Technical Description

ENERCON Wind Energy Converters
Beaconing and Coloured Markings

ENERCON
ENERGY FOR THE WORLD

Publisher

ENERCON GmbH ▪ Dreekamp 5 ▪ 26605 Aurich ▪ Germany
Phone: +49 4941 927-0 ▪ Fax: +49 4941 927-109
E-mail: info@enercon.de ▪ Internet: http://www.enercon.de
Managing Directors: Hans-Dieter Kettwig, Simon-Hermann Wobben
Local court: Aurich ▪ Company registration number: HRB 411
VAT ID no.: DE 181 977 360

Copyright notice

The entire content of this document is protected by copyright and – with regard to other intellectual property rights – international laws and treaties. ENERCON GmbH holds the rights in the content of this document unless another rights holder is expressly identified or obviously recognisable.

ENERCON GmbH grants the user the right to make copies and duplicates of this document for informational purposes for its own intra-corporate use; making this document available does not grant the user any further right of use. Any other duplication, modification, dissemination, publication, circulation, surrender to third parties and/or utilisation of the contents of this document – also in part – shall require the express prior written consent of ENERCON GmbH unless any of the above is permitted by mandatory legislation.

The user is prohibited from registering any industrial property rights in the know-how reproduced in this document, or for parts thereof.

If and to the extent that ENERCON GmbH does not hold the rights in the content of this document, the user shall adhere to the relevant rights holder's terms of use.

Registered trademarks

Any trademarks mentioned in this document are intellectual property of the respective registered trademark holders; the stipulations of the applicable trademark law are valid without restriction.

Reservation of right of modification

ENERCON GmbH reserves the right to change, improve and expand this document and the subject matter described herein at any time without prior notice, unless contractual agreements or legal requirements provide otherwise.

Document details

Document ID	D0258508-5
Note	Original document. Source document of this translation: D0248364-5/2018-08-14

Date	**Language**	**DCC**	**Plant/department**
2018-08-27	en	DA	WRD Management Support GmbH / Documentation Department

Table of contents

1 General information 5

2 Beacon lights 6

2.1 Nacelle beacon lights 6

2.1.1 Obstruction beacons 7

2.1.2 Hazard beacons 8

2.2 Tower beacon lights 11

3 Beacon system management 13

4 Coloured markings 14

4.1 Rotor blade 14

4.2 Nacelle 14

4.3 Tower 15

List of abbreviations

AVV	Allgemeine Verwaltungsvorschrift (German administrative regulation)
EPK	ENERCON PartnerKonzept
ICAO	International Civil Aviation Organization
MOD	UK Ministry of Defence

1 General information

Depending on their height, exposure at the site and the applicable national regulations, wind energy converters must be marked as aviation obstacles where necessary.

The design of the marking is based on the applicable local regulatory requirements and can be implemented by means of beaconing and/or coloured markings.

ENERCON provides markings that meet the ICAO requirements. Country-specific regulations such as the German AVV (2015-08-26) or the British MOD specifications are also taken into consideration.

ENERCON is committed to implementing the recommended course of action that was agreed at the meeting of the “German Wind Energy Association's Marking working group” which was held in Hanover on 2007-11-06.

This document describes the beacon system components provided by ENERCON to international customers, its beacon management system and the coloured markings used for locations in Germany. Solutions geared to specific local conditions are available following consultation.

2 Beacon lights

ENERCON procures certified beacon lights from a subcontractor. Only lights equipped with powerful optics that minimise downward radiation, and whose luminous intensities are only marginally above the statutory requirements, are used. Light emitting diodes are used as the lamps.

The beacon lights are connected to a central control cabinet, the beaconing control cabinet. The beaconing control cabinet is located in the nacelle of the wind energy converter. Batteries supply power in the event of a network loss.

2.1 Nacelle beacon lights

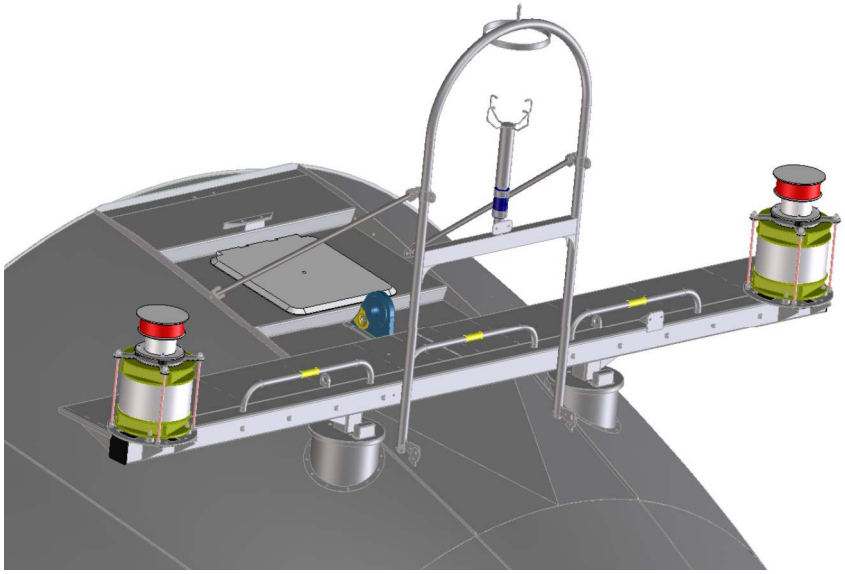


Fig. 1: Nacelle beacon lights

The beacon lights are located on the nacelle of the wind energy converter. The beacon lights are usually installed in pairs so that they cannot be obscured by an obstacle from any direction.

The beacon lights on the nacelle can be designed as obstruction beacons or hazard beacons.

2.1.1 Obstruction beacons

Obstruction beacons are omni-directional fixed lights with a medium-range luminous intensity of at least 10 cd in the horizontal beam range (-2° to +8°) that illuminate in red at night. Obstruction beacons are normally required if the distance between the beacon light and the tip of the rotor blade is less than 15 m when the blade is in a vertical position (less than 3 m in the vicinity of airfields).

Tab. 1: H-Red MB15 beacon light

H-Red MB15 beacon light	
Light intensities	10 cd, 32 cd, 70 cd, 100 cd
Temperature range	-55 °C to +55 °C
Weight	6 kg
Diameter, height	240 mm, 220 mm
Characteristics	According to ICAO, Annex 14, 6-1: low intensity type A (10 cd), B (32 cd)

Tab. 2: MB15 UK beacon light

MB15 UK beacon light	
Light intensities	32 cd, 70 cd, 100 cd, 200 cd
Temperature range	-55 °C to +55 °C
Weight	6 kg
Diameter, height	240 mm, 220 mm
Characteristics	According to ICAO, Annex 14, 6-1: low intensity type B (32 cd) and according to MOD “Specification for IR and Low Intensity Red Vertical Obstruction Lighting” (2012-02-09)

Tab. 3: MB17 E-IR beacon light (infrared), special version for United Kingdom

MB17 E-IR beacon light (infrared), special version for United Kingdom	
Light intensity	900 mW/sr
Temperature range	-55 °C to +55 °C
Weight	6 kg
Diameter, height	240 mm, 220 mm
Characteristics	According to MOD “Specification for IR and Low Intensity Red Vertical Obstruction Lighting” (2012-02-09)

2.1.2 Hazard beacons

Hazard beacons are omni-directional lights that flash red at night and white during the day. Hazard beacons must be installed if there is a potential risk to aviation. Hazard beacons are required if the wind energy converter has a total height of over 100 m, since the distance between the beacon light and the tip of the rotor blade is normally more than 15 m when the blade is in a vertical position.

Tab. 4: W-Red MB20 beacon light

W-Red MB20 beacon light	
Light intensities	100 cd
Temperature range	-55 ºC to +55 ºC
Weight	6 kg
Diameter, height	240 mm, 220 mm
Characteristics	According to AVV, Annex 3
Advanced specifications for W-Red/2 To avoid unnecessary light emissions and to harmonise different beacon lights, it may make sense to specify maximum values for the luminous intensity of the W-Red beacon light. The lights standard for W-Red/2 beacon lights describes adjusted maximum values for luminous intensity. The responsible authorities decide whether the present standard is applied. If the building permit or the responsible authorities require different values, these take precedence. ENERCON fulfils the requirements of the German federal water and navigation authority (WSV) regulations for the marking of wind energy converters, and those of the Kreditanstalt für Wiederaufbau (KfW - Reconstruction Loan Corporation).	

Tab. 5: MB70 beacon light (red), special version for France

MB70 beacon light (red), special version for France	
Light intensity	2,000 cd
Temperature range	-55 °C to +55 °C
Weight	11 kg
Diameter, height	290 mm, 270 mm
Characteristics	Country-specific for France

Tab. 6: MB75 beacon light (red), special version for Brazil

MB75 beacon light (red), special version for Brazil	
Light intensity	2,000 cd
Temperature range	-55 °C to +55 °C
Weight	11 kg
Diameter, height	290 mm, 270 mm
Characteristics	According to ICAO, Annex 14, 6-1: medium intensity type B/C

Tab. 7: MB80 beacon light (red)

MB80 beacon light (red)	
Light intensity	2,000 cd
Temperature range	-55 °C to +55 °C
Weight	11 kg
Diameter, height	290 mm, 270 mm
Characteristics	According to ICAO, Annex 14, 6-1: medium intensity type B/C

Tab. 8: MB80/17 beacon light/combination light (MB80 red and MB17 E-IR infrared), special version for Finland

MB80/17 beacon light/combination light (MB80 red and MB17 E-IR infrared), special version for Finland	
Light intensity	2,000 cd
Temperature range	-55 °C to +55 °C
Weight	17 kg
Diameter, height	290 mm, 351 mm
Characteristics	According to ICAO, Annex 14, 6-1: medium intensity type B/C and according to MOD “Specification for IR and Low Intensity Red Vertical Obstruction Lighting” (2012-02-09)

Tab. 9: MB300 beacon light (white)

MB300 beacon light (white)	
Light intensities	2,000 cd, 20,000 cd
Temperature range	-55 °C to +55 °C
Weight	25 kg
Diameter, height	380 mm, 345 mm
Characteristics	According to ICAO, Annex 14, 6-1: medium intensity type A

Tab. 10: MB500 beacon light (white), special version for Finland, Sweden

MB500 beacon light (white), special version for Finland, Sweden	
Light intensities	50,000 cd
Temperature range	-55 °C to +55 °C
Weight	-
Diameter, height	-
Characteristics	According to ICAO, Annex 14, 6-1: medium intensity type A

Tab. 11: MB800 beacon light (white), special version for Sweden

MB800 beacon light (white), special version for Sweden	
Light intensities	100,000 cd
Temperature range	-55 °C to +50 °C
Weight	44 kg
Diameter, height	-
Characteristics	According to ICAO, Annex 14, 6-1: high intensity type B

2.2 Tower beacon lights



Fig. 2: Tower beacon light

Statutory regulations may require beaconing on the tower. In order to achieve this, the tower is equipped with one beacon tier or, more rarely, two beacon tiers, with four tubular beacons on each tier. Lights can be retrofitted to the tower, but only with great effort.

Tab. 12: MB5 10 cd tubular beacon (red)

MB5 10 cd tubular beacon (red)	
Light intensity	10 cd
Temperature range	-55 °C to +55 °C
Weight	1.25 kg
Diameter	50 mm
Characteristics	According to ICAO, Annex 14, 6-1: low intensity type A and according to AVV

Tab. 13: MB5 10 cd IR tubular beacon (infrared), special version for Finland

MB5 10 cd IR tubular beacon (infrared), special version for Finland	
Light intensity	10 cd
Temperature range	-55 °C to +55 °C
Weight	1.25 kg
Diameter	50 mm
Characteristics	According to ICAO, Annex 14, 6-1: low intensity type A

Tab. 14: MB5 32 cd tubular beacon (red)

MB5 32 cd tubular beacon (red)	
Light intensity	32 cd
Temperature range	-55 °C to +55 °C
Weight	1.25 kg
Diameter	50 mm
Characteristics	According to ICAO, Annex 14, 6-1: low intensity type B

Tab. 15: MB5 50 cd tubular beacon (red), special version for the Netherlands

MB5 50 cd tubular beacon (red), special version for the Netherlands	
Light intensity	50 cd
Temperature range	-55 °C to +55 °C
Weight	1.25 kg
Diameter	50 mm
Characteristics	According to ICAO, Annex 14, 6-1: low intensity type B

Tab. 16: MB5 V2 M tubular beacon (red)

MB5 V2 M tubular beacon (red)	
Light intensity	10 cd, 32 cd, 50 cd
Temperature range	-40 °C to +55 °C
Weight	-
Diameter	50 mm (60 mm at ring)
Characteristics	10 cd - according to ICAO, Annex 14, 6-1: low intensity type A and according to AVV 32 cd - according to ICAO, Annex 14, 6-1: low intensity type B and country-specific for France 50 cd - country-specific for the Netherlands

3 Beacon system management

Wind farm synchronisation

Wind energy converter beaconing can be synchronised within a wind farm via a central wind farm computer. Multiple wind farms can be synchronised using a GPS system on the individual wind farm computers.

In facilitating wind farm synchronisation, ENERCON is fulfilling Item 4 of the recommended course of action agreed by the “Arbeitskreises Kennzeichnung des Bundesverbands WindEnergie e.V. ”(German Wind Energy Association’s Marking working group). Wind farm synchronisation of ENERCON wind energy converter beaconing is compatible with systems from other wind energy converter manufacturers.

Visibility measurement

The beacon system components of a wind energy converter can be equipped with a visibility meter and a luminous intensity control system. If the air is clear, the luminous intensity of the beacon system components is reduced. This saves energy and mitigates any impact that the beacon system components might have on the surrounding area. It is not possible to network the visibility meters on wind energy converters in different wind farms. The visibility measurement system complies with the requirements of AVV, Annex 4.

Remote monitoring system

Warning and fault messages from the beacon system components are automatically forwarded via the connection to the wind energy converter control system and reported via the ENERCON SCADA remote monitoring system. The following aspects are monitored: supply voltage failure, beacon light failure, emergency power supply battery failure and faults on the visibility meter or the battery charger.

Reporting of beaconing failures

The relevant aviation authority, which in Germany is the NOTAM Centre of the German Air Traffic Control Authority in Frankfurt/Main, must be notified of any complete beaconing failures that cannot be rectified immediately, and it must also be notified when the failures are rectified.

If an ENERCON PartnerKonzept (EPK) contract has been concluded, the ENERCON Service Technical Service Dispatch office will notify the relevant aviation authority when such faults occur and when they are rectified.

4 Coloured markings

Local statutory regulations may require wind energy converters to bear coloured markings, which clearly mark the wind energy converter during the day. These can be combined with beacon system components.

In Germany, the coloured marking can take the form shown below. In other countries and regions, different coloured markings may be required on wind energy converters.

Information about this is available on request.

4.1 Rotor blade



Fig. 3: Coloured markings on rotor blade

Coloured markings are applied to rotor blades as three strips, each 6 m wide, in traffic red (RAL 3020), agate grey (RAL 7038) and traffic red (RAL 3020), or as one 6 m-wide strip in traffic red (RAL 3020).

4.2 Nacelle

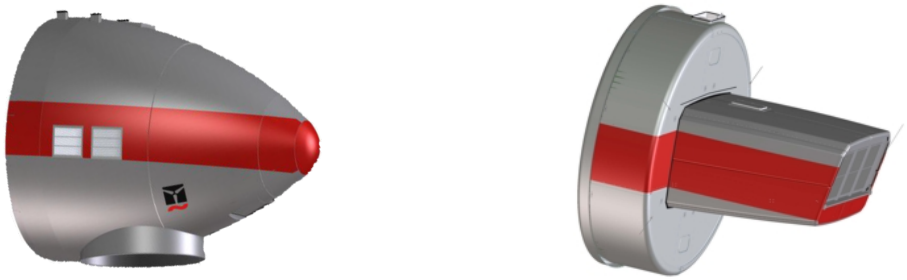


Fig. 4: Coloured markings on the nacelle, drop-shaped (left), compact (right)

To apply coloured markings to the nacelle, one coloured strip in traffic red (RAL 3020) is added to the nacelle.

4.3 Tower



Fig. 5: Coloured markings on tower

To apply coloured markings to the tower, one 3 to 4 m-wide coloured strip in traffic red (RAL 3020) is added at a height of approx. 40 m. The exact height at which the coloured strip is applied depends on the height of the tower.