



**Award of Approval in Principle to
AW Energy Oy
WaveRoller "C1" and "X22"**

Lloyd's Register EMEA hereby awards Approval in Principle (AiP) to the WaveRoller "C1" and "X22" designs based on the review of the information submitted by AW Energy Oy and the results of the Gap Analysis Doc. No. : 427662 -1.

The designed principles have been based on the applicable Codes and Standards attached as part of this AiP.

In granting this AiP it is recognised that the design information presented to Lloyd's Register during the concept design development phase forms a basis which it is capable of being developed into a safe and viable design during detailed and EPCI phases.

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Global FOI
Segment Director
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Codes and Standards

Mechanical systems (Panel system including bearings and leaver arm, drive train hull and mechanism, power unit hull and steel foundation)

DNV-OS-C101 Design of offshore steel structures, general - LRFD method
DNVGL-RP-C202 Buckling strength of shells
DNVGL-RP-C203 Fatigue design of offshore steel structures
DNV-RP-B401 Cathodic Protection Design
DNV-RP-B101 Corrosion protection of floating production and storage units

Manufacturing

DNV-OS-C401 Fabrication and testing of offshore structures
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Concrete Foundation

DNV-OS-C502 Offshore Concrete Structures
DNV-OS-C101 Design of offshore steel structures, general - LRFD method
NS3473.E Design of concrete structures, Design and detailing rules 6th edition, March 2004
EN 1992-1-1 (Eurocode 2) - Eurocode 2, Design of concrete structures, Part 1-1: General rules and rules for buildings

Power unit system

Machinery Directive 2006/42/EC
Low Voltage Directive 2006/95/EC
REACH 1907/2006
RoHS 2011/65/EU

Power Take-Off and Electric units

Standard	Description
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CE	The power take-off and electric units will be manufactured according to European directives: Machinery Directive 2006/42/EC Low Voltage Directive 2006/95/EC REACH 1907/2006 RoHS 2011/65/EU
DNV-OS-C101	Structural design of offshore units

Machinery Directive 2006/42/EC

Following harmonized standards are applied to fulfil the essential requirements of the Machinery Directive 2006/42/EC that are applicable to machinery during manufacturing, maintenance, testing, and operation.

1. EN ISO 12100 Safety of machinery; General principles for design – Risk assessment and risk reduction
2. EN 60204-1 Safety of machinery – Electrical equipment of machines – Part 1: General requirements
3. EN ISO 4413 Hydraulic fluid power – General rules and safety requirements for system and their components
4. EN 764-7 Pressure equipment. Part 7: Safety systems for unfired pressure equipment
5. EN ISO 13849-1 Safety of machinery – Safety-related parts of control system – Part 1: General principles
6. EN ISO 13849-2 Safety of machinery – Safety-related parts of control system – Part 2: Validation
7. EN ISO 14120 Safety of machinery - General requirements for the design and construction of guards
8. EN ISO 14119 Safety of machinery - Interlocking devices associated with guards. Principles for design and selection.
9. EN ISO 14118 Safety of machinery - Prevention of unexpected start-up
10. EN ISO 13850 Safety of machinery – Emergency stop – Principles for design.
11. EN 61131-1 Programmable controllers - Part 1: General information

Low Voltage Directive 2006/95/EC

Following harmonized standards are applied to fulfil the essential health and safety requirements of the Low Voltage Directive 2006/95/EC that are applicable to electric systems during manufacturing, maintenance, testing, and operation.

12. SFS 6000 Low voltage electrical installations (EU version: HD 60364 Low voltage electric installations)
 13. SFS 6001 High voltage electrical installations (EU versions: EN 61936-1 Power installations exceeding 1 kVAc - Part 1: Common rules & EN 50522 Earthing of power installations exceeding 1 kVAc)
 14. SFS 6002 Safety in electrical work (EU version: EN 50110-1:2013 Operation of electrical installations – Part 1: General requirements)
 15. EN 61439-1 Low voltage switchgear and control gear assemblies - Part 1: General rules
 16. EN 61439-2 Low-voltage switchgear and control gear assemblies - Part 2: Power switchgear and control gear assemblies
- All used electric components need to be designed, manufactured, and tested according to harmonized European product standards. Electric components, that also have LR ENV3 type approval, are preferred always.



Other harmonized standards that have been used partly to fulfil the essential requirements during manufacturing, maintenance, testing, and operation.

17. IEC 61892 Mobile and fixed offshore units - Electrical installations

18. IEC 60092 Electrical installations in ships

Chemical substances (REACH) 1907/2006

Restriction of the use of certain hazardous substances (RoHS) 2011/65/EU

Other standards

Standard	Description
DNV-RP-0360	Subsea power cables in shallow water (applicable parts)
DNV-RP-0575	Cyber security for power grid protection devices (applicable parts)

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