (99/5/EC)

3.13 TECHNICAL DATA

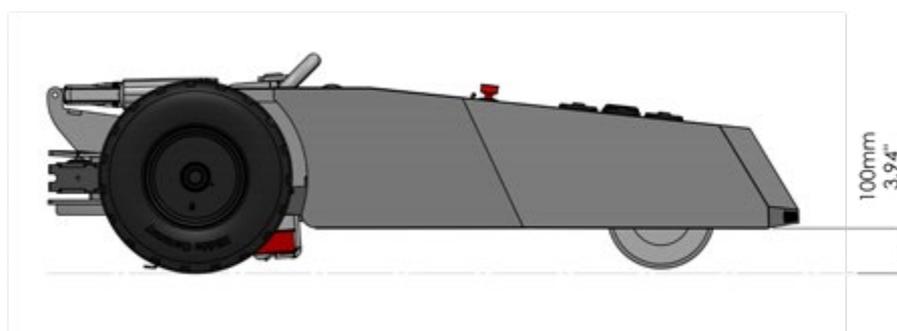
TOP VIEW



BACK VIEW



SIDE VIEW



Length	1.800 mm (70,87")
Width	1.500 mm (59,06")
Height	450 mm (17.72")
Wheelbase	1.350 mm (53,15") Drive Wheels, one Caster Wheel
Ground Clearance	100 mm (3,94")
Turning Radius	1.400 mm (55.,12")
Shipping Weight incl. Batteries	600 kg (1,320 lbs)
Speed (not loaded)	6 km/h (3.83 mi/h)
Speed (loaded)	4 km/h (2.49 mi./h) (in slow mode)
Range in km (miles)	Ca. 3 km (1,9 mi.) (when used at intervals)
Battery Life	3 - 4 days (depending on the load; if used in intervals)
Operating Temperature	-15°C to +50°C (5°F to 122°F)
Operating Humidity	Max. 90% (Relative Humidity)

3.14 REMOTE CONTROL

Frequency Range	see radio remote control
Baud Rate	1,200 - 9,600 Baud (bit/sec)
Operating voltage	battery 7.2V
Power Consumption	0 - 100 mA
RF Power	< 10 mW ERP
Protection Class	IP 65
Operating Temperature	-20°C to +70°C (-4°F to 158°F)
Weight (without batteries)	1.000g / 2,2lbs
Dimensions (L x W x H)	247 x 139 x 117 mm (9,7" x 5,47" x 4,6")

3.15 ENERGY SUPPLY

The aircraft tug is solely powered by batteries. The system consists of two 12VDC maintenance-free, sealed lead-gel batteries. The batteries are charged by an integrated charger (115-230VAC connection)

3.16 CONNECTIONS

The aircraft tug has various connectors. The most important connectors for the operator are shown in the figures below:



Charger for Tug and Battery Charger for RC Batteries



GPU-Connector



3.17 GROUNDPOWER UNIT (GPU)

The TF4 has a ground power connection located behind the right side lid. However, the device cannot be used as a classic GPU, but should not exceed a maximum power of 50 amps. Please note that the batteries have a total power of 24V.



WARNING: Do not start the engines of an aircraft with the unit as this may damage the batteries.

3.18 MAINTENANCE PRODUCTS

The maintenance products used in aircraft tugs are reduced to a minimum, thus minimising the risk of leaking operating materials:

- Helical Gear: Glygoyle 220 CLP VG 220
- Drive Chain: Interflon Lube

3.19 AMBIENT TEMPERATURE & WORKING ENVIRONMENT

With constant use under extreme temperature changes and condensing air humidity special equipment and approval is required for the aircraft tug. In order to ensure the best functionality, we recommend to use the equipment at the following temperature range:

-20°C to +50°C / -4°F to +122°F

In order to preserve a long durability of the device and the batteries, store it neither in very cold, nor in very warm outdoors. Working in rain and snow is no problem for the TF5, but even in these weather conditions, we recommend to store the unit in a protected place after use.

3.20 IMPACT ON THE ENVIRONMENT AND PERSONNEL

The manufacturer confirms compliance with the limits for electromagnetic interference and immunity, as well as the static electricity discharge test according to EN.



WARNING: Interference with medical devices by non-ionizing radiation Electrical equipment of the aircraft tug that emits non-ionizing radiation (e.g. wireless data transmission) can interfere with the functions of medical devices (pacemakers, hearing aids, etc.) of the operator, as well as persons in the surrounding area, and lead to malfunctions.

It should be clarified with a doctor or the manufacturer of the medical device whether it can be used in the vicinity of the aircraft tug.

4. OPERATION AND HANDLING

4.1 RADIO REMOTE CONTROL

The remote control of the aircraft tug is used to transmit any driving commands and other functions to the aircraft tug. Country-specific safety frequency is used.

Two joysticks are used to determine the direction of travel (forward/backward & left/right). Both can be operated independently of each other. All additional functions are located in the lower part of the radio remote control.

An EMERGENCY OFF switch is located centrally. This immediately interrupts the radio connection and the aircraft tug is immediately stopped with maximum braking power until standstill.

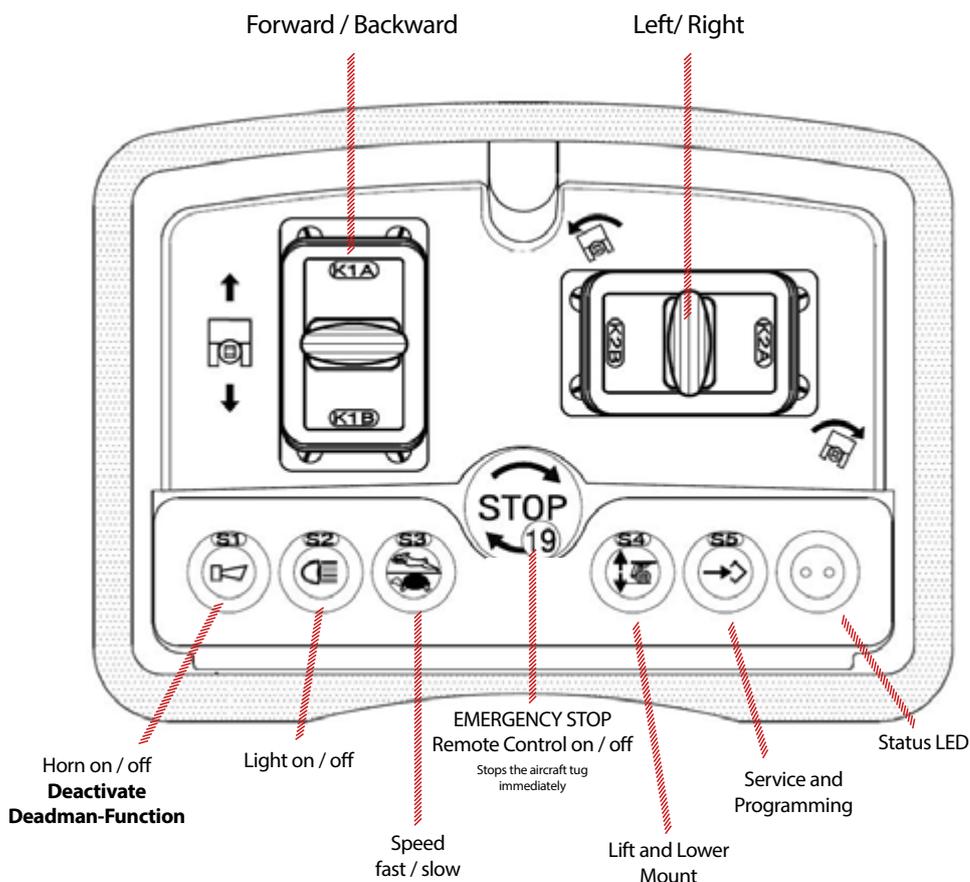


If the EMERGENCY STOP switch is activated while driving, the aircraft tug is braked to a standstill with maximum braking power. There is an increased risk of accidents and injuries.

- **Do not use the EMERGENCY OFF switch as a service brake.**
- **Only use the EMERGENCY OFF switch while driving in the event of danger.**



When starting the aircraft tug, it has to be activated via the radio remote control (deadman switch). Driving commands are only activated after the „horn“-button is pressed once.



4.2 TURNING THE REMOTE CONTROL ON AND OFF

To turn on the remote control, turn the emergency stop switch clockwise until it jumps up slightly. A small LED on the remote control will illuminate.



Note: If it is foreseeable that the aircraft tug will not be used for more than 60 seconds, the remote control should be deactivated immediately!

4.3 REMOTE CONTROL CHARGER AND BATTERY

A charger for the batteries of the remote control is located under the left side lid of the aircraft tug. The batteries are standard AA batteries with 1.900mAh.

The exchange batteries are charged while the aircraft tug is in operation. The side lid will be opened by a foot lever which is located on the underside of the lid.



Open the left lid to get access to the Batteries

4.4 REMOVE BATTERIES

1. remove the bolt
2. open the lid
3. remove batteries



1. open the lid on the back



2. remove the two batteries

The batteries are inserted in the reverse order.



Note: If the remote control is not used for a longer period of time, the batteries must be removed from the transmitter.

4.5 SAFETY FUNCTION (DEAD MAN´S MODE)

If no control pulse is transmitted for a period of 60 seconds, the remote control goes into safety mode. If this mode is activated, the aircraft tug responds to no command from the remote control, until the „Horn-Button“ is pressed once.



The horn deactivates the dead man's mode

4.6 LOCKING THE TURNTABLE

By default the turntable is freely rotating, but can be fixed with a bolt. The pin is located left of the nose wheel mount and is attached to a chain. Fixing the turntable is particularly recommended during aircraft pick-up, so the turntable cannot twist.



Bolzen zur Sicherung des Drehtellers



ATTENTION! An incorrectly closed or secured mount may cause the aircraft to slip out of the mount during towing! There is danger to life!

4.7 BATTERY CHARGER OF THE AIRCRAFT TUG

A charger is integrated into the aircraft tug. It is located behind the left side storage compartment. The charger is powered by 100-240 VAC.

To start the charging process, plug the charging cable into an appropriate power supply. Then pull the battery disconnect switch on the left (in the driving direction) to start the charging process.



Battery Charging Cable located under the left lid.



Pull the left eStop to start the charging Process



WARNING! When charging, the batteries emit a mixture of oxygen and hydrogen (oxyhydrogen gas). Gassing is a chemical process. This gas mixture is highly explosive and must not be ignited.

- ***Connecting and disconnecting the charging cable of the battery charging station with the battery plug must only be carried out with the charging station and tug switched off.***
- ***Cable and plug connection must be checked for damages.***
- ***Ventilate the room in which the aircraft tug is charged sufficiently.***
- ***When handling batteries, do not smoke or use open flames.***
- ***In the area of the aircraft tug parked for charging no flammable substances must be stored or handled. Keep at least 2 meters distance.***
- ***Fire protection equipment must be provided.***
- ***The local safety regulations must be followed.***



ATTENTION! When the tug is not being used or charged, make sure that both battery disconnectors are deactivated (pressed). Otherwise there is a risk of the batteries becoming deeply discharged and irreparably damaged!

4.8 DIRECTION INDICATOR LIGHTS

On top of the aircraft tug there are direction indicators, which show the direction in which the tug is moving. The LEDs show the direction before the tug starts to move, if the joystick is pushed gently.

4.9 STATUS-LED

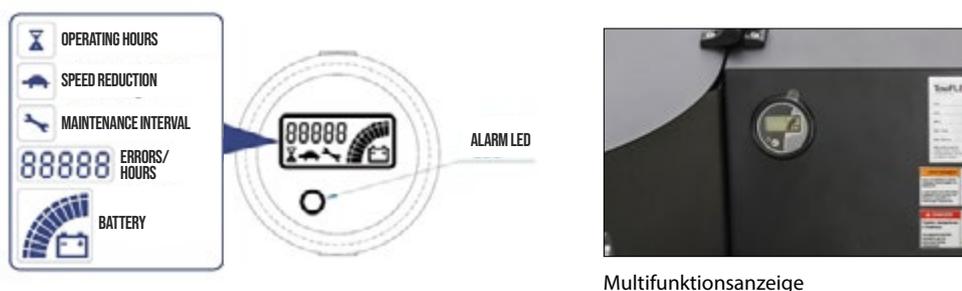
There are two status LEDs directly next to the direction indicator lights. The LED on the left in the direction of travel indicates that the aircraft tractor is ready for operation as soon as the power supply is switched on. After the radio connection has been established, this is indicated by the LED on the right in the direction of travel. If the aircraft tractor is switched off, none of the LEDs is illuminated.

4.10 MDI DISPLAY

The multifunction display shows the operating hours during normal operation. During the start-up sequence, the display first shows the software version of the drive control system.

If there is a malfunction in the aircraft tug, this is indicated by the red LED and an error code in the display.

The MDI display is located on the cover above the type plate.



On the MDI the operating hours of the aircraft tug are displayed. On delivery, up to 12 hours may already be shown on it, due to production processes and functional tests.

5. COMMISSIONING

5.1 TURNING THE AIRCRAFT TUG ON AND OFF

SWITCH ON:

1. unlock both battery disconnecter switches (eStop) by pulling them up.
2. unlock the emergency stop on the remote control by pulling and twisting it clockwise to activate the transmitter.
3. deactivate the dead man's mode on the remote control (horn button)

SWITCH OFF:

1. press both battery disconnect switches.
2. press the emergency stop on the remote control.



ATTENTION! When pressing the battery disconnect switches while driving, the aircraft tug stops with maximum braking power to standstill. There is an increased risk of accidents and injuries.

- Do not use the battery disconnect switches as a service brake.
- Only use the battery disconnect switches while driving in the event of danger.



ATTENTION! There is a potential risk of accident due to a defective or inaccessible battery disconnect switch. In a dangerous situation the operator cannot stop the aircraft tug by pressing the battery disconnect switch in time.

- The function of the battery disconnect switch must not be interfered with by any objects.
- Immediately report any defects found on the battery disconnect switch to your supervisor.
- Mark and immobilise a defective aircraft tug.
- Do not operate a defective aircraft tug until the defect has been located and repaired.



ATTENTION! If the tug is not being used or charged, make sure that both battery disconnect switches are deactivated (pressed). Otherwise there is a risk to the batteries becoming deeply discharged and irreparably damaged!



5.2 PUSHING THE BATTERY DISCONNECT SWITCH (ESTOP)

If one of the battery disconnect switches is pressed, all electrical functions are switched off. The aircraft tug is braked to a standstill immediately.

5.3 PULLING THE BATTERY DISCONNECT SWITCH (ESTOP)

If both battery disconnectors are unlocked by pulling, all electrical functions will be switched on. The aircraft tug is ready for operation (assuming the aircraft tug was ready for operation before the battery disconnectors were pressed).

5.4 TESTS AND ACTIONS BEFORE DAILY STARTUP



Warning! Damage or other defects on the aircraft tug or attachment (optional equipment) may lead to accidents.

If damage or other defects are discovered on the aircraft tug or attachments (optional equipment) during the following checks, the aircraft tug must not be used until it has been properly repaired.

- ***Immediately report any defects found on the aircraft tug to the supervisor.***
 - ***Mark and immobilise a defective aircraft tug.***
 - ***Do not operate a defective aircraft tug until the defect has been located and repaired.***
-
- Check the entire aircraft tug from the outside for damages and leaks.
 - Check wheels for damage.
 - Visual inspection of the drive chain.
 - Check driving directions with the remote control.
 - Check markings and plates for completeness and legibility (see marking points and type plates; page 20).
 - Check the indicator lights (direction and status LEDs)

5.5 PREPARING THE NOSE WHEEL MOUNT FOR TIRE SIZE

To pick-up an aircraft, the mount has to be set to the lowest position so that the arms are open and the access to the mount is not blocked by any objects. The mount is opened and closed via the remote control (see page 27) and will stop automatically as soon as the final position is reached. Remove the nose wheel spacer or set them to the correct wheel size of the aircraft (only needed on single-wheel configurations).



Set the Spacers (only for single wheels)



Adjust the length of the arms



Set the bar for the wheels diameter to fit



ATTENTION! When preparing the nose wheel mount there is hazard of crushing!



Note: For a safe operation with an airplane or helicopter, we recommend to fix the turntable with the provided safety bolt before the starting with the pick-up procedure.

5.6 CAPTURING AN AIRCRAFT

While picking up the aircraft with the aircraft tug, the aircraft must be secured either by chocks or the brakes of the aircraft. Depending on the type of aircraft, it can be picked up from the front or from the back.

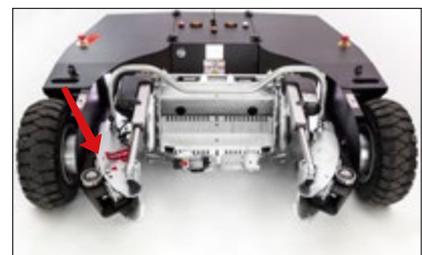


ATTENTION! Always make sure that no components such as flaps, sensors or antennas are in the way during the capturing process, otherwise irreparable damages may occur.

Before capturing, make sure that the aircraft tug is in slow operating mode (turtle) and that the turntable is secured with the safety bolt.



ATTENTION! If the aircraft tug is not in slow mode, there is a risk of causing damage to the nose wheel.



First open the wheel mount using the remote control so that the arms are in the outermost position. Move the tug carefully and slowly towards the nose wheel so that the tug is as centered as possible. Depending on the wheel type (twin or single), first remove the nosewheel spacers (lateral limiters for the nose wheel). These are only required for single-nosewheel configurations.

 **WARNING! Avoid fast and sudden movements at all costs.**

If the nose wheel is centered in the mount so that it touches the rear bracket of the mount, the arms must be adjusted in length to fit the aircraft.

to adjust the arms, first loosen the ball lock pin on the arm. The length of the arm can then be altered.

 **DANGER! Make sure that the ball lock pin is then correctly inserted and locked again, otherwise there is a risk of causing damage to the nose wheel and injuries to personnel.**

Afterwards the capturing process can be started via the remote control. To do this, press the dedicated button. The mount then automatically moves to the top position, as long as the button remains pressed.

 **ATTENTION! Only one button is dedicated to move the mount. If the button is released and pressed again, the mount's movement will change to the opposite direction.**

The mount stops automatically in the uppermost position. In order to ensure the best possible safety, the arms must then be secured with the strap attached to the left arm.

 **WARNING! The arms hold their position even under high forces. However, the strap provides additional safety and should be used in every operation!**

Last step is to remove the locking pin again, to enable the free spinning of the 360° turntable. The pin can remain locked during operation, but countersteering is then deactivated.



5.7 DURING OPERATION

While towing, there are a few points to take into account to prevent possible damage to the aircraft and the tug:

- Only use slow mode (turtle) while an aircraft is on the tug.
- When crossing gate rails, the aircraft tug should be positioned at a 90° angle to the rails if possible. In addition, the tractor should not be swung in during the crossing, otherwise the fixed rollers may get caught between the rails and damage may occur.
- The joysticks of the remote control should be used in gently. If the joysticks are fully pressed, the maximum control signal is given what means that the vehicle is accelerating with its maximum force. Conversely, this means that if the joysticks are released abruptly, the vehicle will be stopped immediately with full force.

When using the 360° slewing ring, always ensure that the safety bolt is pulled. This must be locked again immediately after use. Under certain circumstances, due to the design of the specific nosewheel, it is possible that the turntable will have more friction than the nose wheel. This can be corrected either by lowering the nose wheel to the ground or by manual adjustment.



ATTENTION! Always follow the instructions above, otherwise damage to the aircraft or the aircraft tug may occur.

5.8 RELEASE THE AIRCRAFT

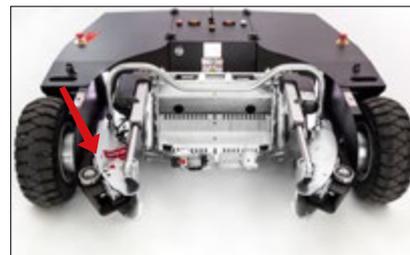
Releasing the aircraft is done in reverse order to capturing and aircraft (5.6 - Capturing an Aircraft). Before unloading, make sure that the aircraft is properly secured. Therefore the chocks must be positioned at the main landing gear and/or the parking brake of the airplane must be set.

Position the aircraft tug parallel to the aircraft or helicopter as you did while capturing. In order to guarantee a safe release, we recommend to fix the turntable with the safety bolt. In any case, the tug should be in slow operating mode (turtle)!





We recommend securing the turntable with the locking pin before lowering it.



First release the strap, otherwise the arms can not open automatically when lowering.



WARNING! Failure to release the strap may result in damage to the aircraft tug.



When the strap is released, press the button for automatic capturing and releasing on the remote control. The mount will then begin to lower. Press this button until the nose wheel is on the ground and the arms of the cradle are fully open. The system stops automatically when the end position is reached.



After that, the nose wheel should be cleared and the tug can be moved away from the nosegear carefully.

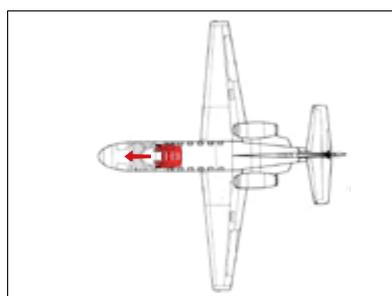
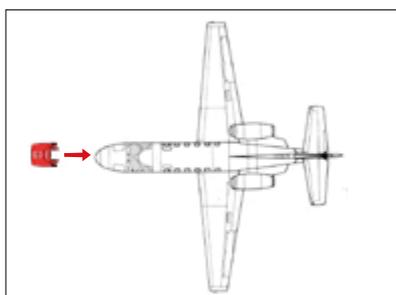


ATTENTION! Remain in the Slow-Mode until the tug is completely disengaged from the aircraft.



5.9 POSSIBILITIES OF NOSE WHEEL PICKUP

The aircraft tug offers two different ways to pick up the nose wheel of the aircraft. The graphic below shows you the different options.



ATTENTION! Before unloading always make sure that no components such as propellers, flaps, sensors or antennas are in the way.

5.10 EMERGENCY BRAKE RELEASE

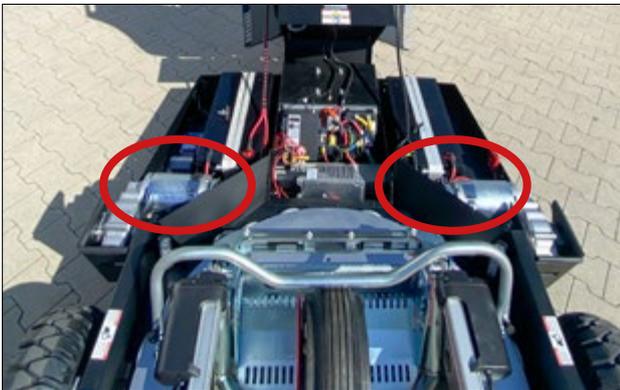
To prevent further movement or rolling away in the event of a transmission failure or other faults on the aircraft tug, the magnetic brake is automatically engaged as soon as there is no control signal given. In the event of a system failure, the brakes can be released manually.

Before applying this emergency procedure, the aircraft tug and the towed aircraft/helicopter should be adequately secured.



CAUTION! Insufficient or missing securing may result in unwanted movements of the aircraft tug and the aircraft!

1. secure tug and aircraft adequately!
2. switch off the aircraft tug by pressing the two battery disconnect switches.
3. pull the marked levers on the motors to release the magnetic brakes. These levers should be fixed to start the transport.



Open the cover to get access to the motors



Each Motos has a lever that can be pushed in one direction



WARNING! There is electric current flowing. This process requires special care. Not observing can lead to personal injury and damage to property!



ATTENTION: If the tug has to be repositioned in an emergency, the TowFLEX TF4 must not be towed or pulled without following the procedure for releasing the magnetic brakes. Alternatively, the tug MUST be repositioned by an suitable forklift truck and forklift operator! Failure to do so may result in damage to the equipment.



5.11 EMERGENCY AIRCRAFT RELEASE

In case there are problems with the electronics, or even mechanical problems, there is always the possibility to remove the aircraft manually from the tug. This can be done either with a screwdriver or a power tool.



DANGER! Before starting with this procedure, secure the aircraft from rolling away. Improper security can result in serious injuries or even death.



Open the cover to get access to the motors

1. secure tug and aircraft adequately!
2. switch off the aircraft tug by pressing the two battery disconnect switches.
3. start unscrewing at the marked position.

6. MAINTENANCE

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WARNING! Ignoring regular maintenance can lead to failure of the aircraft tug and is also a potential hazard for persons and operation.

6.1 MAINTENANCE PLAN

The operating conditions of the aircraft tug have a considerable influence on the wear of components. The maintenance intervals specified in the following assume regular operation and normal operating conditions. In case of increased requirements such as heavy dust accumulation, strong temperature fluctuations or multi-shift operation, the intervals must be shortened accordingly.

The following maintenance checklist specifies the activities to be carried out and the time when they should be performed.



Assembly	Action	Interval
Batteries	<ul style="list-style-type: none"> charge at least 1x per month check the battery plug for damage, function and tightness 	10h monthly
		25h anually
Lighting	<ul style="list-style-type: none"> Check the function of the lighting 	50h anually
Wheels	<ul style="list-style-type: none"> Check drive wheels for wear and damage Tighten the wheel nuts of the drive wheels (220Nm) Check castor for wear and damage Air pressure of pneumatic tires (9 bar) 	50h anually
		25h half-yearly
		50h anually
		10h monthly
Turntable	<ul style="list-style-type: none"> Lubricate flanged rollers Folding mechanism and sitting of the ramp without load Check bolts and screws 	25h half-yearly
		25h half-yearly
		50h anually
Drive Chain	<ul style="list-style-type: none"> Lubricate Drive Chain Visual inspection and tension check 	25h half-yearly
		50h anually
Chassis & Assemblies	<ul style="list-style-type: none"> Visual inspection Check bolts and screws Check readability and completeness of the labels 	50h anually
		50h anually
		50h anually
Functional Check	<ul style="list-style-type: none"> Functional test of all commands on the remote control Driving check 	25h anually
		50h anually

7. REPAIR AND OVERHAUL

7.1 GENERAL INFORMATION

Repairs may only be carried out by trained personnel. Only original spare parts approved by the manufacturer must be used to ensure safe and reliable operation.



WARNING! Any modification to the aircraft tug - especially to the safety equipment - is prohibited.

7.2 REQUIREMENTS FOR STORAGE

If the aircraft tug is taken out of service for more than one month, it may only be stored in a frost-free and dry room. Carry out the following actions before, during and after decommissioning.

7.3 ACTIONS PRIOR TO DECOMMISSIONING

- Clean aircraft tug carefully
- Apply a thin layer of oil or grease to all mechanical parts that are not painted or galvanized.
- Charge the battery (see 4.7 - Battery Charger of the Aircraft Tug, page 30)

7.4 REQUIRED ACTIONS DURING DECOMMISSIONING



Note: Self-discharge of the batteries can cause deep discharge. Deep discharging shortens the life of the battery considerably, or destroys them completely. The batteries should be charged at least once a month.

7.5 TAKING THE AIRCRAFT TUG BACK INTO SERVICE

- Clean aircraft tug carefully
- Charge the batteries
- Carry out maintenance according to plan



7.6 WORKING ON THE ELECTRONICS

Work on the electrical system must only be carried out when it is de-energised. The condensers installed in the controller must be completely discharged. The condensers are completely discharged after approx. 10 minutes. Before starting the maintenance work on the electrical system:

- Work on the electrical system may only be carried out by qualified personnel, trained in electrical engineering.
- Before starting any work, take all precautions that are necessary to prevent an electrical accident.
- Parking the aircraft tug safely
- Disconnect the battery plug
- Take off rings, metal bracelets, etc.



WARNING! There is an increased risk of accidents due to electric current! Local and country-specific regulations must be followed!

7.7 TIRES

The quality of the tires influences the stability and driving characteristics of the aircraft tug.

The TF4 has two air-filled drive wheels which influence the straight-line stability of the tug. The air pressure should be checked at regular intervals. If there is a deviation from the target value of 9bar per tire, this should be corrected immediately to ensure smooth operation.

Uneven wear reduces the stability of the tug and the braking distance is increased.

- When changing wheels, make sure that the tug is not tilted.
- Always replace wheels in pairs



WARNING! There is a risk of an accident if wheels are used that do not meet the manufacturer's specifications.



WARNING The user must check the air pressure of the tires at regular intervals according to the maintenance schedule, otherwise the warranty will be void.

7.8 BATTERY REPLACEMENT

In case of a defective battery, the batteries can be replaced in a few easy steps. The following steps should be taken:

1. open the lids to access the batteries.
2. Remove the battery pole caps and disconnect the connections. Make sure that no short circuit occurs.
3. remove the strap that keeps the battery in position.
4. lift out the battery by the handles. Insert a new battery.



Tip: We recommend using a 13mm wrench to remove the battery.



Tip: We recommend that a second person assist with the battery change.



ATTENTION! Only batteries that have either been purchased from the manufacturer or approved in writing may be used!

7.9 REPLACING THE CASTOR WHEEL

1. Press both emergency stop switches and secure the aircraft tug against rolling away.
2. First open the two lids on the sides to get access to the wing nuts highlighted below.



Wing nuts on both sides must be removed



After the wing nuts are removed the hood can be fully opened

3. Once the wing nuts have been removed, the entire hood can be opened to the front and provides access to the four bolts of the castor wheel.
4. Lift the front of the tug using suitable equipment. Ensure that the aircraft tug is properly secured at all times. Never work on an unsecured unit.
5. Remove the four bolts of the castor wheel. Replace the castor wheel with a new one.
6. Carry out steps 1-5 in reverse order.



Tip: To ensure proper replacement, we recommend the following tools and equipment: crane, jack or ramp, as well as metric tools (wrench, ratchet, etc.)

7.10 REPLACING THE DRIVE WHEELS

1. press both emergency stop switches and secure the aircraft tug against rolling away
2. lift the aircraft tug via the designated jack points. Loosen the wheel nuts. Caution! Do not loosen the nuts of the split rim!
4. replace the drive wheel
5. perform steps 1-3 in reverse order.



Tip: To ensure proper replacement, we recommend the following tools and equipment: crane, jack or ramp, as well as metric tools (wrench, ratchet, etc.)

7.11 TROUBLESHOOTING

Occurring Error	Possible Cause	Troubleshooting
Tug does not start	<ul style="list-style-type: none"> - eStop switch pressed - Voltage too low 	<ul style="list-style-type: none"> - pull the eStop up - charge the unit
No radio connection (red LED on the tug) is lit, white LED is off)	<ul style="list-style-type: none"> - Remote control is switched off - Battery of remote control is empty 	<ul style="list-style-type: none"> - Turn on the remote control - replace the battery pack
Radio connection established, but unit does not move (red LED lit/ white LED lit)	<ul style="list-style-type: none"> - Dead Man mode active - Interference in the channel 	<ul style="list-style-type: none"> - Press the horn-button - Press horn and programming button simultaneously
The tug stops abruptly	<ul style="list-style-type: none"> - Radio connection lost - Voltage too low - Overload due to overvoltage 	<ul style="list-style-type: none"> - Restart unit and remote control - Charge the unit - Check the main fuse
Nosewheel arms do not move	<ul style="list-style-type: none"> - No remote connection - Turntable not in default position 	<ul style="list-style-type: none"> - Start the remote control - Bring the turntable in default position manually
Nosewheel arms do not move to the final position / stops	<ul style="list-style-type: none"> - Overload of the air cylinders 	<ul style="list-style-type: none"> - Lower aircraft manually, check fuse if necessary

7.12 ERROR CODES

If an error occurs, this is indicated by an error code in the MDI. The following possible codes may appear:

Error Code	Possible Cause	Troubleshooting
02A77 - Main relay open	<ul style="list-style-type: none"> - Battery voltage too low - Main relay defective 	<ul style="list-style-type: none"> - charge the unit sufficiently - Service/ Exchange the main relay
02A00 - Battery low	<ul style="list-style-type: none"> - The calculated battery charge is $\leq 10\%$ of full charge 	<ul style="list-style-type: none"> - Charge the battery. If this does not help, contact the dealer/manufacturer
02A65 - Engine temperature	<ul style="list-style-type: none"> - This warning appears when the engine temperature sensor opens or reaches more than 150 °C. 	<ul style="list-style-type: none"> - Avoid continuous loading/overloading. After a short rest time, the unit should be ready to use again. Avoid excessive sun exposure.
002A67 - Engine temperature sensor	<ul style="list-style-type: none"> - The engine temperature sensor is defective 	<ul style="list-style-type: none"> - Contact the dealer/manufacturer
02A54 - Over- / Undervoltage	<ul style="list-style-type: none"> - The voltage of the battery is not within 34-9.5V 	<ul style="list-style-type: none"> - When switching on with low voltage, this error may be displayed. Charge the unit. If the error persists, contact your dealer/manufacturer.

8. PACKAGING AND TRANSPORTATION

8.1 UNLOADING THE AIRCRAFT TUG

In order to provide the best possible protection for the aircraft tractor during transport, it is secured in a reusable wooden transport box. The following steps are necessary to move the tug out of the transport box.



To remove the cover, all bolts on the sides and on top must be loosened. All bolts should be marked with a red dot.



The upper bolts on the side of the front access ramp must also be removed in order to lift the cover.



After removing the cover, take off the wooden beams aligned across the aircraft tug.



Remove the remaining bolts from the front cover and take it off.



Before moving the tug, make sure that all straps are removed.



also remove the eyebolts to which the tension straps are attached.



To prevent unwanted movement during transport, there is a wooden wedge in front of the castor wheels, which is bolted to the floor of the box. Remove these bolts and pull out the wedge.



Take the top cover and attach it to the front of the transport box to use it as ramp for the tug.



Then pull the two eStops and start the unit. Wait until the unit has booted and the connection has been established. Then you can drive the tug very carefully and as slowly as possible over the ramp.



ATTENTION! The tug must be unloaded with absolute caution. The manufacturer will not be liable for any damages caused during unloading (unless this process is performed by a TowFLEX employee).



9. DISPOSAL

The final and proper decommissioning or disposal of the aircraft tug must be carried out in accordance with the respectively valid legal regulations of the user country. In particular, the regulations for the disposal of batteries, the equipment as well as the electronics and electrical system must be observed.

The dismantling of the aircraft tow tug may only be carried out by trained persons in compliance with the procedure prescribed by the manufacturer.



TRAINING CERTIFICATE

The training certificate is an internal document certifying that a skilled use of the TowFLEX TF4 has been instructed.

Hereby we confirm that (Name) _____ employed by _____ completed and passed a successful training with subsequent acceptance.

(Name) _____ is now qualified for the following tasks with the TowFLEX TF4:

- Pick-up and handling of aircraft
- Service and maintenance of the aircraft tug
- Training of other colleagues

Both the trainer and the trainee confirm that a professional and complete instruction of the functions as well as the dangers in dealing with the TowFLEX TF4 were addressed and understood.

Date, Internal Trainer

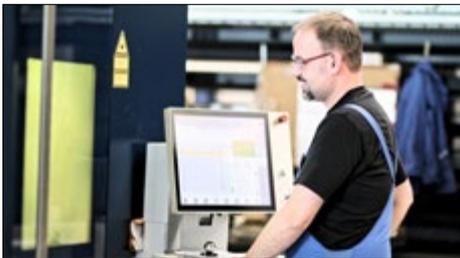
Date, Internal Trainee





TOWFLEX
Aircraft Tugs

TOWFLEX TF4 - UP TO 14.000KG MTOW



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