

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 ³ to 225 000 m ³	66
Table E.2 – LNGC > 225 000 m ³	66