ABSTRACT

Guidance on corrosion protection is currently being provided in DNV GL Guideline for the Certification of Offshore Wind Turbines, Edition 2012, DNV-OS-J101, or DNV-RP-B401. This guidance is updated and summarized in the upcoming DNV GL Recommended Practice on Corrosion Protection of Offshore Wind Farms. Our worldwide experience leads to relevant information on cathodic protection systems design for typical foundation structures of wind farms, on the inside and outside of monopiles and jacket types. Recommendation will be given on choice of coating systems, corrosion allowance, the necessity of pre-qualification, and the effects of durability of these. Also the danger of microbiologically induced corrosion or the effects of high (tidal) currents will be presented. Guidance and justifications for the recommended approaches will be given.

KEY WORDS: Wind turbines, Offshore, Corrosion Protection, Guidelines, Recommended Practice.

INTRODUCTION

After the merger of DNV and Germanischer Lloyd in 2013 all standards are going through a process of harmonization and alignment. During this process the beneficial effects of a new recommended practice to summarize and clarify the requirements given in DNV GL Offshore Wind Guideline 2012, DNV-OS-J101:2014, and DNV-RP-B401:2010 for the use on offshore structures of the wind industry has been identified. The existing standards give requirements for established offshore structures that are developed with the experiences from the oil and gas industry. The erection of offshore wind farms brings in new challenges especially through the large number of structures per project to erect and maintain throughout the expected lifetime of operation. These wind farms are a significant change in the environment. Maintenance and repair of corrosion protection systems shall be minimized for ecological, environmental, and commercial reasons. DNV GL will provide guidance to reach these aims by issuing DNVGL-ST-0126 Design of Wind Turbine Support Structures as a unified standard combining the content of DNV-OS J101 and DNV GL Guideline for the Certification of Offshore Wind Turbines, as well as a new Recommended practice on corrosion protection of offshore wind farms end of 2015 to give more specific advice on the most important topics.

Corrosion protection has still little attention in today’s wind energy world. Significant challenges with regard to technical issues such as turbine development, the variability of wind and affordable energy storage solutions, grid capacities and capabilities, financing and numerous other issues are in the focus and leave corrosion protection little attention. Furthermore the application of coating systems belongs to the last steps in the production process and falls into the project phase where delays accumulate and time pressure rises. Both, the lack of attention for the importance of the topic and the time pressure lead very often to compromises which have expensive reworks as consequence, especially if the steel structure is exposed to offshore conditions.

This text will provide a summary of the most important aspects in designing a holistic corrosion protection system for an offshore wind farm.

DESIGN REQUIREMENTS

Methods for corrosion protection of offshore wind farms shall include a holistic approach. They include corrosion allowance, cathodic protection, protective coatings and use of corrosion resistant materials. In closed internal compartments, corrosion may also be mitigated by control of humidity or depletion of oxygen. The term corrosion control further includes the inspection and maintenance of corrosion protection systems during operation. A corrosion friendly design of the structure shall be aimed for. This can be achieved by following the recommendations of the ISO 12944-3 during the complete design process. The majority of coating failures on offshore wind turbines results from poor craftsmanship, often due to insufficient surface preparation. The structure shall be designed in such a way that the surface preparation and coating application can easily be performed.

For special parts of the structure it can be advisable to use corrosion resistant materials, like chromium nickel steels. Any corrosion resistant materials to be used should be specified by reference to a material standard (e.g. AISI, EN) defining requirements to chemical composition, mechanical properties and quality control of manufacturing. PREN (pitting resistance equivalent with nitrogen) values can be used as guidance for the material selection. Special attention shall be paid to deviating pre-tension capabilities of bolts made from these materials in comparison to regular carbon steel bolts. For these materials possible bimetal corrosion shall be prohibited by appropriate actions, e.g. proper electrical insulation.