# Operating and Maintenance Manual
# NEUFORM C3 Series - Ground Adjustable -

Related Types:

CR3-65-(IP)-47-101.6
CL3-65-(IP)-47-101.6
CR3-75-(IP)-47-101.6
CL3-75-(IP)-47-101.6


Rev.4/ 05 March 2018

Manual according to ASTM-F2506-13, Part.-No. of this Manual: 9640

**WARNING:**
**Prior to mounting and prior to the first use of the NEUFORM C3 Propeller the manual must be read completely and carefully as it contains safety relevant information!**

**The manual must remain with the propeller in case of sale.**

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## 1. GENERAL

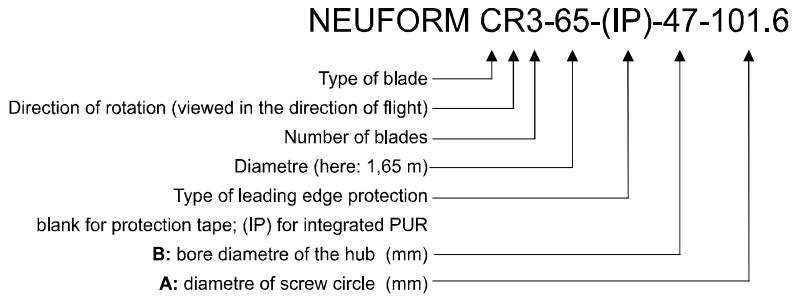
The NEUFORM Adjustable Pitch Propellers are designed for the operation in microlight(ultralight) and experimental aircraft. They can be used for tractor drives as well as for pusher drives. The pitch of the propeller blades can be adjusted on the ground is fixed during the flight.

The possibility to adjust the blades allows the best possible adaptation to the aircraft and has a big advantage compared with fixed propellers. The propeller is low in maintenance and runs smoothly.

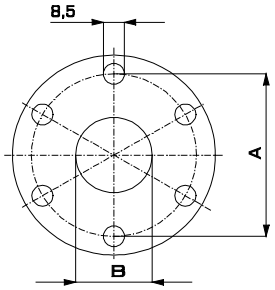
### 1.1. Type Description

The complete type description of a C_3-Propeller contains the type of the propeller blade, a note concerning the direction of rotation („R" or „L", viewed in direction of flight), the number of propeller blades, the propeller diameter, the type of leading edge protection and some flange measures.

Example for type description




Flange measures back of hub




***Note:***

The description of the direction of rotation, diameter and flange measures will not be mentioned in this manual since it is not important for the technical handling of the propeller. Therefore if you own a NEUFORM CR3-65-(IP)-47-101.6, you will find the necessary information under the designation C_3-65.

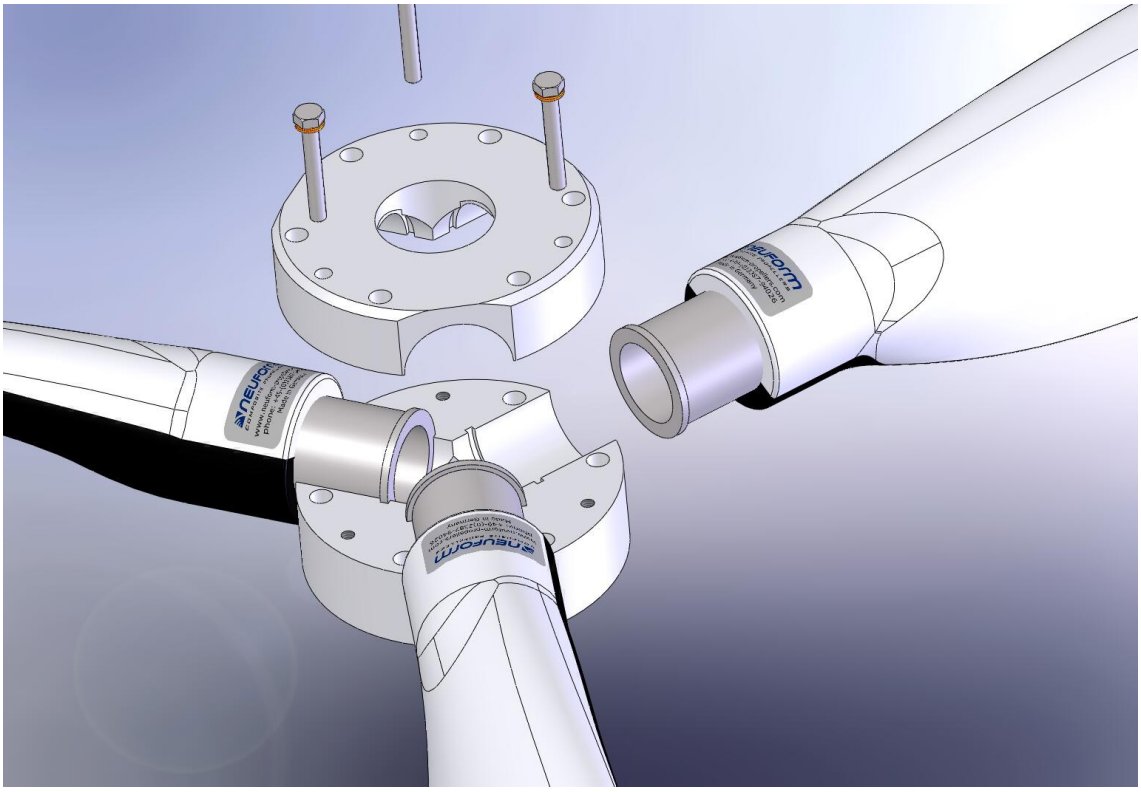
### 1.2. Construction and Functional Features

The NEUFORM C3 consists of a hub and 3 single blades. The propeller blades consist of an upper and a lower shell made of glass fibre reinforced plastic or carbon fibre reinforced plastic respectively and a core made of a special high-resistance foam. The glass fibre shell of the propeller blade is meant to take on the forces that occur during operation.

Therefore special attention needs to be paid to the shell during the daily checks (see. Daily Checks, page 10).

The blades are connected to the hub via a special steel connecting tube that is embedded in the composite. On its outer end it features a collar, that ensures blade retention. As counterpart there is a groove in every blade support of the hub.

As long as the bolts of the hub are not completely tied, the blade pitch is continuously variable. The 2-parts hub will feature a slot between both parts. This is to ensure that the screw forces fully act as clamping force. When finally all screws all fully tied, due to the high clamp forces any changes in pitch are absolutely impossible under all circumstances of operation.



### 1.3. Acceptable Engines

The operation of NEUFORM C3 is acceptable with the following engines:

| Manufacturer | Type | Nominal Performance | Reduction Ratio |
|---|---|---|---|
| Rotax | 912 UL / A / F config. 2 or 4 | 59.6 kW | 2.273 |
| Rotax | 912 UL / A / F config. 2 or 4 | 59.6 kW | 2.43 |
| Rotax | 912 ULS / S config. 2 or 4 | 73.5 kW | 2.43 |
| Rotax | 912 iSc / iS config. 2 | 73.5 kW | 2.43 |

Operation with similar engines is conceivable, if it is ensured, that the propeller is always operated within its operating limits. If mounting of an engine not mentioned in the list is desired please contact Neuform by all means.

### 1.4. Technical Data

| | | |
|---|---|---|
| Propeller Type | C_3-65 | C_3-75 |
| Diameter | 1,65 m/65" | 1,75 m/68.9" |
| Mass moment of inertia | 3830 kg/cm$^2$/3.39 lb·inch·s$^2$ | 3920 kg/cm$^2$/3.47 lb·inch·s$^2$ |
| Weight* | 5,1 kg/11.2 lb | 5,2 kg/11.5 lb |

*) Since the propeller blades are handcrafted, slightly variations in total weight are possible

## 2. OPERATING LIMITATIONS

Various loads have an effect on the propeller during the operation. The loads consist of bending loads due to thrust and the power applied, centrifugal forces and gyroscopic loads. They basically depend on the *number of revolutions* and on the *power* with which the propeller is operated:

### 2.1. Maximum Allowable Propeller Rotational Speed

Maximum allowable propeller speed: $n_{max} = 2600\ min^{-1}$

### 2.2. Maximum Allowable Engine Power

The maximum allowable power input to the propeller is limited to 100 kW.

### 2.3. Allowable Pitch Settings

Basically the propeller can be operated in a pitch range between **14°** and **24°** measured at 75% blade radius resulting in engine speeds at full throttle on ground between 4500 and 5300 1/min.

CAUTION: If the certification data sheet of the airplane defines a certain pitch, then this pitch has to be used to set up the propeller. Other settings then are not allowed.

### 2.4. Life Limitations

So far though no problems in connection with ageing or fatigue have become known, so the time of use is not restricted to a flat rate. However it is absolutely necessary to carry out the Factory Overhaul (see page 7) in order to guarantee a safe operation.

### 2.5. Aerobatics

Aerobatics cause higher loads to the propeller. This propeller has not been tested for aerobatics. That's why aerobatics are not allowed.

## 3. FLIGHT OPERATION

### 3.1. Usual Operation

Prior to operation make sure that the daily check (see Daily Checks, page 10) has been carried out. Always choose a flight path that ensures a landing without engine any time.

WARNING! Never operate the propeller on ground while persons or animals are close.

Apart from that there are no special operation procedures. The pilot is responsible for keeping the propeller within it's operation limitations any time.

### 3.2. Emergency Operation

In case of sudden unusual vibration reduce power and land at the next possible airfield.

In case of sudden extreme vibration cut off the engine and land in gliding flight.

## 4. ASSEMBLY AND ADJUSTMENT

### 4.1. Assembly

#### 4.1.1. To start with: a few words with regard to nut retention

The kind of nut retention to be used depends on the bores of the engine or the gear flange respectively of your drive:

Use lock nuts for bores without thread for nut retention. There is no need to use any further securing devices like Nordlock or Loctite as mentioned below.

If there are screw threads, nut retention can be done easily with the help of Nordlock washers that can be reused.

***CAUTION:***

If Nordlock-Washer are used: Place two of the supplied Nordlock washers under every screw head. Make sure that the two washers face each other in a way that the coarse, ascending sides touch each other. Only in this position can the washers secure the nut.

#### 4.1.2. Clean Components

Please clean all components prior to assembly. Especially make sure, that the engine flange, the hub, and the steel connection tubes of the blades are free of any kind of lubricant.

#### 4.1.3. Sequence of Assembly

1. **Mount the blades to the hub**
2. **Adjust the pitch**
3. **Mount the propeller to the aircraft**
4. **Tighten the screws**

The propeller hub comes in two parts. For the delivery it is only loosely screwed with M6 screws. On the outside of each half of the hubs you will find an imprinted number.

Both halves must display identical numbers!

Loosen the screws and lift the two halves apart from each other. The delivery consists of 3 M6 screws, 6 M8 screws, Nordlock lock washers in two sizes as well as 6 M8 lock nuts.

#### 4.1.4. Mounting the Blades to the Hub

Put the half of the hub, that shows screw threads, on a table and place the propeller blades in the fitted areas.

At this moment the pitch of the blades are not yet of importance.

Now place the second half of the hub on the first one.

***Important:***

Make sure that the imprinted numbers of both halves of the hub face each other.

Now screw down the two halves using the M6 screws:

Don’t forget the appropriate nut retention (see page 7).

Do not fasten the screws too tightly. It should still be possible to turn the blades.

***Important:***

Now pull all blades radially to the outside up to the limit.

#### 4.1.5. Adjusting the Blade Angle

Adjusting the blade angle is not that simple and requires some patience.

Ask somebody to help you in order to simplify the procedure.

The fitted areas of the hub and the connecting tubes of the blades must be absolutely grease-free in order to prevent a rotation of the blades during the operation.

Use the adjusting gauge provided by us to adjust the blade angles

(for the use of the NEUFORM adjusting gauge please refer to page 9).

If your aircraft has got a tractor drive place the propeller on the table with the heads of the screws pointing downwards. Then turn the blades so that their lower sides point upwards and adjust the blade angles this way.

If your aircraft has got a pusher drive mount the propeller to the aircraft now and make the adjustments there. This is somewhat more comfortable (see: Mounting the Propeller to the Aircraft, page 8). After you have adjusted the angles of all blades tighten the screws more firmly and check the angles of all blades.

You may have to make some adjustments until all angles are identical and the screws are firmly tightened.

***Important:***

The blade angles need to be adjusted very thoroughly in order to avoid aerodynamic unbalanced situations later on.

For notes concerning the pitch please refer to 2.3 Allowable Pitch Settings, page 6.

#### 4.1.6. Mounting the Propeller to the Aircraft

Mount the propeller to the engine flange using the M8 screws provided.

Please make sure again to use the appropriate nut retention (see page 7).

If you still want to make the adjustment of the blade angles (push drive) tighten the M8 screws only very slightly and adjust the blade angles first (see: Adjusting the Blade Angle, page 8).

#### 4.1.7. Tightening the Screws

Pay attention to the sequence while tightening the screws.

Start with tightening the M8 screws crosswise with 27 Nm.

Then tighten the M6 screws with 10 Nm.

When loosening the screws you need to use the reverse sequence. The M6 screws should only be relieved slightly from their tightening torque.

If the M8 screws were loosened first the tensile stress of the M6 screws would rise enormously. As a result the loosening of these screws would become impossible or the screws would shear off during the loosening process.

***Note:***

The M6 screws are meant to keep the propeller in one piece after the M8 screws have been removed. This way the adjusted blade angles remain and do not have to be readjusted. Therefore the propeller can be removed from the aircraft completely and can be mounted again later.

The tightening torque of all screws must be checked after 2 operating hours.

### 4.2. Using the NEUFORM Adjusting Gauge

The adjusting gauge consists of an angle gauge on the one side and a couple of reference heads on the other side (two hexagon socket screw heads with reference disks).

The gauge measures the blade angle in a constant distance of approx. 365 mm from the rotational axis of the propeller. This corresponds to approx. 40% of the propeller radius. Due to the torsion of the propeller blade the angle measured in this way is not identical with the angle at 75 % of the radius as it is stated in the aircraft registration.

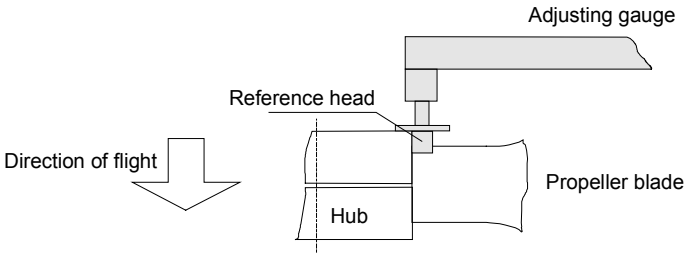
In order to adjust the correct angle an angle conversion becomes necessary. This can be done using the following table:

| $\alpha_{NEUFORM} = \alpha_{75\%} + K$ | |
|---|---|
| C_3-75 | +10° |
| C_3-65 | +9° |

Begin with adjusting the desired blade angle at the angle gauge.

The following instructions may sound complicated at first but they are really rather simple:

Place the adjusting gauge on the hub in a way that both reference heads are positioned on the edge of the hub (sketch). The longitudinal axis of the adjusting gauge must run parallel to the longitudinal axis of the blade. The angle gauge should lie against the propeller blade without any pressure.




Now the angle gauge touches the lower side of the profile of the propeller blade at one point. Turn the blade until the back edge of its profile and another point of the frontal profile area of the blade touch the tongue of the adjusting gauge. Now a specified angle is established (sketch).

### 4.3. Disassembly

Loose the M6 screws only slighty, because loosing the M8 screws first would hand over the full high clamp force to the 3 M6 screws, which would make it difficult to loose them if desired later.

Then loose the M8 screws and remove the propeller from the airplane. You can now store the propeller if you like while keeping it's adjustment.

If you want to disassemble the propeller as well, put it onto a table, loose the M6 screws and remove the blades.

## 5. CHECKS

### 5.1. After the First Flight

NOTE: After the first flight after each new assembly of the propeller hub, the tightening torque of the flange bolts must be checked as described in 5.4.

This is necessary to counteract torque settlement effects.

### 5.2. Daily Checks

Check the propeller prior to each operation for the following items:

- **Hub free of cracks**
- **Are all blades and all screws tight ?**
- **No damage of the propeller blade composite fabric**
- **No cracks in the blade surface**
- **No blade tip play**

Always keep the propeller clean on order to have good visibility to the propeller surface.

### 5.3. 25 Hours after Propeller Assembly

25 hours after each new assembly of the propeller hub, the tightening torque of the flange bolts must be checked as described in **5.4**.

### 5.4. 100-Hours Check

- **Remove spinner cap**
- **Clean propeller thoroughly**
- **Perform daily checks (->5.2)**
- **Check the tightening torque of the flange bolts. Do not unscrew to do that. The correct tightening torque is 27 Nm. Use a calibrated torque wrench.**

**CAUTION: Too high or too low a tightening torque may damage the screws!**

### 5.5. Factory Overhaul

After every **2000 hours of operation** the propeller must be submitted to a Factory Overhaul at the NEUFORM works or an authorized partner. To keep a record of the operation time, a flight log must be kept. Any further operation of the propeller after reaching 2000 operating hours is not permitted without the factory overhaul!!

## 6. DAMAGES

The propeller must be taken out of operation if cracks in the blades or the hub or any other damage to the fabric occur. In all cases of doubt the operation has to be terminated as well.

Intensive wear of the integrated leading edge however is allowed and does not impair further operation as long as the fibre fabric beneath is not yet visible.

## 7. REPAIRS

Minor damage to the coloured top layer can be repaired by qualified persons on their own accord. The surface resin needed for this can be obtained from NEUFORM in small quantities.

All other repairs should be done by NEUFORM or authorized partners.

## 8. SERVICING AND MAINTENANCE

The propeller and the hub must always be kept clean in order to guarantee a faultless visual inspection during the daily checks.

Clear water is ideal for cleaning. You may add some washing-up liquid and use a soft sponge. The plastic surface should be polished with car polish from time to time.

There is no need for any other maintenance than the daily checks.

## 9. RECORD OF REVISONS

| Revision | Date | Subject |
|---|---|---|
| Edition 1 | 25.09.09 | |
| Revision 1 | 30.08.12 | Rotax 912 iSc /iS added |
| Revision 2 | 06.06.13 | Typing error under 2.4 Life Limitations (number of hours) removed |
| Revision 3 | 2.03.15 | Reference to ASTM F2506 updated from 07 to 13 |
| Revision 4 | 5.03.18 | Redefinition of *1500-Hours Check* to *Factory Overhaul* and increase of interval to 2000 operating hours |