

TYPE APPROVAL CERTIFICATE

This is to certify:**That the High Voltage Cable**

with type designation(s)

SENBS & TENBS 5 kV, SENBS & TENBS 8 kV, SENBS & TENBS 15 kV

Issued to

TMC Co., Ltd**CHUNGNAM, Republic of Korea**

is found to comply with

Det Norske Veritas' Rules for Classification of Ships, High Speed & Light Craft and Det Norske Veritas' Offshore Standards**IEEE 1580 (2010)****IEC 60332-3-22 (2009-02)****Application :****Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.**

Type	Voltage (kV)	Temp. class (°C)
SENBS & TENBS 5 kV	5	90
SENBS & TENBS 8 kV	8	90
SENBS & TENBS 15 kV	15	90

This Certificate is valid until **2019-11-30**.Issued at **Busan** on **2015-12-01**for **DNV GL**DNV GL local station: **Seoul**Approval Engineer: **Eun Sook Kim**

Baeg Soon Choi
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

Product description

Type: SENBS & TENBS 5 kV & 8 kV & 15 kV
Construction:
Conductors: Tinned, flexible stranded copper
Core insulation: EPR (Type E & E90)
Screening: Tinned copper wire braid
Inner sheath: Type N
Metal covering: Bronze wire braid
Outer sheath: Type N

SENBS 5 kV

Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
SENBS 100%		
1 x 8	20,8	0,819
1 x 6	22,9	0,902
1 x 4	25,0	0,984
1 x 2	26,2	1,031
1 x 1	28,8	1,134
1 x 1/0	30,0	1,181
1 x 2/0	31,2	1,228
1 x 3/0	32,7	1,287
1 x 4/0	34,4	1,354
1 x 262	36,0	1,417
1 x 313	37,7	1,484
1 x 373	39,4	1,551
1 x 444	41,3	1,626
1 x 535	44,9	1,768
1 x 646	47,1	1,854
1 x 777	49,3	1,941
1 x 1111	56,0	2,205

Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
SENBS 133%		
1 x 8	23,1	0,909
1 x 6	24,1	0,949
1 x 4	26,2	1,031
1 x 2	28,5	1,122
1 x 1	30,0	1,181
1 x 1/0	31,2	1,228
1 x 2/0	32,4	1,276
1 x 3/0	34,0	1,339
1 x 4/0	35,7	1,406
1 x 262	37,2	1,465
1 x 313	38,9	1,531
1 x 373	40,6	1,598
1 x 444	44,0	1,732
1 x 535	46,1	1,815
1 x 646	48,3	1,902
1 x 777	52,0	2,047
1 x 1111	57,2	2,252

TENBS 5 kV

Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
TENBS 100%		
3 x 8	37,2	1,465
3 x 6	39,6	1,559
3 x 4	45,6	1,795
3 x 2	48,2	1,898
3 x 1	52,9	2,083
3 x 1/0	55,5	2,185
3 x 2/0	58,1	2,287
3 x 3/0	61,3	2,413
3 x 4/0	65,0	2,559
3 x 262	68,5	2,697
3 x 313	73,6	2,898
3 x 373	77,3	3,043
3 x 444	82,9	3,264

Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
TENBS 133%		
3 x 535	87,4	3,441
3 x 646	92,1	3,626
3 x 777	96,9	3,815
3 x 1111	108,1	4,256
TENBS 133%		
3 x 8	40,0	1,575
3 x 6	42,2	1,661
3 x 4	48,2	1,898
3 x 2	52,3	2,059
3 x 1	55,5	2,185
3 x 1/0	58,1	2,287
3 x 2/0	60,7	2,390
3 x 3/0	64,1	2,524
3 x 4/0	67,8	2,669

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Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
3 x 262	72,5	2,854
3 x 313	76,2	3,000
3 x 373	81,4	3,205
3 x 444	85,5	3,366

Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
3 x 535	90,0	3,543
3 x 646	94,7	3,728
3 x 777	99,5	3,917

SENBS 8 kV

Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
SENBS 100%		
1 x 6	24,5	0,965
1 x 4	26,7	1,051
1 x 2	29,0	1,142
1 x 1	30,6	1,205
1 x 1/0	31,8	1,252
1 x 2/0	33,0	1,299
1 x 3/0	34,6	1,362
1 x 4/0	36,4	1,433
1 x 262	37,9	1,492
1 x 313	39,6	1,559
1 x 373	41,4	1,630
1 x 444	44,9	1,768
1 x 535	47,0	1,850
1 x 646	49,2	1,937
1 x 777	53,0	2,087
1 x 1111	58,3	2,295

Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
SENBS 133%		
1 x 6	25,9	1,020
1 x 4	29,1	1,146
1 x 2	30,4	1,197
1 x 1	31,9	1,256
1 x 1/0	33,1	1,303
1 x 2/0	34,3	1,350
1 x 3/0	36,0	1,417
1 x 4/0	37,7	1,484
1 x 262	39,2	1,543
1 x 313	41,0	1,614
1 x 373	42,7	1,681
1 x 444	46,2	1,819
1 x 535	48,3	1,902
1 x 646	50,6	1,992
1 x 777	54,3	2,138
1 x 1111	59,6	2,346

TENBS 8 kV

Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
TENBS 100%		
3 x 6	44,8	1,764
3 x 4	49,3	1,941
3 x 2	53,5	2,106
3 x 1	56,9	2,240
3 x 1/0	59,4	2,339
3 x 2/0	62,1	2,445
3 x 3/0	65,7	2,587
3 x 4/0	69,3	2,728
3 x 262	74,3	2,925
3 x 313	77,9	3,067
3 x 373	83,3	3,280
3 x 444	87,4	3,441
3 x 535	92,0	3,622
3 x 646	96,9	3,815

Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
3 x 777	101,7	4,004
TENBS 133%		
3 x 6	47,6	1,874
3 x 4	53,7	2,114
3 x 2	56,4	2,220
3 x 1	59,8	2,354
3 x 1/0	62,3	2,453
3 x 2/0	65,0	2,559
3 x 3/0	68,5	2,697
3 x 4/0	73,8	2,906
3 x 262	77,1	3,035
3 x 313	82,3	3,240
3 x 373	86,1	3,390
3 x 444	90,3	3,555
3 x 535	94,9	3,736

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Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
3 x 646	99,8	3,929

Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
3 x 777	104,6	4,118

SENBS 15 kV

Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
SENBS 100%		
1 x 2	32,6	1,283
1 x 1	34,1	1,343
1 x 1/0	35,4	1,394
1 x 2/0	36,6	1,441
1 x 3/0	38,1	1,500
1 x 4/0	39,8	1,567
1 x 262	41,5	1,634
1 x 313	44,8	1,764
1 x 373	46,5	1,831
1 x 444	48,4	1,906
1 x 535	50,6	1,992
1 x 646	54,3	2,138
1 x 777	56,6	2,228
1 x 1111	61,9	2,437

Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
SENBS 133%		
1 x 2	34,0	1,339
1 x 1	35,5	1,398
1 x 1/0	36,7	1,445
1 x 2/0	37,9	1,492
1 x 3/0	39,5	1,555
1 x 4/0	41,2	1,622
1 x 262	44,2	1,740
1 x 313	45,9	1,807
1 x 373	47,6	1,874
1 x 444	49,5	1,949
1 x 535	53,1	2,091
1 x 646	55,3	2,177
1 x 777	57,5	2,264
1 x 1111	62,7	2,469

TENBS 15 kV

Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
TENBS 100%		
3 x 2	61,3	2,413
3 x 1	64,5	2,539
3 x 1/0	67,2	2,646
3 x 2/0	69,8	2,748
3 x 3/0	74,7	2,941
3 x 4/0	78,5	3,091
3 x 262	83,5	3,287
3 x 313	87,2	3,433
3 x 373	90,9	3,579
3 x 444	95,1	3,744
3 x 535	99,8	3,929
3 x 646	104,6	4,118

Number of cores x conductor cross-section	Overall Diameter Approx.	Overall Diameter Approx.
AWG/MCM	mm	inches
TENBS 133%		
3 x 2	65,7	2,587
3 x 1	68,9	2,713
3 x 1/0	73,2	2,882
3 x 2/0	75,8	2,984
3 x 3/0	79,3	3,122
3 x 4/0	84,6	3,331
3 x 262	87,8	3,457
3 x 313	91,6	3,606
3 x 373	95,3	3,752
3 x 444	99,5	3,917
3 x 535	104,2	4,102
3 x 646	109,0	4,291

Application/Limitation

The requirements of SOLAS Amendments Chapter II-1, Part D, Reg. 45, 5.2 (provision to be taken to limit Fire Propagation along Bunches of Cables or Wires) are fulfilled without any additional measures.

Type Approval documentation Tests carried out

Job Id: **262.1-003643-2**
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Type test according to IEEE 1580, UL 1072, IEEE 1202, UL 1309 and IEC 60332-3-22.

Marking of product

TMC – SENBS or TENBS – Size – 5 kV or 8 kV or 15 kV

Periodical assessment

The scope of the retention/renewal survey is to verify that the conditions stipulated for the Type approval is complied with and that no alterations are made to the product design or choice of materials.

The main elements of the survey are:

- Inspection on factory samples, selected at random from the production line (where practicable)
- Results from Production Sample Tests (PST) and Routines (RT) checked (if not available tests according to PST and RT to be carried out)
- Review of type approval documentation
- Review of possible change in design, materials and performance
- Ensuring traceability between manufacturer's product type marking and Type Approval Certificate.

Survey to be performed at least every second year.

END OF CERTIFICATE