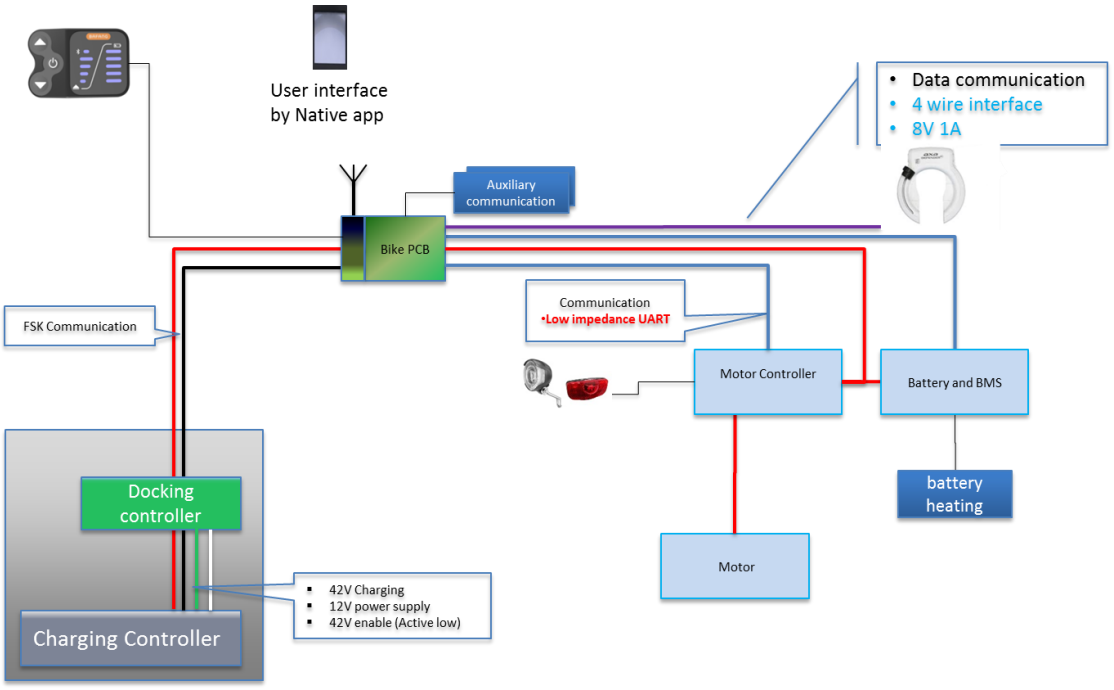
Bysykkelen.no

ELECTRIC BICYCLE FOR BIKE-SHARE

APPENDIX 1, ANNEX A1:

BICYCLE SPECIFICATION



System schematics: Motor controller and Battery BMS may communicate to bikePCB via UART (as above) <u>or</u> via Auxiliary communication (CAN Bus or USB).

Table of Contents, Appendix 1: Bicycle specification

1. Background

This appendix is part of the system Requirement specification for the Tender for procurement of Electric bicycles. The system specification contains all requirements for the entire Bysykkel bike share system.

All technical Requirements for the electric bicycle are collected in this document.

The BikePCB requirements are defined in Requirement specification Appendix 1 Annex A2: BikePCB – Bike share interface.

1.1. Used input – Information sources

- Requirements lists collected by Bysykkelen AS.
- Bike, gear and crank sensor type test in Stavanger 7-9 December 2017.

1.2. Purpose

The purpose of the document is to serve as a requirement specification. Where description of features exists, it is described as feature requirement. It shall not be seen as requirement to how the features should be implemented.

1.3. Definition of requirements in dialogue

The requirements specified must be understood as minimum requirements. That is, if better or cheaper solutions can be identified then all project members have the right and duty to suggest reductions and / or enhancements.

Actually, all requirements in this document boils down to:

The bike must be user friendly and provide necessary assistance (state of the art) in the Stavanger environment. The bike must be optimized to a minimum total cost of ownership in a depreciation period of 8 years, where the cost of maintaining the properties of the bike is included.

1.4. Readers guide

The document is divided in the following sections:

- Section 2: User requirements
- Section 3: eBike requirements
- Section 4: General bike requirements
- Section 5: Certification
- Section 6: Test and test equipment

1.5. Definitions

See: Appendix 1: Requirement specification

1.6. References

See: Appendix 1: Requirement specification

Compliance and comments to the requirements listed below must be noted by the supplier in Appendix 1 Annex B1, Section A1.

Furthermore, some questions must be answered in: Appendix 3, Annex C1: Suppliers prices on bicycles and spare parts

2. User requirements

This section lists user requirement and features on the bike.

2.1. Seat height adjustment

The seat must be very easy to adjust. Even in outer position adjustment must be possible with minimal force. The arm to tighten and untighten the position must only require 30 N to operate. The seat post must be protected against theft, this also includes the adjustment arm. The adjustment screw shall require special tools to adjust.

It shall not be possible to turn the seat around, even when the seat height adjustment arm is released.

2.2. Children friendly

2.2.1 Adapter for child seat

The bike may (optionally) have a possibility to install an adapter for child seat.

2.2.2 Adapter for trailer

A standard bike trailer mounting plate or connector must be possible to install on the bike. The supplier must specify how this is possible on the delivered bike.

2.3. Front carrier

The bike must have a front carrier for a standard office back. The carrier must be an open rack rather than a basket.

If the supplier provides another front carrier than the front carrier included in the design package, then the design must be enclosed in answer.

2.4. Mobile phone holder

It must be possible to store a standard mobile phone on a holder on the handlebar. The user might need to use the navigation on mobile phone while driving.

It would be considered added value if the mobile holder is equipped with an induction charger compatible with modern mobile phones. Alternatively, ready for later installation. Please specify possible solution.

Note: The USB charger requirement to the display in section: 3.4 ON/(OFF)/assist level (Handlebar display).

2.5. Lock placement

The lock must be placed easily accessible to the user. Near the lock there must be space to place graphical instructions to the user: "Use app to lock and unlock the bike". May be place on the rear mudguard.

2.6. Bike visual id

Each bike must have a visual Id marked/Printed in a weather resistant material. The Id shall be a 4-digit integer.

2.7. Bike bag holder

There must be a rack for Pannier bags on the rear of the bike.

3. eBike system requirements

The requirements below are described based on the assumption that the standard Bafang eBike UART protocol is applied. See Reference [2].

However, other solutions are also welcome. The bikePCB supports also CANBUS and USB. See further information in Requirement specification: Appendix 1 Annex A2: BikePCB – Bike share interface

Please specify used protocol in the product that the BikePCB shall interface (Controller and Battery).

If the system proposed does not use the Bafang protocol then the protocol documentation must be enclosed to the proposal. See section: 6.2 Protocol commands/ Delivery of documentation.

3.1. Battery charging in outdoor Nordic environment is required.

Provided normal eBike lithium batteries are used, then Battery heating is required.

If the battery technology used may not be charged down to -20° then a battery heating system shall be applied.

It is expected that the protocol is extended with information about status on Heating, Charging, idle is provided. Battery, Heating [1]

Please specify the battery heating system provided.

Bysykkelen prefer a short delivery time. The bikes will be added to the system gradually. Furthermore, the demand of bikes is less during winter time. Therefore, Bysykkelen accept a first batch of first order of bikes delivered with a battery without heating.

Supplier must answer this question in:

- Appendix 1 Annex B1, Section A1 AND
- Appendix 3, Annex C1: Suppliers prices on bicycles and spare parts

3.1.1 Battery characteristics

The battery provided must support the bike frame design.

The existing charging curve is documented in [3] Open interface - Docking point. (Appendix 1 Annex A4). The battery provided must be compatible with the charging curve.

Bysykkelen aims to extend the battery life time by reducing deep discharge events and, if applicable, full charge. Please provide extended battery recommendations for the charging management system.

Battery with capacity of min. 400Wh (10Ah) or equivalent. Min. 500 Charging cycles.

Please specify: Capacity provided and number of charging cycles guaranteed using the specified capacity in: Appendix 3, Annex C1: Suppliers prices on bicycles and spare parts

3.1.2 Option: larger battery capacity

The supplier may recommend other (larger) Battery capacities. Please specify the capacity provided, number of charging cycles guaranteed using the specified capacity and related additional price per bike, compared to the standard solution specified, in Appendix 3 Annex C1: Suppliers prices on bicycles and spare parts.

3.2. Power supply

The bikePCB must have power supply at all time, also when the bike is off. The reason is that there is a requirement that the bike shall be able to report position (GPS) also when the bike is off.

The Battery (or the bike controller) must supply 9-12V min. 1 A for the operation of the BikePCB (continually).

Please provide description of solution.

3.2.1 Battery operation 36V

The Battery must also provide 36V 1A (max) to the BikePCB. The 36V power supply may be switched off to save power, however, the protocol or mean shall enable wake of the battery BMS.

High peek current is required for most bike locks (when the servo motor starts the (short) peak is typically 300-1000 mA).

3.2.2 Battery protection

The battery management system must disconnect motor well before the battery management system switch down power to the BikePCB e.g. at 10% capacity. The BikePCB shall at any time report position, and the user might continue the trip without motor assistance.

This function may also be handled by the BikePCB but knowledge about how the battery management system manages the situation is needed.

3.3. Light control

The light management shall be controlled by the eBike controller. However, it shall be possible to switch the light on and off via the protocol.

Furthermore, it shall be possible to issue a protocol command to initiate and stop Blinking. Alternatively, it shall be possible to issue a series of Light-on and light-off commands to provide the blinking function. Blink frequency: 0,5 HZ – 1 Hz is expected.

3.4. ON/(OFF)/assist level – Input device on handlebar.

A simple control must be provided the display must be able to control assist level and show remaining battery capacity.

It is expected to use a standard device on the handlebar. However, as the bikePCB will use the communication port of the controller then the on/(off)/+/- shifter must be connected to the BikePCB. As the bikePCB will set initial assist level this will be no problem.

The device may also be used to take the bike from idle to On and to enable walk assist.

The device must support UART or CANbus

3.4.1 Cable and connector

Water tight connectors shall be used (min. IP 66).

The supplier must specify the connectors used internally in the cable design.

3.5. Bell

Bell integrated into the break handle is preferred. Please describe solution.

3.6. Lock

The locking function is mandatory; however, two options may be provided:

3.6.1 AXA eRental

AXA eRental or equivalent must be offered.

3.6.2 Option: Motor lock.

If the supplier may provide a motor system with a short cut of direct driven motor or equivalent solution, as an addition to the Axa lock, this would be appreciated.

This feature has several opportunities: a) Increased security b) Remote locking of bikes. c) Enhanced used friendliness.

If this addition is provided please describe the solution in details.

If the solution has extra price then it must be specified in Appendix 3 Annex C1

3.7. Kick stand sensor (Not Used)

It is decided that no kickstand sensor will be needed. Other sensors and logic will be used to achieve the same functionality.

3.8. Compartment for other sensors

It is desirable to have a compartment somewhere on/in the bike where future equipment may be installed, preferable close to the BikePCB.

The supplier must describe how this requirement is or may be handled.

4. General bike requirements

Please find below a list of requirements in un-prioritized order:

4.1. General requirements

4.1.1 All cables must be protected (Vandalism proof)

All cables shall be protected against un-intended and intended vandalism.

4.1.2 General requirement stainless parts

All bolts and nots and other steel material shall be in A4 / Grade 316 or equivalent quality, (Acid-resistant stainless) where it is technically possible.

All other steel parts shall be stainless parts, unless specified.

4.1.3 No closed compartment

There must be no compartments in the bike frame where water cannot auto drain.

4.1.4 Theft safe

Valuable parts on the bike must be secured in order to delay process of theft. The protection must be designed in a way so service and maintenance may be carried out without increased time consumption. As for example:

- Display must be secured with a security bold. (But no other protection of the display is expected).

4.1.5 Protection of bike extremities

The bike must be designed so bike extremities (e.g. brake handles, gear shifters, display etc.) are protected when the bike falls over.

4.2. Physical dimensions

The Bike is expected to be suitable for people between 150-195 cm. and possible to ride for people between 145-205 cm.

4.3. Bike weight (unloaded)

Max. Weight (functional incl. all required parts for operation): 30 kg. If the specified weight is not deemed possible, then the supplier must specify the target weight.

4.4. Load

Maximum load: 145 Kg (Person and luggage)

Front carrier: Max 10 Kg. according to EN ISO 11243:2016

4.5. Easy to repair and maintenance (ES)

There are a lot of elements that affect maintainability. The items listed below just outline examples. All elements of the design shall be evaluated in the light of maintainability.

4.5.1 Cable connection

All cables shall have easy connection on both ends, in order to avoid pulling the whole cable thru the whole bicycle frame, when exchange of parts is needed.

4.5.2 Cable way

No sharp places where the cables going thru the bike frames, must be present without sufficient cable protection.

4.5.3 Alignment

All adjustment places should be straight after welding, for example: Calliper bracket on the front fork should be parallel to the plane of the rotor, or other e.g. the holes on the fork should have the same spacing as on the docking points etc.

4.5.4 Diagnostic system

Diagnostic system to ease repair of the bike is needed and must be explained in the offer.

4.5.5 Avoid loose parts

In production all bolts and other fasteners must be tightened according to correct torque for the parts involved. Furthermore, these torque values must be specified in the repair manual.

4.6. Existing docking point structure

The bike shall be compatible with the existing docking point structure.

Please note that the referenced document: Appendix 1 Annex A4: Open interface - Docking point also contains requirements to among others, but not limited to: the bike handlebar, front fork and Battery charging curve.

4.7. Wheels and tires

26" wheels, strong rims, puncture resistance tubes or still solid tubes may be offered. Good all year puncture resistance tires are preferred.

The tires must have reflective sidewall (no lose reflectors).

The tubes must be equipped with auto valve (“Auto ventil”).

4.7.1 Option: Security against bleeding air (vandalism)

Cap on the auto valve that is secured against vandalism and requires (special) tools to remove. The solution shall avoid bleeding air as a vandalism attempt.

Please explain the solution and provide extra price if this option is offered.

4.8. Pedal height

Daily operation of bike share systems suggests that the bike must be designed to have a higher pedal height than required by the EN standard. 1) Un-intended vandalism happens when a curb is parsed with the pedal down. 2) Future tires might not have same profile height.

4.9. Belt

Gates Carbon Drive CDX or equivalent.

4.10. Gear and motor combination

In order to get the best possible solution a test has been carried out on location in Stavanger. Based on this test the following requirements has been established:

- Single speed, rear motor, torque sensor must be used.

The preferred single speed is a 46 teeth front sprocket and 20 teeth rear sprocket. If the gear combination is not available, in the selected belt system, then the next larger front sprocket or next smaller rear sprocket should be used.

4.11. Motor

Nominal 250W, but with peak power 350W please provide torque on provided motor.

The motor must have free-wheel function to ease ride the bike if out of power, or equivalent functionality.

Minimum requirements:

- Min. Torque: 40 N.m (@250W)
- Operating Temperature: -20 – 45°C
- Noise < 55 dB
- IP 65

4.12. Batteri placement

Battery in the middle position in frame/on the (seat) down tube. It will be added value to have access to charging socket in the battery using normal charger without taking out battery from the frame or by other means.

4.13. Disk break

Hydraulic disk break must be offered.

Tektro, Shimano or equivalent is preferred.

Surface treatment of the disk to avoid cosmetic rust is expected, due to the costal environment in Stavanger.

4.13.1 Coaster break

In all cases coaster brake is preferred against rear hydraulic disc brake.
Please explain solution.

4.14. Kick stand

The frame must support both standard (one side) and Double Kickstand.

Standard double kick stand shall be offered.

4.15. Painting Colour and artwork

Strong painting quality must be offered. See section: 4.16 Painting quality below.
The basis price must include this painting.

Painting Colour and artwork (if required) will be defined 3 months before delivery.

Please quote (additional) option price on the three examples of decal/special painting below.

4.15.1 Art works example one

4.15.2 Art work example two

4.15.3 Art work example three

4.16. Painting quality

The painting must be impact strengthened quality due to the heavy-duty use nature of bike share. Furthermore, the painting quality must be designed for a costal near environment. Special care must be taken if steel parts are used.

Please specify the painting quality and methods used in quality control.

4.17. Aluminium alloy treatment

Mudguards, belt guards, crank, seat post and kick stand are expected delivered anodized black, in a quality that does not fade over time.

All other parts that cannot be delivered in the frame colour shall be treated the same way. If not possible, still be delivered in black colour.

The delivered solution must be specified.

4.18. Advertisement and profiling surfaces

The design must specify space for advertisement and information. Please show advertisement and profiling surfaces on bike drawing in the offer.

4.19. Steering stop / cable protection

The Supplier must specify how the cables will be protected in cable way: Frame – front fork using cable protection, steering stop etc.

4.20. Mudguards and belt protection

Mudguards and belt protection must be in aluminium alloy.

5. Certification

The bike must be CE marked and be certified or tested against EN 15194:2017 by an approved third party.

This certification/test shall include the entire bike (including bikePCB). However, if it is proven that the test fails due to the bikePCB then the additional testing costs shall be covered by Bysykkelen AS.

6. Test equipment and test plan.

These requirements are linked to the BikePCB integration work.

For test plan requirements, see Appendix 1.

6.1. Test equipment

In order to establish a successful project min. 3 sets of test equipment are needed:

- Complete eBike kit: Battery, Controller, Motor and the relevant handlebar device.

Especially the battery and controller are mandatory because Battery charging change the impedance of the powerline, therefore this must be tested as early in the project as possible.

If batteries are delivered in two variants (e.g. with and without heating) then both variants must be provided early in the process.

6.2. Protocol commands/ Delivery of documentation

Protocol information and documentation must be provided for the system offered.

The producer of the new bikePCB (iCsys.no) needs the documentation and reasonable system support to implement the protocol used by the offered system.

The protocol must enable read out/ control of:

- Battery serial number (or other equal information), Version
- Remaining capacity
- Individual cell tension
- Current (online charging and discharging current)
- Cell temperature
- Battery status
- Motor Temperature
- Motor status, and error codes

7. Document information

Version	Date	Issued by	Status	Purpose of update
1.0	12 Mar 18	PSA	Draft	Changes for tender preparation.
2.0	13 Mar 18	PSA	Final	Aligned with other tender documents.
3.0	24 May 18	PSA	Final	New tender.
3.1	6. Jun 18	PSA	Final	Max. torque changed to min. torque
4.0	20. jun 18	PSA	Final	Main document language changed to English.