Certificate no.:
TAE00004ZT

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Field bus cables

with type designation(s)
Marine Bus Cable Profibus-DP, Canbus and RS-485/422

issued to
AP MOG Solutions Pte Ltd
Singapore, **Singapore**

is found to comply with

DNV rules for classification – Ships, offshore units, and high speed and light craft

Application:

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV.

Issued at **Hamburg** on **2024-11-22**
This Certificate is valid until **2029-11-21**.
DNV local unit: **Certification of Materials - Singapore**

Approval Engineer: **Carsten Hunsalz**

for **DNV**

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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.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to USD 300 000.

Product description

IEC 61158-2	Type A	Type B	
Bus Type	Profibus-DP	Canbus	RS-485/422
Impedance	150 ohm f=3-20MHz	120 ohm f=1MHz	120 ohm f=1MHz
Capacitance	<30 pF/m	<40 pF/m	<42 pF/m
Resistance	≤55 ohm/km	≤55 ohm/km	≤93.8 ohm/km
Conductor cross-sectional area	0.35, 0.5, 0.75 mm^2	0.35, 0.5, 0.75 mm^2	0.22, 0.35, 0.5, 0.75 mm^2
Number of pairs	1, 2, 4	1, 2, 4	1, 2, 4, 8
Number of single conductors		4	
Overall shield	2	2	2
Wire A Colour	Green	N/S	N/S
Wire B Colour	Red	N/S	N/S
Option	Armor + Outer Sheath	Armor + Outer Sheath	Armor + Outer Sheath

Construction:

Conductor material	Solid bare copper wire for Profibus-DP, stranded tinned copper wire for Canbus / RS-485/422
Insulation material	Foamed PE
Filler	PP
Individual screen (Optional)	AL/Mylar
Overall screen	AL/Mylar+ Tinned copper wire braid coverage ≥60% for Profibus-DP, ≥80% for Canbus ≥85% for RS-485/422
Inner jacket material	SHF1 or SHF2 or SHF2-MUD
Armor (Optional)	Tinned copper or galvanized steel wire braiding coverage ≥60%
Outer jacket material (Optional)	SHF1 or SHF2 or SHF2-MUD

Cable parameter acc. IEC 61158-2	**Type A**	**Type B**
Impedance	135 to 165 ohm (f=3 to 20MHz)	100 to 130 ohm (f>100KHz)
Capacity	<30pF/m	<60pF/m
Resistance	<110ohm/km	Not specified
Conductor cross-sectional area	>=0.34mm^2	>=0.22mm^2

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.

Fieldbus Data communication cables.
Flame retardant in bunch; cat A. Low smoke
Outer sheath SHF1 or SHF2 or SHF2 MUD according to NEK TS 606

Temperature range:
Install at: -20°C to +60 °C
Operate at: -52°C to +90 °C

Type Approval documentation

Tests carried out

Standard	Release	General description	Limitation
IEC 61158-2	2023-03	Industrial communication networks - Fieldbus specifications - Part 2: Physical layer specification and service definition	Cable specifications as per item 22.1.2.2 and table 144.
IEC 60092-360	2021-01	Electrical installations in ships - Part 360: Insulating and sheathing materials for shipboard and offshore units, power, control, instrumentation and telecommunication cables.	
IEC 60332-1-2	2015-07	Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable –Procedure for 1 kW pre-mixed flame	
IEC 60332-3-22	2018-07	Tests on electric and optical fibre cables under fire conditions – Part 3-22: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category A	Charred portion of sample does not exceed 2,5m above bottom edge of burner.
IEC 60754-1	2019-11	Test on gases evolved during combustion of materials from cables - Part 1: Determination of the halogen acid gas content	Sheath only Low Halogen: <0,5% Halogen
IEC 60754-2	2019-11	Test on gases evolved during combustion of materials from cables - Part 2: Determination of acidity (by pH measurement) and conductivity	Sheath only Halogen free: pH > 4,3 Conductivity < 10µS/mm
IEC 60684-2	2011-08	Clause 45.2 Methods of determination of low levels of fluorine	Sheath only Fluorine content < 0,1%
IEC 61034-1/2	2019-11	Measurement of smoke density of cables burning under defined conditions – Test apparatus, procedure and requirements	Low smoke Light transmittance >60%
NEK TS 606	2022	Cables for offshore installations. Halogen-free and/or mud resistant. Technical specification.	SHF2-MUD resistance test: IRM902+IRM903 100°C 7d. Calcium Bromide 70°C 56d. Oil based mud: EDC 95/11 70°C 56d
UL 1581	2020-02	UL Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords	SHF1, SHF2, SHF-MUD UV resistant acc. UL 1581 Cl.1200 min. 85% after 300h in the tensile strength and elongation
IEC 60092-360	2021-01	Electrical installations in ships - Part 360: Insulating and sheathing materials for shipboard and offshore units, power, control, instrumentation and telecommunication cables.	SHF1 aging in IRM 902 70°C 4h SHF2 aging in IRM 902 100°C 24h tensile strength and elongation max +- 40%
IEC 60079-14	2013-11	Explosive atmospheres - Part 14: Electrical installations design, selection and erection	Test for limitation of the gas flow through the cable according tp Annex E
EN 50288-1	2013-05	Multi-element metallic cables used in analogue and digital communication and control - Part 1: Generic specification	5.3.1 Cold bend performance

Marking of product

APS FINLAND MOG □WW/YY□Armored□M82□Cable□Cable model□Cable shielding type and size□Jacket material□IEC□60332-3-22□IEC□60332-3-24□XXXXXX□****m

Notice: □ represent Space; Armored only for armored cable types; XXXXXX represent batch number; ****m represent meter mark

Example:

APS FINLAND MOG 08/24 Armored M82 Cable Profibus-DP size SHF1 IEC 60332-3-22 XXXXXX ****m

Place of Production

DNV id: 10630537

Periodical assessment

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

The main elements of the assessment are:

- Inspection on factory samples, selected at random from the production line (where practicable)
- Results from Routine Tests (RT) checked (if not available tests according to 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.

Periodical assessment is to be performed after 2 years and after 3.5 years. A renewal assessment will be performed at renewal of the certificate.

END OF CERTIFICATE