Document type: **B.1** **DESIGN DRAWINGS, DATA SHEETS**	Nexans

Project: **Anholt Offshore Wind Farm** **34 kV Submarine Cable Supply**	Nexans document number: **10.AB.2441-B.1-005**	Issue: **AB4**
Document title: **Technical Data 34kV Submarine cable system 835738 - CN-ANH-NEXANS-0004**	Pages: **6 including this cover sheet**	Category: **EXT**

Scope:

AB4	20.12.2012	Issued for As-Built	HH	TM	TM	PW
AB3	13.12.2012	Issued for As-Built	HH	TM	TM	PW
AB2	17.07.2012	Issued for As-Built	HH	TM	TM	PW
I1	01.06.2011	Issued for Information	HH	TM	TM	DS
Issue:	Date:	Document Status:	Prepared:	Checked:	Approved:	Released:

Company: DONG energy	Company's contract no.: **48 0000 5464**
	Company's document no.:

Client's Approval			
Issue:	Date:	Approved:	Signature:

Revision Description Sheet

Rev.	Para.	Revision Description
I1		New Version of 10.AB.2441-B.1-001
AB2		Changes made according CN-ANH-NEXANS-0004
AB3		Changes made according e-mail from Kamilla Krzesinski 2012-11-05
AB4		Changes made according e-mail from Kamilla Krzesinski 2012-12-17

1. Technical data 34kV Submarine cable system

34kV submarine cable system				
	Unit	Size 1	Size 2	Size 3
Conductor cross section and material	mm^2	500 Cu	240 Cu	150 Cu
Conductor construction		Circular stranded compacted, water tight		
Longitudinal water tightening material		NI13	NI 13	NI13
Conductor, outside diameter	mm	Nom. 26,6	18,6	14,5
Semiconductor, outside diameter	mm	Calc. 29,1	21,1	17,0
Insulation material and thickness	mm	XLPE nom. 8,0		
Insulation outer diameter	mm	Calc. 44,3	36,3	32,2
Insulation semiconductor screen, thickness	mm	Nom. 0,65	0,65	0,65
Screen, outer diameter	mm	Calc. 45,6	37,6	36,1
Number of screen wires		40	26	26
Dimension of wires	mm	Nom. Ø 0.9		
Radial water tightness barrier each core or covering all 3 core		Swelling powder in screen wire interstices at each core		
Type of material for radial water tightness barrier, if lead the type of lead		One side copolymere covered aluminium tape with overlap, bonded to PE sheath above		
Radial water tightness barrier, thickness	mm	Nom. 0.2		
Radial water tightness barrier outer diameter	mm	Calc. 48,6	40,6	36,5
A protection layer over the radial water tightness barrier, type of material		Semi-conductive PE, black	PE, black + thin layer of extruded outer electrode	PE, black + thin layer of extruded outer electrode
Protection layer, thickness	mm	Nom. 2,6	Nom. 2,3+0,15	Nom. 2,2+0,15
Core outside diameter	mm	Calc. 53,4	45,1	40,9

Overall three core diameter before armouring	mm	Calc. 120,6	101,4	92,4
Filling material between cores, type of material, solid or loose		Polypropylene strings as fillers		
Armouring, single/double		Single		
Type of armouring material		Round steel wires, heavy galvanised		
Numbers of wire	No.	63	61	56
Dimensions of wire	mm	Nom. Ø 4,75	Ø 4,0	Ø 4,0
Length of lay of armouring wire along the cable	mm	Nom. 1200	736	683
Armouring corrosive protection material		Zinc on each wire, bitumen flashing on wires		
Outer protection yarn, material and thickness	mm	2 layers of Hessian tape (with gap), 1 layer of polypropylene threads with coloured stripe, approx. 4mm		
Overall diameter	mm	Calc. 138,3	117,6	108,6
Conductor weight per metre	kg/m	13,965	6,898	4,396
Screen weight per metre	kg/m			
Armouring weight per metre	kg/m	9,2	6,6	6,0
Cable weight in air	kg/m	32,3	20,3	16,3
Cable weight in seawater	kg/m	21,5	12,7	10,0
Minimum bending radius of 3-core armoured cable	mm	During pulling 2085	During pulling 1770	During pulling 1635
Minimum bending radius of 3-core armoured cable at drum	mm	1090	920	840
Minimum bending radius of single core	mm	810, once 540	690,once 455	630, once 410
Minimum bending radius of optical fibre	mm			
Maximum allowed pulling force	kN	90,0	81,8	75,1
Maximum allowed free cable length hanging from the hang-off in air	m	319	414	473
Maximum continuous current in the submarine section, 1m burial	A	776,3	570,1	442,4

Maximum continuous current in the J-tubes	A	822/669, without/with sun	---/---, without/with sun	---/---, without/with sun
Maximum continuous current in the steel monopole at 20°C ambient temp. (sun income 1000 W/m²); Note: for several cables in MP (monopile) see separate calculations	A	892/691 without/with sun	629/489 without/with sun	478/371 without/with sun
Thermal resistance between conductors and cable surface	K*m/W	Calc. 0,4777	0,5867	0,6760
Capacitance per phase	µF/km	Calc. 0,3305	0,2560	0,2174
Conductor dc resistance per phase at 20°C	Ω/km	Max. 0,0366	0,0754	0,124
Screen ac resistance per phase at 20°C	Ω/km	0,772	1,15	1,15
Metallic water barrier ac resistance per phase at 20°C	Ω/km	0,94	1,05	1,15
Inductance between conductors per phase	mH/km	Calc. 0,3280	0,3657	0,3960
Positive sequence impedance per phase at 90°C	Ω/km	Calc. 0,069 + j0,103	0,113 +j0,115	0,173 + j0,124
Negative sequence impedance per phase at 90°C	Ω/km	Calc. 0,069 + j0,103	0,113 +j0,115	0,173 + j0,124
Zero sequence impedance per phase at 20°C	Ω/km	Calc. 0,129 + j0,133	0,211 +j0,160	0,270 + j0,178
Total losses at 100% of nominal current I_n	W/m	In = 612A 74,7	In = 428 A 57,0	In = 245A 27,0
Total losses at 50% of nominal current I_n	W/m	18,3	13,5	6,9
Conductor losses at 100% of nominal current I_n	W/m	51,6	47,7	23,7
Conductor losses at 50% of nominal current I_n	W/m	11,7	10,8	5,7
Shield/armouring losses per phase at 100% of nominal current I_n	W/m	22,5	8,7	3,0
Shield/armouring losses per phase at 50% of nominal current In	W/m	6,0	2,4	0,9
Dielectric losses per phase at 34 kV	W/m	Calc. 0,480	0,372	0,316
Maximum field strength at 36 kV	kV/mm	Calc. 3,40	3,63	3,62
Conductor temperature at 100% of nominal current I_n	°C	59,2	53,5	34,7

Conductor temperature at 50% of nominal current I_n	°C	25,7	24,0	19,8
Cable surface temperature at 100% of nominal current I_n	°C	41,9	36,3	25,3
Temperature drop between conductor and ambient	°C	17,3	17,2	9,4
Temperature drop across the insulation	°C	4,0	4,8	2,8
Max conductor short circuit current for 1 second	kA	72,3	34,7	21,9
Max conductor temperature after 1 second with max short circuit current	°C	250	250	250
Max screen short circuit current for 1 second	kA	4,0	2,6	2,6