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USER MANUAL

HANDCYCLE ASSEMBLY AND MAINTENANCE

TROUBLEMAKER



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Contents

1. GENERAL INFORMATION	3
2. INTENDED USE	3
3. USER WEIGHT AND TOTAL HANDCYCLE WEIGHT	4
4. SAFETY	4
5. RIDING THE HANDCYCLE ON PUBLIC ROADS	4
6. SPARE PARTS	5
7. HANDCYCLE ASSEMBLY AFTER DELIVERY	5
7.1. Package contents	5
7.2. Tools necessary for assembly	6
7.3. Assembling the components	7
7.3.1. Front fork assembly	7
7.3.2. Footrest assembly	14
7.3.3. Installing the backrest supports	15
7.3.4. Rear wheels assembly	17
7.3.5. Installing the rear brake calipers	19
7.3.6. Connecting the wiring to the battery base (optional), arranging the wiring bundle, installing flags	20
7.3.7. Adjusting the seat, backrest, and drive crank position	22
8. MAINTENANCE	25
8.1. Inspecting screws and bolts	25
8.2. Inspecting brakes	25
8.3. Adjusting the gear shift system	26
8.4. Chain maintenance and chain elongation	28
8.5. Inspecting tires	28
8.6. Checking for slack in the fork steering system	29
8.7. Electric assist maintenance	30
8.8. Periodic inspection of the handcycle	31
8.9. Cleaning the handcycle	31
8.10. Tightening torques for threaded connections	32
9. WARRANTY CARD	33
10. WARRANTY TERMS AND CONDITIONS	34
11. SUMMARY	36
12. CONTACT	36

1. GENERAL INFORMATION

This manual contains information on how to assemble the Troublemaker three-wheeler handcycle after delivery at the dealer's or at the user's residence.

It contains guidelines for adjusting and maintaining individual components during operation. An important part of this document are the safety rules of using the handcycle.

Since the handcycle is a complex design, this manual does not fully cover its maintenance and servicing. If repair, service, or maintenance are necessary, please contact the dealer or the handcycle manufacturer to obtain the necessary information or arrange a visit to an authorized service center.

There may be differences between the information contained in this manual and the information contained in the manufacturer's instructions on the maintenance of specific parts of the handcycle (e.g., hubs). In that case, follow the manufacturer's instructions.

If you receive the handcycle from a distributor, the distributor is obliged to deliver the handcycle assembled and properly working. Before the first ride, read the chapters "4. SAFETY" and "5. RIDING THE HANDCYCLE ON PUBLIC ROADS" of this manual.

If the handcycle was ordered directly by the user, it should be assembled in accordance with chapter "7. HANDCYCLE ASSEMBLY AFTER DELIVERY". After assembly, the user is obliged to follow the rules specified in the remaining chapters of this manual.

2. INTENDED USE

The basic condition for ensuring the long life and failure-free use of the handcycle is to use it as intended. Troublemaker was designed for bike paths and hardened trails, like gravel forest roads and dirt roads. The main idea behind the project was to enable cycling for people who, due to physical limitations, are unable to use a classic handcycle. Troublemaker was created primarily for children. This model is decidedly not suitable for riding in off-road and extreme conditions such as freeride, downhill, jumping, etc. Failure to comply with any of the above may lead to premature wear of the handcycle and damage to its components. Using the equipment in a manner inconsistent with its intended purpose indicates that the user intentionally places himself in danger, incurring the risk of serious health consequences. The manufacturer and the dealer are not responsible for any malfunctions, damage to the handcycle, or health issues resulting from improper use of the equipment. Any malfunctions and damage resulting from improper use of the equipment will not be included in the warranty.

3. USER WEIGHT AND TOTAL HANDCYCLE WEIGHT

The Troublemaker handcycle was designed for children, so the maximum user weight should not exceed 50 kg. The total weight of the handcycle with the user and paraphernalia should not exceed 60 kg. The handcycle is designed to be used by people with a minimum height of 120 cm to a maximum of 160 cm.

4. SAFETY

After assembling the handcycle, before a test ride, check if all mechanisms work as intended. A detailed description of these inspections can be found in chapter “8. *MAINTENANCE*” of the manual. Inspection of the braking system and the components responsible for shifting gears is mandatory. The handling of a three-wheeled handcycle is completely different from a typical two-wheeled design. Driving, shifting, and braking are done with two limbs, not four. For safety reasons, you should make sure that your first ride takes place in a less frequented location, which will provide adequate space to maneuver freely and become familiar with riding a three-wheeled handcycle. The supervision of an adult is essential here, as the adult can safeguard the first attempts made by the young user. Since it is important to protect the child’s body, a certified helmet, gloves, and protective glasses are recommended, even during the test ride. To prevent items of clothing from getting caught in the handcycle’s drive, the user should avoid wearing loose clothing. To protect knees and elbows against possible injury caused by a fall, using dedicated pads is recommended. Shoes are equally important. The user should choose high shoes that will protect the ankles against bruising if they fall. Shoes should be laced securely to fit the foot well.

Securing the handcycle to prevent theft is also advisable. The user should write down the serial number of the frame and register the handcycle with the appropriate offices (police, municipal guard). The frame serial number must also be added to the warranty card. The card with a dealer’s stamp is proof of handcycle ownership. Do not leave your handcycle unlocked and unattended.

5. RIDING THE HANDCYCLE ON PUBLIC ROADS

The Troublemaker handcycle is intended for recreational purposes, and its basic version cannot be used on public roads or if visibility is poor. To enable riding on public roads and in poor visibility, the device must be equipped with lighting that is compliant with the regulations in force in the country where the handcycle will be used. The handcycle is intended to be used

by children; therefore, after equipping it with lighting, riding on public roads must take place under the supervision of an adult.

6. SPARE PARTS

The handcycle is built with original parts from recognized manufacturers to ensure an appropriate level of safety and functionality. The friction materials of brakes, tires, tubes, and steering column bearings are critical equipment for safety reasons; therefore, they must be maintained in accordance with the guidelines specified in chapter “8. *MAINTENANCE*”. If it is necessary to replace any of the components listed above, substitutes of equivalent quality should be used. Please contact the dealer or handcycle manufacturer for information on spare parts and accessories.

7. HANDCYCLE ASSEMBLY AFTER DELIVERY

This chapter describes the contents of the package, the tools needed to assemble the handcycle parts, and how to perform all assembly steps. It contains the necessary illustrations.

7.1. Package contents

After unpacking the package and organizing the components, the person assembling the handcycle should have the following parts:

1. Handcycle fork, consisting of:
 - assembled electric motor or Schlumpf drive (depending on the order) together with a complete drivetrain system, i.e., front wheel, chain, chain tensioner;
 - mounted display with a function switch for operating the electric motor (only if the electric assist was ordered);
 - brake system with completed bleeding for the front wheel and rear wheels (optional);
 - adjusted shifting gear system;
 - drive cranks with arms and attached brake levers (or one lever if the order was only for a front wheel brake) and a gear shifter;
 - steering limiter attached with a dedicated screw.
2. Footrests with harnesses;
3. Main frame with the seat and backrest attached (the seat and backrest are not visible in Figure 1), additionally bearing races mounted in the head and a headset, seat backrest supports attached to the frame, and a battery base in the case of the electric motor option;

4. Rear wheels with axles;
5. Battery (only if the handcycle is delivered to the recipient by road transport);
6. Flags with mounting brackets.

The contents of the package are shown in Figure 1.

7.2. Tools necessary for assembly

The following tools are needed to assemble the Troublemaker components:

1. 1 x 10 mm combination spanner;
2. 1 x 13 mm combination spanner;
3. 1 x 14 mm socket spanner;
4. 1 x HX8 Allen key (in case of the option with the electric motor);
5. 1 x HX6 Allen key;
6. 1 x HX5 Allen key;
7. 1 x HX4 Allen key;
8. 1 x HX1.5 Allen key;
9. 1 x electrical cable cutter.



Fig. 1. Components of the Troublemaker handcycle included in the package (the seat and the backrest attached to the frame are not visible in the photo).

7.3. Assembling the components

7.3.1. Front fork assembly

To ensure comfort during handcycle assembly, it is best to place the main frame at hip height so that it is accessible from all sides. You can, for example, place it on a tool chest or on a table of appropriate dimensions (a square table 450x450mm with a solid base will be adequate). Additionally, the frame should be properly attached to the chest or table so that it does not move during assembly. The head of the frame must be completely outside the outline of the cabinet or table so that it does not hinder the fork assembly. Before starting work, secure the main frame from paint damage using, for example, several layers of stretch film, rags, etc., and leave only the area on which the assembly will be performed at this moment exposed.

Since the fork is supplied fully assembled, it is very heavy, making it a difficult component to work on. Two people are therefore required to connect the fork to the main frame.

The front fork assembly should begin by preparing the headset for attachment. The set should be removed from the fork head. The parts should be arranged on the table, dividing them into the lower set (marked in Figure 2 with a red arrow) and the upper set (marked in Figure 2 with a green arrow), in the same order as they were in the frame. Then, in the fork, dismantle the steering limiter (marked with a blue arrow in Figure 3) with a HX6 Allen key, and the upper arch (marked with a red arrow in Figure 3), by unscrewing all the screws securing it with a HX5 Allen key.



Fig. 2. Frame head with a headset (photo shows fork head in XCR handcycle with similar bearings).

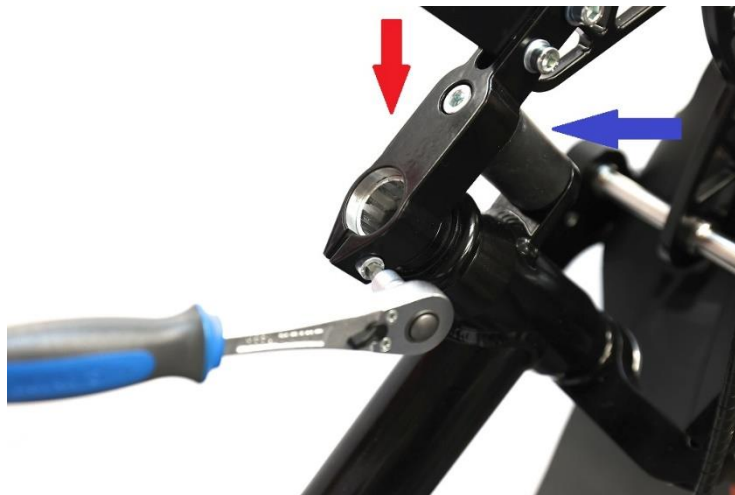


Fig. 3. The upper arch is marked with a red arrow, and the steering limiter is marked with a blue arrow.

The steerer tube, which is attached to the lower arch, can be lubricated with technical Vaseline, and then the lower set of head bearings should be inserted into it, i.e., the lower outer race, dust cover, and bearing, which should be positioned with the rollers towards the race in the frame head. The fork prepared this way, with the help of a second person, should be inserted with the steerer tube on the bottom into the frame head carefully, until it stops, i.e., until the

lower bearing rests simultaneously on the race in the frame head and the race mounted on the steerer tube. One person should hold the fork in the straight-ahead position. The second person should then attach the upper set of head bearings. The assembly should be started with the bearing, positioning it with the rollers towards the race mounted in the frame head. Then, install the outer race, insert the rubber ring with the conical surface towards the bearing, a thin washer covering the rubber ring, the spacer washers included in the set, and finally, insert the upper arch (Figure 4) onto the steerer tube, making sure that the fork profile fits between its sides. The next step is to install the cap, which is used to eliminate the slack in the head bearing. The cap should be initially tightened with an HX5 Allen key (Figure 4) until the first resistance. During this operation, check whether the parts located on the steerer tube are positioned correctly, especially the rubber ring in the upper set. The next step is to replace the screws that attach the upper arch sides to the fork profile. These screws should be lightly tightened and left loose (marked with a red loop in Figure 4). This is the moment when you should eliminate the slack in the head bearing.



Fig. 4. Mounting the upper arch cap

It is necessary for a second person to constantly hold the fork in the straight-ahead direction until the steering limiter is installed. This will ensure the slack will be eliminated with the required precision, and an unsecured fork without the steering limiter will fall rapidly to the left or right side, which may result in damage to the paintwork.

To eliminate the slack in the headset, gradually tighten the screw securing the cap, which was previously screwed until the first resistance was felt (HX5 Allen key). From this point, this operation should be performed in stages, i.e., the screw should be tightened by $\frac{1}{2}$ turn, and the

slack in the headset should be checked by moving the fork up and down alternately. When the slack begins to decrease, the screw tightening should be reduced to $\frac{1}{4}$ turn. When the slack is already negligible, the screw tightening should be reduced again, this time to $\frac{1}{8}$ turn, until it is eliminated. When the slack is eliminated, then the screw clamping the upper arch on the steerer tube should be tightened with the HX5 Allen key to a torque of 10 - 12 Nm (Figure 5).



Fig. 5. Tightening the upper arch clamp screw.

Next up are the screws connecting the upper arch to the fork (Figure 6), which should be tightened to a torque of 10 - 12Nm using an HX5 Allen key.



Fig. 6. Screws connecting the upper arch to the fork.

The next step is to install the steering limiter, which should be set so that the fork maintains a straight-ahead direction, and then both of the mounting screws should be tightened with an HX6 Allen key to a torque of 20 Nm (Figure 7). The last element to be installed in the frame tube area is the cover for the central upper arch screw, which is used to eliminate slack in the headset.



Fig. 7. Lower steering limiter mounting screw.

The fork is connected to the frame. To power the handcycle, the drive cranks must be mounted. On the right side, mount the crank that has the brake lever and gear shifter mounted on the grip. On the left side, mount the crank with a “clean” grip or with a brake lever in the case of the option with rear axle brakes. The cranks and grip axles are marked “R” for the right side and “L” for the left side (Figure 8). If you are unsure, look for these markings. The sides of the handcycle should be located from the driver’s position.

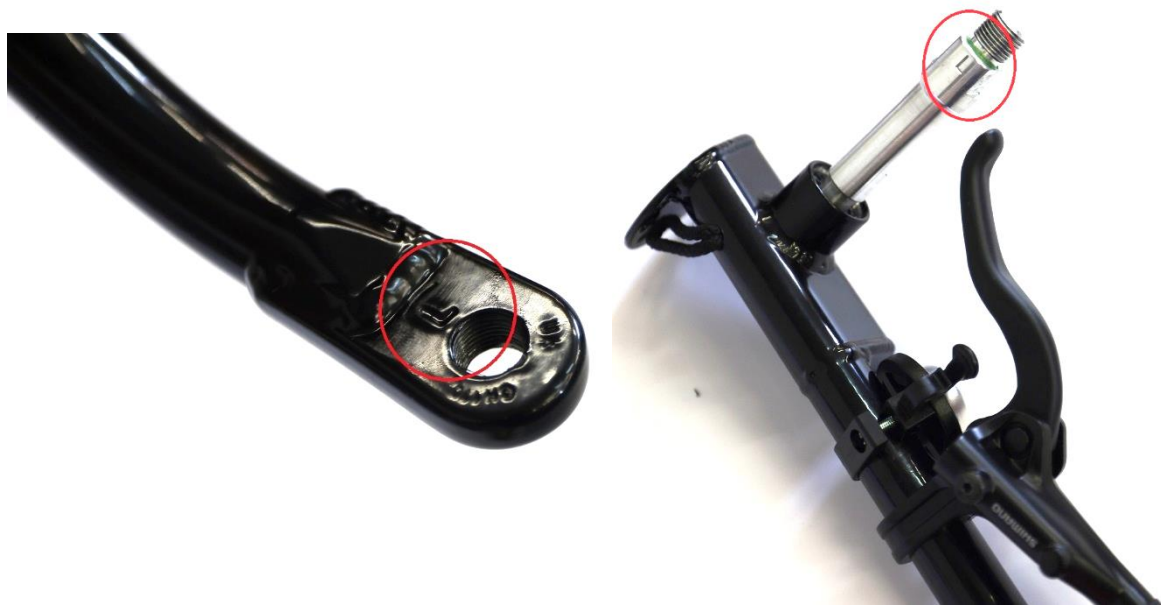


Fig. 8. Crank and grip axis marking.

Depending on the option ordered, the handcycle can be equipped with electric assist or a Schlumpf Mountain Drive gear. The crank assembly is different in those cases.

For handcycles equipped with electric assist, the cranks should be tightened with dedicated screws, which were screwed into the drive axle for transport. After unscrewing them (if it cannot be done by hand, use an HX8 Allen key), the cranks should be placed on greased pivots, making sure that they are positioned concurrently and do not rotate alternately, as they would in a classic two-wheeled bicycle. The crank screws should be tightened with an HX8 Allen key with a torque of 38 - 42 Nm. The method of attaching the cranks is shown in Figure 9.



Fig. 9. Crank assembly with electric assist option (photo shows the XCR handcycle. For Troublemaker, the assembly is identical)

In the case of a Schlumpf gear, the tool set shown in Figure 10 is required to assemble the cranks – a 14 mm socket spanner, a button rotation lock, and an HX1.5 Allen key.



Fig. 10. Set of tools for assembling the cranks on a Schlumpf Mountain Drive

The cranks should be placed on pivots and then tightened to a torque of 50-55 Nm using a 14 mm socket spanner. Figure 11 shows the screw that fastens the crank to the gear.



Fig. 11. Crank mounting screw marked with a red loop.

Then, using the rotation lock and the HX1.5 Allen key, assemble the buttons used to change the gear ratio. The method of assembling the buttons is shown in Figure 12. The tightening torque of the buttons in the gear manufacturer's instructions is specified at 110 cNm, which is 1.1 Nm. It is difficult to find a hand tool that would allow you to tighten the screw with such precision, so the manufacturer recommends that the buttons be tightened by hand with sensitivity, bearing in mind the fragility of the elements.

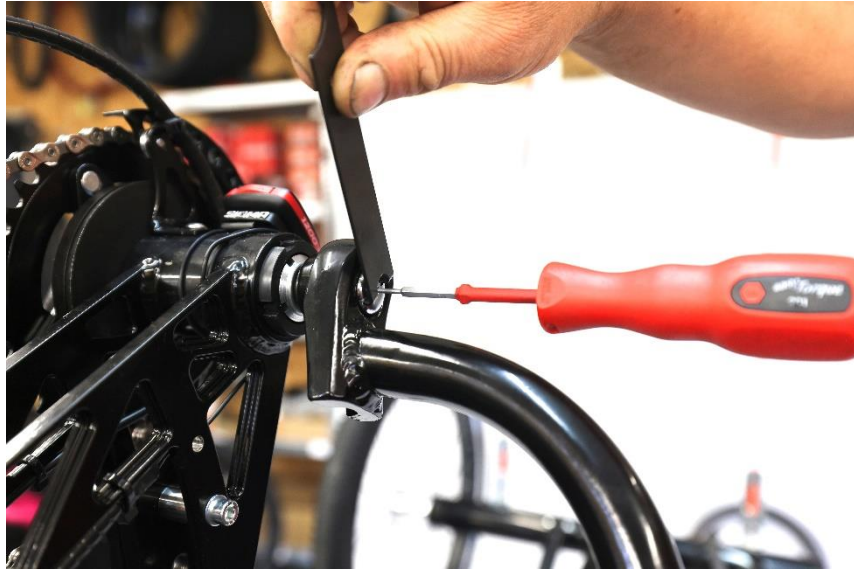


Fig. 12. Gear shift button assembly is similar on both sides.

In the next step, put the tools aside and try to unscrew the button by hand. If the attempt is successful, tighten it again and try to unscrew the button again using only your hand. Under no circumstances should assembly glue be used to mount the buttons. Figure 13 shows the crank mounted on the gear.



Fig. 13. The final result of mounting the drive crank on the Schlumpf gear.

7.3.2. Footrest assembly

To complete the front fork, the footrests must be installed. The right footrest is shown in Figure 14, along with its assembly location. The mounting screws were attached to the footrest mounting locations for transport. Start the assembly by unscrewing the footrest mounting

screws from the fork. If this is difficult to do manually, use an HX5 Allen key to help. Then, the footrest adjustment rail should be placed against the fork in such a way that both threaded holes are visible in the oval hole of the rail, in which the screws should be placed. The screws should be tightened to a torque of 10 - 12 Nm. The oval holes in the footrests allow them to be adjusted, which allows the backrest to be set in the right position for the user's height.



Fig. 14. Right footrest mounting location.

The left footrest should be mounted similarly. The rounding of the footrest profile should always be positioned in the direction of driving straight ahead.

7.3.3. Installing the backrest supports

As described in section 7.1, the handcycle comes with a seat and backrest mounted on the frame. To set the backrest in the correct position, attach it to the supports, which are also mounted to the frame (Figure 15).

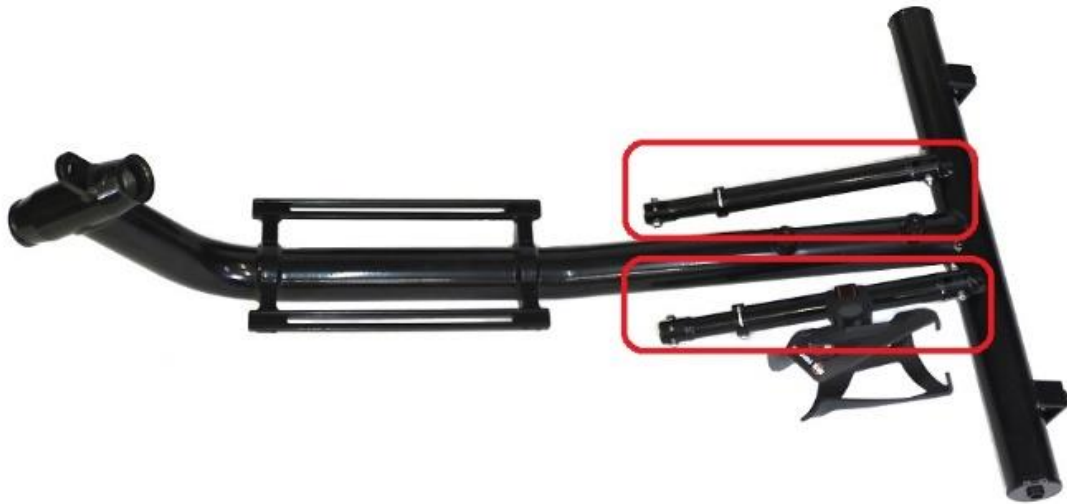


Fig. 15. Seat backrest supports marked with red frames.

Dedicated bolts and nuts are attached to the bracket forks and should be removed before assembly. Between the forks of each support, place the corresponding loop of the side profile of the backrest and insert the bolt through them, directing its thread towards the handcycle frame. Then, using HX5 Allen keys and a 10 mm combination spanner, tighten the connection with a tightening torque of 10-12Nm. After installing the backrest supports, tighten the bolts connecting the backrest to the seat (Figure 16) using HX5 Allen keys and a 10 mm combination spanner with a tightening torque of 10-12Nm.



Fig. 16. Bolt connecting the backrest profile with the seat profile (here visible on the right side of the handcycle)

7.3.4. Rear wheels assembly

Installing the rear wheels on the Troublemaker handcycle is the easiest task in this manual. Depending on the side of the assembly, the wheels should be selected based on the rotation direction marking on the tire. The wheels should be attached so that the rotation direction marking on the tire is positioned towards the front of the handcycle. If the handcycle does not have brakes on the rear axle, the wheels are mounted using a quick-release skewer. Simply press the lock button on the wheel hub and insert the axle into the socket on the rear axle of the handcycle (Figure 17).



Fig. 17. Handcycle rear wheel axle with the quick-release skewer

The wheel axle should be inserted as far as it will go, and after releasing the lock button, check whether the wheel does not slide out by itself. If it cannot be pushed out, it means that it has been properly attached. A properly attached wheel is shown in Figure 18. A wheel mounted on a quick-release skewer has a minimal level of assembly slack. This is a natural feature of this element.



Fig. 18. Fig. 18. Correctly attached rear wheel

If the handcycle was ordered with rear axle brakes, then the rear wheels of the handcycle are supplied with mounting axles attached to the spokes. Both axles are right-handed. The mounting side of a wheel should be selected in the same way as the wheels mounted on a quick-release skewer by finding the rotation direction marking on the tire. You can also use the rotation direction marking on the brake disc. We selected the wheel so that the arrow on the tire or disc after mounting points in the direction of the front of the handcycle. Before attaching the wheel, check whether the threads in the wheel axles are greased, which will protect them from seizing. The wheel should be attached with a 19 mm spanner and a tightening torque of 40 Nm. The method of assembly is shown in Figure 19.



Fig. 19. Rear wheel assembly (the photo shows the XCR handcycle wheel; the assembly in Troublemaker is similar)

7.3.5. Installing the rear brake calipers

Since the rear brake calipers are already attached to the brake lever and the entire system is bled, the handcycle must be removed from the assembly stand and placed on its wheels to mount them. This is necessary because the wiring bundle visible in Figure 20, in which the brake cables are interlaced together with the electric cable connecting the electric drive (if ordered) to the battery base, is routed under the handcycle seat.

The wiring bundle and clamp should be led under the handcycle in the location shown in Figure 21. The cables should be routed along the left side of the frame head and then along the center tube of the frame, which is located under the seat. The bundle should be left loose until the rear clamps are mounted.



Fig. 20. Wiring bundle with T-piece and rear caliper brake lines (photo shows XCR handcycle; similar solution was used in Troublemaker)



Fig. 21. Routing the wiring bundle with brake and electric cables (the photo shows an XCR handcycle; a similar solution was used for Troublemaker)

The brake calipers must be prepared for installation by removing the spacers from between the brake pads. The spacers are secured against falling out with cable ties, which must be cut to make removing them possible (Figure 22).



Fig. 22. Removing the spacers from between the brake pads.

Both calipers were dismantled for transport together with the adapters to avoid having to readjust their position relative to the brake disc after the handcycle is delivered to the distributor or the user. The caliper, ready for assembly, should be gently pushed onto the brake disc so that it fits between the pads. Then, the adapters should be screwed to the mounting brackets using the screws screwed into them for transport. The mounting screws should be tightened with an HX5 Allen key with a torque of 10-12Nm. The assembly method is shown in Figure 23.



Fig. 23. Rear brake caliper assembly.

7.3.6. Connecting the wiring to the battery base (optional), arranging the wiring bundle, installing flags

In the last stage of assembling the handcycle, connect the electrical system to the battery base, arrange the wiring bundle under the seat, and mount the flag. Connecting the battery base is a simple task. The yellow plug coming out of the base should be plugged into the system's yellow socket. The socket and the plug only fit together in one arrangement, so there is no risk of reversing the polarity of the connector. The connection is visible in Figure 24.



Fig. 24. Connecting the electrical system to the battery base (the photo shows an XCR handcycle; in Troublemaker, the connection looks identical, but the base is mounted in the opposite direction).

The section of the wiring that runs along the central tube under the seat should be attached to this tube with several cable ties. It is recommended that the front wheel be turned as far to the right as possible during this task. The section of the wiring that comes out from under the seat in the area of the frame head should be attached using a cable tie without pulling the tie completely out. This is to allow the bundle to move during maneuvering.

The flags are mounted by screwing their grips to the rear axle of the frame, as shown in Figure 25. This should be done using an HX4 Allen key, tightening the mounting screws to a torque of 6 - 8 Nm.



Fig. 25. Flag assembly (the right side is shown in the photo, the left side has similar assembly)

The flag is the culmination of the work leading to the final effect, which is the complete Troublemaker handcycle visible in Figure 26. The last stage of work to be performed is to adjust the position of the seat, backrest, and the height of the drive cranks.



Fig. 26. The final result - the complete Troublemaker handcycle

7.3.7. Adjusting the seat, backrest, and drive crank position

Troublemaker was designed for children and people between 120 and 160 cm tall. For this reason, the seat and footrests of the handcycle can be adjusted backward and forwards, the angle of the backrest can be changed, and there are 3 crank height positions available.

It is best to start adjusting the user's position by setting the seat distance. To do this, loosen the screws connecting the backrest profiles to the seat profiles (marked with red loops in Figure 27) and all screws fastening the backrest supports (red loops in Figure 27), using HX5 Allen keys and a 10 mm combination spanner. Then, using the HX4 Allen key, loosen the clamps on the backrest supports (yellow loop in Figure 27). The last screws to loosen using the HX5 Allen key are the seat fastening screws marked with a blue frame in Figure 4. Now, place the seat in the desired position.



Fig. 27. Screws that need to be loosened to adjust the distance between the seat and the drive cranks.

The seat distance should be adjusted so that when the cranks are at their maximum distance from the user's chest, the arms are still slightly bent at the elbows. When the seat is

placed in the correct position, tighten the screws marked with a blue frame in Figure 27 using an HX5 Allen key to a torque of 10 - 12 Nm.

The next step is to select the backrest angle. Here, too, remember that it is important to select a backrest position that ensures a slight bend in the user's elbows when the crank grips are as far away from the user as possible. It is also important to ensure that there is free space between the user's chest and the electric assist motor or the Schlumpf gear chainring. This is important for safety reasons, as well as for getting on and off the handcycle. When the correct backrest position is found, first, retighten the screws in the bracket clamps marked with a yellow loop in Figure 27 using an HX4 Allen key. The tightening torque, in this case, should be in the range of 6 – 8 Nm. Then, the bracket mounting screws should be tightened to a torque of 10 – 12 Nm using the HX5 and 10mm Allen keys.

After adjusting the seat and backrest, move on to adjusting the footrests. To adjust their position, use an HX5 Allen key to loosen the screws marked with green loops in Figure 28.



Fig. 28. Footrest mounting screws.

After loosening the screws, the footrests should be adjusted so that the user's feet rest in the middle on the rounded part of the footrest and the legs are slightly bent at the knees. When the optimal position has been set, the footrest mounting screws should be retightened to a torque of 10 - 12 Nm.

The last stage of adjusting the user's position is to select the height of the drive cranks. There are 3 settings available, without the possibility of smooth movement between them. To change the position of the drive cranks, loosen the screw marked in orange in Figure 29 with an HX6 Allen key. There is an identical screw on the other side of the fork, and it should also

be loosened. The screws marked in purple should be completely removed. They are located on both sides of the fork. The Allen key required for this operation is HX5. The height of the cranks should be changed by grasping them and moving the drive unit up or down, depending on the position in which it was set before starting the adjustment. The handcycle is delivered with the crank position set to maximum. After setting the cranks to the desired position, first, tighten the screws marked with purple loops in Figure 29 using an HX5 Allen key with a torque of 10 – 12 Nm. Next, tighten the screw marked with an orange loop in Figure 29 on both sides of the fork, using an HX6 Allen key to a torque of 20 Nm.



Fig. 29. Crank height adjustment screws

Finding a comfortable and correct position for the user will require patience and time. It is not guaranteed that everything will work out the first time. Adjustments may be necessary during the first few rides to find the optimal setting. It is obvious that each element will require adjustment as the user grows. When it comes to the adjustment of the seat itself, it is recommended that the user does not sit on it when changing its position. This is to protect the adjustment rails from bending when the loaded seat is moved. The remaining elements can be adjusted with the user sitting on the handcycle.

Adjusting the user's position on the handcycle completes the work that needs to be done before the test ride. Make sure to read section "8. *MAINTENANCE*" before the test ride.

8. MAINTENANCE

8.1. Inspecting screws and bolts

After assembling the handcycle, but before the first test ride, check all screws and bolts. For safety reasons, during the first period of using the handcycle, the inspections should be performed before each ride. This is because the parts are breaking in and aligning, which may result in some screws or bolts loosening. Over time, the frequency of the inspections may be reduced, but they should still be performed from time to time.

8.2. Inspecting brakes

The brake system is the most important system of the handcycle, so the user should check it before each ride. The key elements of this system are brake discs and pads. The basic parameter that should be checked particularly often is the thickness of the brake discs. The thickness of the discs should be measured at least every 200 km. If the disc thickness drops to 1.5 mm, the disc should be replaced immediately. When replacing a brake disc, the new disc should always be installed with a set of new brake pads. Use a caliper tool to measure the thickness of the disc. The measurement method is shown in Figure 30.



Fig. 30. Method of measuring the brake disc thickness (illustrative photo)

Brake pads should be replaced when the brake lining thickness drops to 0.5 mm. Do not allow the brake pad lining to be completely worn off. Contact between a pad and a disc with completely worn-off lining will result in the need to replace the entire set, i.e., the pads and the brake disc. The pads are mounted in the brake caliper with a spreader, which maintains the

appropriate distance between the pads and the brake disc. When the thickness of the pad lining is reduced to 0.5÷0.6 mm, the spreader will begin to touch the disc, which will result in a characteristic crackling sound during braking. This is a clear signal to replace the pads. You can visually assess the condition of the pad linings. When you notice significant wear, the pads should be dismantled, and the lining thickness should be measured using a caliper tool. If the thickness is 0.5 mm or less, the pads should be replaced. The measurement method of pad thickness is demonstrated in Figure 31. Each time the pads are replaced, we recommend replacing the fluid in the hydraulic system and bleeding air from it.



Fig. 31. Method of measuring the brake pad lining thickness

When measuring the pad lining thickness, as shown in Figure 28, the thickness of the pad base lining must be subtracted from the result.

Under no circumstances should any abnormality in the operation of the braking system be ignored. Disturbing sounds coming from the area of the friction elements of the system during braking indicate their excessive wear. In this case, the system components should be immediately inspected and, if necessary, replaced. Deep sinking of the brake handle (or handles, depending on the ordered option) and a decrease in braking effectiveness may indicate air in the hydraulic system. In this case, the handcycle should be immediately delivered to a service center. Please note that on a Troublemaker handcycle, the operation of the rear axle brake lever and front wheel brake lever is slightly different. The front brake works harder than the rear brake due to differences in the design and the capacity of hydraulic systems.

8.3. Adjusting the gear shift system

The most commonly used planetary hub in the Troublemaker handcycle is the 8 or 11-speed Alfine by Shimano. The hub calibration should be checked before the test ride and in the situations described below. If the gear change becomes imprecise and the hub starts to pop

characteristically, the setting of the calibration marks on the hub should be checked. In the case of an 8-speed hub, select gear no. 5, and in the case of an 11-speed hub, select gear no. 6, as shown in Figure 32.



Fig. 32. Setting gear no. 6 in Alfine 11

Next, check that the calibration marks on the selector mounted on the hub axle match. These are the two yellow lines. One is on the fixed element of the selector, and the other is on the rotating element (Figure 33).



Fig. 33. Location of calibration marks on the hub selector

If they do not match, this should be corrected using the knob on the gear selection lever. Usually, $\frac{1}{4}$ or $\frac{1}{2}$ turn is enough. After making the correction, it is best to go through the entire range of gears up and down, and then again select gear no. 5 for an 8-speed hub, and for an 11-speed hub, select gear no. 6, and then check the position of the calibration marks again. This operation should be repeated until the marks match as precisely as possible. If this does not help, the handcycle should be scheduled for maintenance in a service center.

After the first 500 km, in the case of an 11-speed hub, the oil should be replaced. This procedure should be repeated regularly every 3,000 km. You can easily buy a dedicated kit for this task on the market, consisting of the appropriate tools and oil, with detailed instructions. If the user does not feel confident to perform this procedure on their own, the handcycle should be scheduled for a visit to a service center.

The Alfine 8-speed hub is permanently lubricated and does not require additional lubricating.

8.4. Chain maintenance and chain elongation

The chain in the handcycle drive stretches during use, and this phenomenon should be monitored to maintain the good condition of drive components. Chain elongation is checked by a special tool, for example, the one shown in Figure 34. A chain elongation of 0.75% qualifies it for immediate replacement, while if the chain elongation reaches or exceeds 1%, the chain and all its chainrings must be replaced. Replacing the chain on time will significantly reduce the frequency of chainring replacement.



Fig. 34. Tool for measuring chain elongation.

The life of the drive is greatly increased by periodic cleaning and maintenance with dedicated tools and substances, which are widely available on the market. The chain and chainrings should be roughly cleaned and then lubricated with dedicated oil every 50-70 km, while the drive should be thoroughly cleaned and lubricated every 200 km. If the handcycle was used in difficult conditions, on surfaces that cause the drive to become dirty quickly, cleaning should be performed immediately after the ride.

8.5. Inspecting tires

The basic parameter controlled by the handcycle user is the wheel air pressure. The permissible pressure range at which the tire can operate is indicated by the tire manufacturer on its side profile (Figure 35).



Fig. 35. Tire marked with the permissible pressure.

Tire pressure should be higher when riding on hard surfaces (asphalt, concrete, etc.). When driving on looser surfaces (forest roads, trails, sand), tire pressure should be lowered. It is not possible to provide exact values of the pressure parameter here for every surface on which the handcycle will be used. It is strictly dependent on the weight, preferences, and experience of the user.

Tires should also be checked for mechanical damage. The obvious case is lack of air, which suggests a puncture in the inner tube and the need to repair it. Another issue is damage in the form of tread defects or visible tire deformations. These defects indicate tire surface damage, and the only way to repair them is to replace the tires with new ones. It is not necessary to remove the wheels from the handcycle for repairs or during rear wheel tire replacement. The front wheel, however, must be removed to repair or replace the tire. To make the task easier, the chain connecting the hub with the electric motor gear can be unfastened by opening the clasp.

8.6. Checking for slack in the fork steering system

At the initial stage of using the handcycle, the headset slack should be checked as often as possible, every 30-40 km. It is best to do this with two people. The handcycle should be set so that the front wheel is a few centimeters above the ground. The easiest way to do this is to place a suitable-sized object under the frame in the place shown in Figure 36 (e.g., a toolbox). This object must be high enough to lift the front wheel off the ground.



Fig. 36. Place an object here to check the headset slack.

It is a good idea to remove the steering limiter to check the slack in the headstock bearings. To do this, one person should control the position of the fork as if it were riding straight ahead. Then, the second person, after removing the steering limiter, presses the frame towards the ground, stabilizing it, and the person controlling the fork position moves it alternately up and down in short movements, trying to feel the slightest slack in the headset. If any, it should be eliminated by following the description starting under Figure 4 in section “7.3.1. Front fork assembly”.

8.7. Electric assist maintenance

The customer will receive the handcycle with or without a battery depending on the conditions set out in point 7.1. in chapter 7. If the handcycle is delivered without a battery, the customer is obliged to purchase a battery dedicated to the motor installed on the handcycle.

The basic battery maintenance performed by the user is charging, depending on energy consumption during driving. Please note that the battery charge level naturally decreases when the handcycle is not in use. The battery should not be excessively discharged; therefore, it is recommended to perform preventive charging once a month when the handcycle is parked, which will protect the battery against a decrease in its capacity and severe damage. The number of charging cycles also influences the battery capacity. The more times the battery is charged, the smaller its capacity will be. This is a completely normal phenomenon that should be considered because as the mileage of the handcycle increases, the range of electric assist will decrease.

Only a dedicated charger should be used to charge the battery. It is a good idea to remove the battery from the handcycle when charging and charge it in a closed, well-ventilated, dry room that is inaccessible to children and pets. Do not approach the battery with an open flame.

Apart from charging, the battery is maintenance-free. It is forbidden to disassemble it and attempt to modify it in any way. The same applies to the charger.

A crucial factor affecting battery performance is the ambient temperature. The battery rapidly loses its efficiency at temperatures below 5°C, and elevated temperatures on hot days negatively affect its operation. This phenomenon is directly felt by a noticeable decrease in the range of electric assist.

Apart from the influence of the ambient temperature, the battery heats up during operation, which is a direct result of using the device. Under no circumstances should the battery heat up to a point where it cannot be touched with a bare hand. This phenomenon indicates damage to the battery cells.

For safety reasons, the battery must not be stored in closed rooms with limited ventilation on hot days, as it may spontaneously combust.

When washing the handcycle, remove the battery and make sure that the drive and all electrical connections remain dry. Since the handcycle has electric assist, it should not be cleaned with high-pressure washers.

8.8. Periodic inspection of the handcycle

To detect irregularities in individual handcycle components as early as possible, before each ride, you should check:

- the correct operation of the braking system;
- the centering of the wheels;
- tire pressure;

After driving 500 km or every month, the following should be checked:

- spoke tension;
- chain elongation;
- tire wear;
- thickness of brake pad and brake disc linings;
- frame for mechanical damage.

After 3,000 km or every 6 months, the handcycle should be checked by an authorized service center.

8.9. Cleaning the handcycle

To keep your handcycle in good technical condition, you need to take care of both its mechanical and aesthetic aspects. There are many cleaning agents and tools from various

manufacturers available on the market, dedicated to cleaning handcycles. The choice of cleaning agents for individual elements is left to the user. Most of these substances require rinsing after use, and in the case of the Troublemaker handcycle, one rule must be strictly followed. The use of any high-pressure washers is completely prohibited for rinsing and other stages of cleaning. Wetting the vehicle before thorough cleaning and rinsing should be done with running water, e.g., from a garden hose, the flow of which can be regulated using an appropriate tip.

The handcycle should not be sprayed with copious amounts of water. Another way to wet and rinse off dirt is to use a plant sprayer. This is a particularly good solution that allows for effective rinsing of the cleaning agents and, at the same time, does not cause too much water to be sprayed onto the handcycle.


8.10. Tightening torques for threaded connections

Tab. 1. List of tightening torque values for individual threaded connections

Tightening torque values for threaded connections		
Part name	Connection	Value [Nm]
Fork arches	M6 screw	10 - 12
	Ahead-type steering - M6 central screw	10 - 12
Fork footrests	M6 screw	10 - 12
Drive cranks	M8 screw (option with electric assist)	38 - 42
	M14 screw (option with Schlumpf gear)	50 - 55
Drive crank handles	Aluminum axle with M10 thread	25
Brake levers, gear shift levers	Brake lever clamp M5screw	6 - 8
	Alfine gear shift lever clamp M5 screw	6 - 8
Brake discs	Disc to hub connecting screws	6
Rear wheels	M20 aluminum wheel axles	40
Front wheel	Alfine hub axle M10 nuts	40
Brake calipers	Screws connecting the clamp adapter to the brackets in the frame and fork M6	10 - 12
	Screws connecting the clamp to the adapter M6	10 - 12
Battery base	M5 screws	5
Backrest support clamp	M5 screw	6 - 8
Backrest supports	M6 screws	10 - 12
Seat	M6 screws	10 - 12
Crank height adjustment	M6 screws	10 - 12
	M8 screw	20

If the manufacturer's tightening torque values are specified on the parts and they differ from those given in the table above, use those provided by the part manufacturer.

9. WARRANTY CARD

Warranty Card	
	
Dealer	
Stamp and signature of the Dealer	
Handcycle Model	
Manufacturing Year	
Date of Sale	
Frame Serial Number	
Customer	
Name	
Residence Address	
Telephone, E-mail	

10. WARRANTY TERMS AND CONDITIONS

The handcycle is covered by a 2-year warranty, counted from the date of delivery to the end customer.

If the handcycle was purchased from a distributor, after riding the first 100 km or after the first 30 days of use, it should be returned to the place of purchase for warranty inspection. This will help to remove any defects resulting from parts breaking in and improve the adjustment of components that require it. Failure to perform this inspection may result in defects that the warranty will not cover.

If the end user assembled the handcycle, the inspection should be carried out in accordance with the guidelines contained in chapter “8. *MAINTENANCE*”.

Warranty terms and conditions:

1. The manufacturer guarantees delivery to the distributor or end user of a handcycle that has been assembled and tested before shipment.
2. The manufacturer guarantees the delivery of the equipment without any paint or mechanical damage to individual parts of the handcycle, excluding damage occurring during transport.
3. To submit the handcycle for warranty repair, the equipment should be washed, and any additional equipment installed by the user should be removed. A completed warranty card and proof of purchase must be provided with the handcycle.
4. Warranty for individual components such as drive parts, brake system parts, etc., are subject to the warranty conditions of the manufacturer of the individual part.
5. The warranty remains valid only if the vehicle is used as intended, i.e., for the purposes described in chapter 2 of the manual.

The warranty does not apply if:

1. Damage to the paint or any component occurred during the assembly of the handcycle by the distributor or end user.
2. The failure or damage to the handcycle occurred due to the use of the product outside of its intended purpose, unprofessional repairs, storage of the handcycle without protection against unfavorable weather conditions, or due to an accident.
3. The defect covered by the warranty was reported after the warranty period expired.
4. The product was not properly maintained and used without adhering to the manual.
5. When submitting the handcycle for warranty repair, a properly completed warranty card and proof of purchase have not been provided.

6. The defect resulted from normal wear and tear of parts.
7. Modifications to the structure that constitute independent interference by the owner have been found (replacement of handcycle components resulting in a change of frame geometry, wheel track, or change in loads on individual parts).
8. The fault has not been reported immediately after it occurred.
9. Unprofessional repairs have caused damage or caused threads to break off.
10. The paint was damaged during repairs or while using the handcycle, e.g., a chip caused by a stone thrown from under the tire.
11. Damage (dents, bends) to the frame and wishbones occurred as a result of hitting an obstacle.

11. SUMMARY

The user manual contains all the information needed to assemble the handcycle after its delivery to the customer. It is especially important to follow point 4 of this manual before your first ride. To reduce the wear and tear of parts, to use the handcycle properly, to ensure your safety, and to maximize the period of failure-free riding, you must strictly follow the instructions contained in section “8. *MAINTENANCE*”. For spare parts, technical support, and warranty service, please contact the distributor or handcycle manufacturer.

12. CONTACT

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