

### CONTENTS

FOREWORD.....	6
INTRODUCTION.....	9
1 Scope.....	10
2 Normative references .....	10
3 Terms and definitions .....	11
4 General requirements .....	13
4.1 System description.....	13
4.2 Distribution system .....	14
4.2.1 General .....	14
4.2.2 Equipotential bonding .....	14
4.3 Compatibility assessment before connection.....	15
4.4 HVSC system design and operation .....	15
4.4.1 System design.....	15
4.4.2 System operation.....	15
4.5 Personnel safety .....	16
4.6 Design requirements.....	16
4.6.1 General .....	16
4.6.2 Protection against moisture and condensation .....	16
4.6.3 Location and construction .....	16
4.6.4 Electrical equipment in areas where flammable gas or vapour and/or combustible dust can be present.....	17
4.7 Electrical requirements .....	17
4.8 System study and calculations .....	17
4.9 Emergency shutdown including emergency-stop facilities .....	18
5 HV shore supply system requirements .....	19
5.1 Voltages and frequencies.....	19
5.2 Quality of HV shore supply.....	20
6 Shore side installation .....	22
6.1 General.....	22
6.2 System component requirements .....	22
6.2.1 Circuit-breaker, disconnector and earthing switch .....	22
6.2.2 Transformer .....	22
6.2.3 Neutral earthing resistor .....	23
6.2.4 Equipment-earthing conductor bonding.....	23
6.3 Shore-to-ship electrical protection system.....	23
6.4 HV interlocking .....	24
6.4.1 General .....	24
6.4.2 Operating of the high-voltage (HV) circuit breakers, disconnectors and earthing switches.....	24
6.5 Shore connection convertor equipment .....	25
6.5.1 General .....	25
6.5.2 Degree of protection .....	25
6.5.3 Cooling.....	25
6.5.4 Protection .....	26
7 Ship-to-shore connection and interface equipment .....	26
7.1 General.....	26

7.2	Cable management system .....	26
7.2.1	General .....	26
7.2.2	Monitoring of cable mechanical tension .....	27
7.2.3	Monitoring of the cable length.....	27
7.2.4	Connectors protection.....	27
7.2.5	Equipotential bond monitoring.....	27
7.2.6	Slip ring units .....	27
7.3	Connectors .....	28
7.3.1	General .....	28
7.3.2	Pilot contacts.....	28
7.3.3	Earth contact .....	28
7.3.4	Fibre-optic connection .....	29
7.4	Interlocking of earthing switches .....	30
7.5	Ship-to-shore connection cable .....	30
7.6	Control and monitoring cable .....	31
7.7	Storage.....	31
7.8	Data communication .....	31
8	Ship requirements .....	31
8.1	General.....	31
8.2	Ship electrical distribution system protection.....	32
8.2.1	Short-circuit protection .....	32
8.2.2	Earth fault protection, monitoring and alarm.....	32
8.3	Shore connection switchboard .....	32
8.3.1	General .....	32
8.3.2	Circuit-breaker, disconnecter and earthing switch.....	32
8.3.3	Instrumentation and protection.....	33
8.4	Onboard transformer.....	33
8.5	Onboard receiving switchboard connection point.....	33
8.5.1	General .....	33
8.5.2	Circuit-breaker and earthing switch.....	33
8.5.3	Instrumentation.....	34
8.5.4	Protection .....	34
8.5.5	Operation of the circuit-breaker .....	35
8.6	Ship power restoration .....	35
9	HVSC system control and monitoring.....	36
9.1	General.....	36
9.2	Load transfer via blackout.....	36
9.3	Load transfer via automatic synchronization.....	36
9.3.1	General .....	36
9.3.2	Protection .....	37
10	Verification and testing .....	37
10.1	General.....	37
10.2	Initial tests of shore side installation .....	37
10.2.1	General .....	37
10.2.2	Tests .....	37
10.3	Initial tests of ship-side installation .....	38
10.3.1	General .....	38
10.3.2	Tests .....	38
10.4	Tests at the first call at a shore supply point .....	38

10.4.1	General .....	38
10.4.2	Tests .....	38
11	Periodic tests and maintenance .....	39
11.1	General.....	39
11.2	Tests at repeated calls of a shore supply point .....	39
11.2.1	General .....	39
11.2.2	Verification .....	39
11.3	Earthing bonding connections .....	39
12	Documentation .....	40
12.1	General.....	40
12.2	System description.....	40
Annex A (informative)	Ship-to-shore connection cable .....	41
A.1	Rated voltage .....	41
A.2	General design .....	41
A.2.1	General .....	41
A.2.2	Conductors .....	41
A.2.3	Insulation of power cores and neutral core.....	41
A.2.4	Screening .....	42
A.2.5	Earth conductors .....	42
A.2.6	Pilot element with rated voltage $U_0/U (U_m) = 150/250 (300) V$ .....	42
A.2.7	Optical fibres .....	43
A.2.8	Cabling.....	43
A.2.9	Separator tape.....	43
A.2.10	Outer sheath.....	43
A.2.11	Markings.....	43
A.3	Tests on complete cables .....	44
Annex B (normative)	Additional requirements for Roll-on Roll-off (Ro-Ro) cargo ships and Ro-Ro passenger ships .....	47
B.1	General.....	47
Annex C (normative)	Additional requirements for cruise ships.....	52
C.1	General.....	52
C.6	Shore side installation.....	57
Annex D (normative)	Additional requirements of container ships .....	60
D.1	General.....	60
Annex E (informative)	Additional requirements of liquefied natural gas carriers (LNGC).....	64
E.1	General.....	64
Annex F (informative)	Additional requirements for tankers .....	70
F.1	General.....	70
	Bibliography.....	73
	Figure 1 – Block diagram of a typical described HVSC system arrangement .....	14
	Figure 2 – Phase sequences .....	20
	Figure 3 – Single harmonic distortion limits .....	21
	Figure 4 – Fibre-optic socket outlet.....	29
	Figure 5 – Fibre-optic plug .....	30
	Figure A.1 – Bending test arrangement.....	45
	Figure B.1 – General system diagram .....	48

Figure B.2 – Safety circuits .....	50
Figure B.3 – Three-phase plug and socket-outlet contact assignment .....	51
Figure C.1 – General system diagram .....	52
Figure C.2 – Cruise ship HVSC system functional diagram .....	53
Figure C.3 – Safety and control circuits .....	56
Figure C.4 – Three-phase ship connector and ship inlet contact assignment.....	58
Figure C.5 – Three-phase ship inlet fitted with fail-safe limit switch.....	59
Figure D.1 – General system diagram .....	60
Figure D.2 – Safety circuits.....	62
Figure D.3 – Three-phase plug and socket-outlet contact assignment.....	63
Figure E.1 – General system diagram .....	65
Figure E.2 – Three-phase ship connector and ship inlet contact assignment.....	68
Figure F.1 – General system diagram .....	70
Figure F.2 – Three-phase shore plug and ship socket-outlet contact assignment .....	72
Table E.1 – LNGC 140 000 m <sup>3</sup> to 225 000 m <sup>3</sup> .....	66
Table E.2 – LNGC > 225 000 m <sup>3</sup> .....	66