Military Shipboard Cables

(VG-95218)

Special Cables Marine in LS cable and system

Cables for military vessels are used for power, control, instrumentation and communication systems onboard warships such as transport ships, destroyers and submarines. Especially, we are manufacturing three type's cables having been applied for U.S NAVSEA certification; MIL-DTL-24643, MIL-DTL-24640, and VG 95218.

MIL-DTL-24643: This cable conforms to U.S Navy Mil-Spec standards and either water-proof or non-waterproof. This product is highly abrasion-proof

MIL-DTL-24640: This cable conforms to U.S Navy Mil-Spec standards and is much lither than 24643. This product is categorized as either water-proof or non-waterproof and is easy to install since it is light and flexible

VG 95218: This cable is highly flame-retardant, halogen-free and oil-proof.

In this catalogue, we mainly explain VG 95218. Moreover, the size and weight optimized LS Navy Cables, in accordance with VG 95218 parts 60-66, listed in this catalogue are highly flame-retardant, halogen-free, oil-proof and etc. Moreover, our cables simultaneously correspond with all requirements of naval ship design and construction rules of the German Navy (BV 3400).

This catalogue seeks to address a solution in a context of concurrent engineering, with active linkage between international design variables and processing Cable parameter.

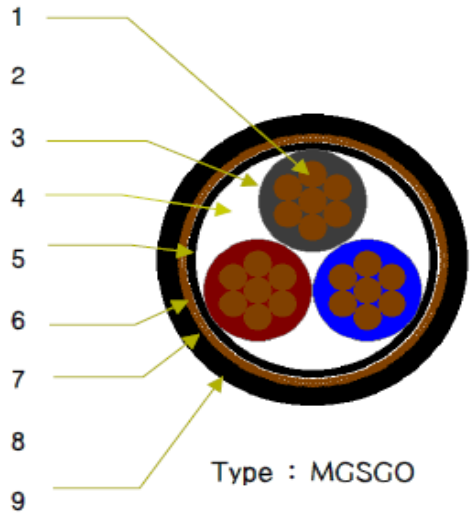
※ With this catalogue all other catalogue issues for Navy cables according to VG 95218 invalid.

List of Cables

MGSGO (Ships Power Cables)

According to VG 95218 part 60

With and without screen, with sheath, halogen-free, and low fire hazard



Type : MGSGO

▶ Applied Standard

1) IEC 60228 for conductor
2) DIN VDE 0207-20(VDE 0207 part 20) for insulation
3) VG 95218-60 for design guideline, insulation, EPR, sheath, and XLPO
4) VG 95218-2 for test method

▶ Lowest permissible temperature for installation

- -15℃

▶ Design

1) Conductor: Copper for electrical application, Class 2
2) Separator
3) Insulation: Ethylene Propylene Rubber
4) Assembly
5) Covering of cores: Elastic or plastic compound halogen free
6) Binder tape
7) Screen: Copper for electrical application
8) Binder tape
9) Sheath: Cross-linked Polyolefin

▶ Core Identification1

- 1C : Black
- 2C : Black, Blue
- 3C : Black, Blue, Brown
- 4C : Black, Blue, Brown, Black
- More than 5C : Cores black, with printed number, beginning with 1 from inside to outside.

※ Pilot and directing shall be the same in all layers.

▶ Color of sheath

- Black

MGSGO

- **Single-core insulated wire, screened with sheath operating voltage up to AC 1200V, DC 1800V, operation temperature up to 85℃**
- **Type A**

Dash -No.		Nominal cross-section (mm^2)	Number of the single wires (min)	Diameter of the insulation (Nominal value) (mm)	Wall thickness of insulation (Nominal value) (mm)	screen Diameter of the single wire (max) (mm)	Wall thickness of sheath (Nominal value) (mm)	Diameter of the insulated wire		Conductor resistance (20℃) (max) (Ω/km)	Insulation resistance (20℃) (min) (MΩ·km)
								min (mm)	max (mm)		
001		4	7	2.7	1.0	0.3	1.0	7.5	8.5	4.70	850
002		6	7	3.3	1.0	0.3	1.0	8.4	9.4	3.11	750
003		10	7	4.2	1.0	0.3	1.1	9.5	10.5	1.84	600
004		16	7	5.3	1.0	0.3	1.1	10.0	11.0	1.16	500
005		25	7	6.6	1.2	0.3	1.2	12.0	13.0	0.734	450
006		35	7	7.9	1.2	0.3	1.2	13.0	14.0	0.529	400
007		50	19	9.1	1.4	0.3	1.3	15.0	16.0	0.391	400
008		70	19	11.0	1.4	0.3	1.3	17.0	18.0	0.270	350
009		95	19	12.9	1.6	0.3	1.4	19.5	20.5	0.195	350
010		120	37	14.5	1.6	0.3	1.5	21.0	22.4	0.154	300
011		150	37	16.2	1.8	0.3	1.5	23.0	24.4	0.126	300
012		185	37	18.0	2.0	0.3	1.6	25.5	27.0	0.100	300
	015	185	1360	18.1	2.0	0.3	1.6	26.2	27.2	0.106	300
013		240	61	20.6	2.2	0.3	1.7	29.0	30.5	0.0762	300
014		300	61	23.1	2.4	0.3	1.8	31.5	33.5	0.0607	300

MGSGO

- **Cable single screened with sheath operating voltage up to AC 1200V, DC 1800V, operation temperature up to 85℃**
- **Type B**

Dash -No.	Number of cores	Nominal cross-section (mm^2)	Number of the single wires (min)	Diameter of the insulation (Nominal value) (mm)	Wall thickness of insulation (Nominal value) (mm)	Wall thickness of common covering of insulation (Standard value) (mm)	screen	Wall thickness of sheath (Nominal value) (mm)	Diameter				Conductor resistance (20℃) (max) (Ω/km)	Insulation resistance (20℃) (min) (MΩ·km)
							Diameter of the single wire (max) (mm)		Covering		Overall			
									min (mm)	max (mm)	min (mm)	max (mm)		
001	2	1.5	7	1.7	1.0	1.0	0.3	1.2	7.5	8.5	11.5	12.5	12.2	1200
002	2	2.5	7	2.2	1.0	1.0	0.3	1.2	8.5	9.5	12.4	13.4	7.56	1000
003	2	4	7	2.7	1.0	1.0	0.3	1.2	9.5	10.8	13.4	14.7	4.70	850
004	2	6	7	3.3	1.0	1.0	0.3	1.3	10.8	12.1	14.7	16..0	3.11	750
005	2	10	7	4.2	1.0	1.0	0.3	1.3	12.5	13.8	16.2	17.7	1.84	600
006	2	16	7	5.3	1.0	1.0	0.3	1.4	14.5	15.8	19.0	20.3	1.16	500
007	2	25	7	6.6	1.2	1.0	0.3	1.5	17.8	19.3	22.5	24.0	0.734	450

MGSGO

- **Cable single screened with sheath operating voltage up to AC 1200V, DC 1800V, operation temperature up to 85℃**
- **Type B**

Dash -No.		Number of cores	Nominal cross-section (mm^2)	Number of the single wires (min)	Diameter of the insulation (Nominal value) (mm)	Wall thickness of insulation (Nominal value) (mm)	Wall thickness of common covering of insulation (Standard value) (mm)	screen	Wall thickness of sheath (Nominal value) (mm)	Diameter				Conductor resistance (20℃) (max) (Ω/km)	Insulation resistance (20℃) (min) (MΩ·km)
								Diameter of the single wire (max) (mm)		Covering		Overall			
										min (mm)	max (mm)	min (mm)	max (mm)		
008		3	1.5	7	1.7	1.0	1.0	0.3	1.2	8.5	9.5	12.0	13.0	12.2	1200
009		3	2.5	7	2.2	1.0	1.0	0.3	1.2	9.3	10.3	13.0	14.2	7.56	1000
010		3	4	7	2.7	1.0	1.0	0.3	1.2	10.3	11.5	14.0	15.2	4.70	850
011		3	6	7	3.3	1.0	1.0	0.3	1.3	11.6	12.9	15.5	16.8	3.11	750
012		3	10	7	4.2	1.0	1.0	0.3	1.4	13.5	14.8	17.6	18.9	1.84	600
013		3	16	7	5.3	1.0	1.0	0.3	1.4	15.7	17.1	20.0	21.4	1.16	500
014		3	25	7	6.6	1.2	1.0	0.3	1.6	19.2	20.6	24.0	25.4	0.734	450
015		3	35	7	7.9	1.2	1.0	0.3	1.7	21.5	23.0	26.0	28.2	0.529	400
016		3	50	19	9.1	1.4	1.0	0.3	1.8	25.0	26.7	30.0	32.2	0.391	400
017		3	70	19	11.0	1.4	1.2	0.3	1.9	28.9	31.1	34.5	36.7	0.270	350
018		3	95	19	12.9	1.6	1.2	0.4	2.1	33.6	35.8	39.7	42.2	0.195	350
	031	3	95	695	13.0	1.6	1.2	0.4	2.1	35.5	37.7	41.6	43.8	0.21	350
019		3	120	37	14.5	1.6	1.2	0.4	2.2	36.9	39.4	43.0	45.7	0.154	300

MGSGO

- **Cable single screened with sheath operating voltage up to AC 1200V, DC 1800V, operation temperature up to 85℃**
- **Type B**

Dash -No.	Number of cores	Nominal cross-section (mm^2)	Number of the single wires (min)	Diameter of the insulation (Nominal value) (mm)	Wall thickness of insulation (Nominal value) (mm)	Wall thickness of common covering of insulation (Standard value) (mm)	screen	Wall thickness of sheath (Nominal value) (mm)	Diameter				Conductor resistance (20℃) (max) (Ω/km)	Insulation resistance (20℃) (min) (MΩ·km)
							Diameter of the single wire (max) (mm)		Covering		Overall			
									min (mm)	max (mm)	min (mm)	max (mm)		
020	4	4	7	2.7	1.0	1.0	0.3	1.3	11.4	12.7	15.2	16.5	4.7	850
021	4	6	7	3.3	1.0	1.0	0.3	1.3	12.9	14.2	17.0	18.3	3.11	750
022	4	10	7	4.2	1.0	1.0	0.3	1.4	15.1	16.6	19.4	20.9	1.84	600
023	4	16	7	5.3	1.0	1.0	0.3	1.5	17.5	19.0	22.0	23.5	1.16	500
024	4	25	7	6.6	1.2	1.0	0.3	1.7	21.4	23.0	26.4	28.0	0.734	450
025	4	35	7	7.9	1.2	1.0	0.3	1.8	24.0	25.8	29.2	31.0	0.529	400
026	4	50	19	9.1	1.4	1.2	0.4	1.9	28.1	30.4	33.5	35.8	0.391	400
027	4	70	19	11.0	1.4	1.2	0.4	2.1	32.2	34.5	38.2	40.7	0.270	350
028	4	95	19	12.9	1.6	1.2	0.4	2.3	37.5	39.8	44.2	46.7	0.195	350
029	19	6	73	3.2	0.7	1.5	0.3	1.8	24.2	26.0	29.4	31.2	3.30	750
030	33	0.75	7	1.2	0.8	0.5	0.3	1.4	18.6	19.5	22.5	24.5	6.60	1200

MGSGO

- **Insulated wire with sheath operating voltage up to AC 1200V, DC 1800V, operation temperature up to 85℃**
- **Type C**

Dash-No.	Nominal cross-section (mm^2)	Number of the single wires (min)	Diameter of the conductor (max) (mm)	Wall thickness of insulation (Nominal value) (mm)	Wall thickness of sheath (Nominal value) (mm)	Overall diameter		Conductor resistance (20℃) (max) (Ω/km)	Insulation resistance (20℃) (min) (MΩ·km)
						min (mm)	max (mm)		
001	150	37	16.2	1.8	1.5	21.5	24.0	0.126	300
002	185	1360	18.1	2.0	1.6	24.8	26.3	0.106	300

MGSGO (tests)

Test items	Standard	Test method
1. Appearance and size	Test Ok	VG 95218-2 5.1 clause
2. Tensile strength and elongation at break of insulations and sheaths	Insulation Tensile strength: min. 5.0 N/mm^2 Elongation at break: min. 200% Sheath Tensile strength: min. 10.0 N/mm^2 Elongation at break: min. 150%	VG 95218-2 5.2.2 clause
3. Abrasion of sheath	Number of double-strokes: min. 1000	VG 95218-2 5.2.5 clause
4. Indelibility of markings	No stripes	VG 95218-2 5.2.10 clause
5. Notch sensitivity	No cracks	VG 95218-2 5.2.13 clause
6. Tear resistance	Min. 6N/mm	VG 95218-2 5.2.19 clause
7. Coiling test at low temperature (At -30±2℃)	No cracks	VG 95218-2 5.3.1 clause
8. Cold bend (At -30±2℃)	No cracks	VG 95218-2 5.3.1 clause
9. Thermal expansion (Tensile stress: 20N/cm^2) (Test temperature: 200±3℃) (Test duration: 15min)	Insulation and sheath Elongation at tensile stress: max. 175% Elongation after tensile stress: max. 25%	VG 95218-2 5.3.3 clause
10. Behavior under fire conditions	Naturally dying out a flame	VG 95218-2 5.3.4 clause
11. Ageing of prepared specimen in air oven (Ageing duration: 168±4h) (Ageing temperature: 100±2℃)	Sheath Tensile strength: -30% Elongation at break: ±40%	VG 95218-2 5.3.8 clause
12. Ageing of prepared specimen in air bomb (Ageing duration: 40±1h) (Ageing temperature: 127±1℃) (Air pressure: 5.5 ± 0.2bar)	Insulation Tensile strength and elongation at break : ±30%	VG 95218-2 5.3.8 clause

(Continue)

Test items	Standard	Test method
13. Ageing of specimen of complete Cords or cables in air oven (Ageing duration: 168±4h) (Ageing temperature: 95±2℃)	Tensile strength for the insulation : ±30% Elongation at break for the insulation : ±30% Tensile strength for the sheath: -30% Elongation at break for the sheath : ±40%	VG 95218-2 5.3.8 clause
14. Ageing of cores (Insulation with conductor) in air oven	Ageing duration(168±4)h Ageing temperature(135±2)℃ Tensile strength and elongation at break: ±30%	VG 95218-2 5.3.8 clause
15. Ozone resistance	No cracks	VG 95218-2 5.3.9 clause
16. Heat shock behavior (Test temperature: 105±2℃) (Test duration: 4h)	Test OK	VG 95218-2 5.3.11 clause
17. Smoke density	Min. 60%	VG 95218-2 5.3.14 clause
18. Conductor resistance	Referring to above mentioned tables	VG 95218-2 5.4.1 clause
19. Voltage test on cables and insulated wires for power insulation in air	Test voltage AC 50Hz. 3.5 kV Test duration: 5 minutes Test temperature: room temperature Specimen length: Manufacture length	VG 95218-2 5.4.2 clause
20. Insulation resistance	Referring to above mentioned tables	VG 95218-2 5.4.3 clause
21. Transfer impedance	Max. 30mΩ/m at 10MHz	VG 95218-2 5.4.8.2 clause
22. Capacitance alteration and insulation Resistance after water storage (Test voltage: AC 50Hz, 1000V)	Capacitance alteration: C_{14} ~ C_1: ≤ 0.15 C_1 C_{14} ~ C_7: ≤ 0.05 C_7 Specific volume resistivity(ρ_{14}): ≥10^{11}Ω·cm at 50℃	VG 95218-2 5.4.12 clause
23. Corrosivity of combustion gases	PH-value: min 4.3 Conductivity of the solution : Max. 10μS/mm	VG 95218-2 5.5.3 clause
24. Non Halogen verification		VG 95218-2 5.5.4.1 clause
25. In-service life (Temperature: 85℃)	Insulation: 20,000 h Sheath: 20,000 h	VG 95218-2 5.5.5 clause
26. Toxicity index	Max 5	VG 95218-2 5.5.12 clause

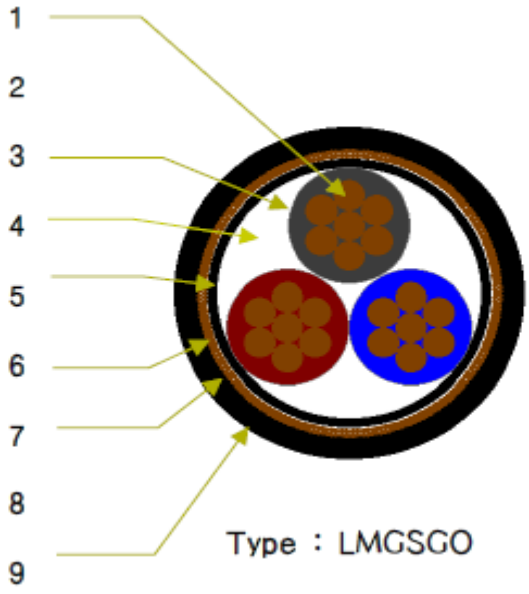
(Continue)

Test items	Standard	Test method
27. Resistance against chemicals(Sheath) ※ Test mediums refer to VG 95214-4	1.7(H-515) (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±60% 3.3 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±40% 4.2 (Max. permissible changes) Tensile strength: -20% Elongation at break: -20% Mass: ±10% Diesel fuel according to DIN 51601 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±50% IRM 902 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±40% Mass: ±50% Lubricating oil (O-278) (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±40% Mass: ±50% (At 100±2℃, 168±4h) Mass: ±30% (At 50±2℃, 672±4h) Acionat with 3.5% NaCl (Max. permissible changes) Tensile strength: -20% Elongation at break: -20% Mass: ±10%	VG 95218-2 5.5.7 clause 1.7: Test temperature : 50±2℃ Test duration : 168±4h, 672±4h 3.3: Test temperature : 23+2℃, 23-5℃ Test duration : 24±1h 4.2: Test temperature : 50±2℃ Test duration : 672±4h Diesel fuel: Test temperature and Test duration : (50±2℃, 168±4h), (23+2℃, 23-5℃, 672±4h) IRM 902: Test temperature and Test duration : (100±2℃, 24±1h) (90±2℃, 672±4h) Lubricating oil: Test temperature and Test duration : (100±2℃, 168±4h) (50±2℃, 672±4h) Acionat: Test temperature : 50±2℃ Test duration : 672±4h

LMGSGO (Light Weight Ships Power Cables)

According to VG 95218 part 61

With screen and sheath, light weight, halogen-free, low fire hazard



▶ Applied Standard

1) IEC 60228 for conductor
2) DIN VDE 0207-20(VDE 0207 part 20) for insulation
3) VG 95218-61 for design guideline, insulation, Polyalkene, sheath, and XLPO
4) VG 95218-2 for test method

▶ Lowest permissible temperature for installation

- -15℃

▶ Design

1) Conductor: Copper for electrical application, Class 2
2) Separator
3) Insulation: Halogen free cross-linked polyalkene
4) Assembly
5) Covering of cores: Elastic or plastic compound halogen free
6) Binder tape
7) Screen: Copper for electrical application
8) Binder tape
9) Sheath: Cross-linked Polyolefin

▶ Core Identification1

- 1C : Black
- 2C : Black, Blue
- 3C : Black, Blue, Brown
- 4C : Black, Blue, Brown, Black
- More than 5C : Printing a number on black insulations

▶ Color of sheath

- Black

LMGSGO

- **Cable, screened with sheath, operating voltage up to AC 550V, DC 825V, operating temperature up to 85℃**
- **Type A**

Dash-No.		Number of cores X Nominal cross-section (mm^2)	Number of the single wires (min)	Diameter of the insulation (Nominal value) (mm)	Wall thickness of insulation (Nominal value) (mm)	Wall thickness of common covering of cores		sheath	Wall thickness of sheath (Nominal value) (mm)	Diameter				Conductor resistance (max) (Ω/km)	Insulation resistance (min) (MΩ·km)
						wrapped (mm)	extruded (mm)	Diameter of the single wire (mm)		Covering		Overall			
										min (mm)	max (mm)	min (mm)	max (mm)		
	001	2X1.5	7	1.7	0.4	0.1	0.4	0.15	0.8	4.7	5.5	7.0	7.8	12.2	600
014		2X2.5	7	2.2	0.4	0.1	0.4	0.20	0.8	5.4	6.3	7.7	8.6	7.56	500
	002	3X1.5	7	1.7	0.4	0.1	0.4	0.15	0.8	5.1	6.1	7.2	8.2	12.2	600
102		3GX1.5	7	1.7	0.4	0.1	0.4	0.15	0.8	5.1	6.1	7.2	8.2	12.2	600
	015	3X2.5	7	2.2	0.4	0.1	0.4	0.20	0.8	5.9	6.9	8.0	9.2	7.56	500
115		3GX2.5	7	2.2	0.4	0.1	0.4	0.20	0.8	5.9	6.9	8.0	9.2	7.56	500
	003	4X1.5	7	1.7	0.4	0.1	0.4	0.20	0.8	5.6	6.6	7.8	9.2	12.2	600
016		4X2.5	7	2.2	0.4	0.1	0.4	0.20	0.8	6.5	7.5	8.7	10.2	7.56	500
	004	5X1.5	7	1.7	0.4	0.1	-	0.20	0.8	6.2	7.2	8.3	9.3	12.2	600
104		5GX1.5	7	1.7	0.4	0.1	-	0.20	0.8	6.2	7.2	8.3	9.3	12.2	600
	005	7X1.5	7	1.7	0.4	0.1	-	0.20	1.0	6.9	7.9	9.3	10.3	12.2	600
105		7GX1.5	7	1.7	0.4	0.1	-	0.20	1.0	6.9	7.9	9.3	10.3	12.2	600
	017	7X2.5	7	2.2	0.4	0.1	-	0.20	1.0	8.1	9.3	10.3	11.7	7.56	500

LMGSGO

- **Cable, screened with sheath, operating voltage up to AC 550V, DC 825V, operating temperature up to 85℃**
- **Type A**

Dash-No.		Number of cores X Nominal cross-section (mm^2)	Number of the single wires (min)	Diameter of the insulation (Nominal value) (mm)	Wall thickness of insulation (Nominal value) (mm)	Wall thickness of common covering of cores		sheath	Wall thickness of sheath (Nominal value) (mm)	Diameter				Conductor resistance (max) (Ω/km)	Insulation resistance (min) (MΩ·km)
						wrapped (mm)	extruded (mm)	Diameter of the single wire (mm)		Covering		Overall			
										min (mm)	max (mm)	min (mm)	max (mm)		
006		10X1.5	7	1.7	0.4	0.1	-	0.20	1.0	8.2	9.4	10.8	12.2	12.2	600
	016	10GX1.5	7	1.7	0.4	0.1	-	0.20	1.0	8.2	9.4	10.8	12.2	12.2	600
007		12X1.5	7	1.7	0.4	0.1	-	0.20	1.0	9.6	10.9	12.0	13.3	12.2	600
008		14X1.5	7	1.7	0.4	0.1	-	0.20	1.0	10.2	11.5	12.7	14.0	12.2	600
009		16X1.5	7	1.7	0.4	0.1	-	0.20	1.0	10.8	12.2	13.2	14.6	12.2	600
	010	19X1.5	7	1.7	0.4	0.1	-	0.20	1.0	11.5	12.9	13.9	14.7	12.2	600
	011	24X1.5	7	1.7	0.4	0.1	-	0.20	1.0	13.0	14.5	15.5	17.2	12.2	600
	012	27X1.5	7	1.7	0.4	0.1	-	0.20	1.0	14.2	15.7	16.6	18.1	12.2	600
	013	33X1.5	7	1.7	0.4	0.1	-	0.20	1.0	15.4	17.1	17.5	19.5	12.2	600
018		37X1.5	7	1.7	0.4	0.1	-	0.20	1.0	15.4	17.1	20.0	22.0	12.2	600

LMGSGO (tests)

Test items	Standard	Test method
1. Appearance and size	Test Ok	VG 95218-2 5.1 clause
2. Tensile strength and elongation At break of insulations and sheaths	Insulation Tensile strength: min. 10.0 N/mm^2 Elongation at break: 150% ~ 200% Sheath Tensile strength: min. 10.0 N/mm^2 Elongation at break: min. 150%	VG 95218-2 5.2.2 clause
3. Abrasion of sheath	Number of double-strokes: min. 1000	VG 95218-2 5.2.5 clause
4. Indelibility of markings	No stripes	VG 95218-2 5.2.10 clause
5. Notch sensitivity	No cracks	VG 95218-2 5.2.13 clause
6. Tear resistance	Min. 6N/mm	VG 95218-2 5.2.19 clause
7. Coiling test at low temperature (At -30±2℃)	No cracks	VG 95218-2 5.3.1 clause
7. Cold bend (At -30±2℃)	No cracks	VG 95218-2 5.3.1 clause
8. Thermal expansion (Tensile stress: 20N/cm^2) (Test temperature: 200±3℃) (Test duration: 15min)	Insulation and sheath Elongation at tensile stress: max. 175% Elongation after tensile stress: max. 25%	VG 95218-2 5.3.3 clause
9. Behavior under fire conditions	Naturally dying out a flame	VG 95218-2 5.3.4 clause
10. Ageing of prepared specimen in air oven (Ageing duration: 168±4h) (Ageing temperature: 100±2℃)	Sheath Tensile strength: -30% Elongation at break: ±40%	VG 95218-2 5.3.8 clause
11. Ageing of prepared specimen in air bomb (Ageing duration: 40±1h) (Ageing temperature: 127±1℃) (Air pressure: 5.5 ± 0.2bar)	Insulation Tensile strength and elongation at break : ±30%	VG 95218-2 5.3.8 clause

(Continue)

Test items	Standard	Test method
12. Ageing of specimen of complete Cords or cables in air oven (Ageing duration: 168±4h) (Ageing temperature: 95±2℃)	Tensile strength for the insulation : ±30% Elongation at break for the insulation : ±30% Tensile strength for the sheath: -30% Elongation at break for the sheath : ±40%	VG 95218-2 5.3.8 clause
13. Ageing of cores(Insulation with conductor) in air oven	Ageing duration(168±4)h Ageing temperature(120±2)℃ Tensile strength and elongation at break: ±30%	VG 95218-2 5.3.8 clause
14. Ozone resistance	No cracks	VG 95218-2 5.3.9 clause
15. Heat shock (Test temperature: 105±2℃) (Test duration: 4h)	Test OK	VG 95218-2 5.3.11 clause
16. Smoke density	Min. 60%	VG 95218-2 5.3.14 clause
17. Conductor resistance	Referring to above mentioned tables	VG 95218-2 5.4.1 clause
18. Voltage test on cables and insulated wires for power insulation in air	Test voltage AC 50Hz. 2.5 kV Test duration: 5 minutes Test temperature: room temperature Specimen length: Manufacture length	VG 95218-2 5.4.2 clause
19. Insulation resistance	Referring to above mentioned tables	VG 95218-2 5.4.3 clause
20. Transfer impedance	Max. 30mΩ/m at 10MHz	VG 95218-2 5.4.8.2 clause
21. Capacitance alteration and insulation Resistance after water storage (Test voltage: AC 50Hz, 1000V)	Capacitance alteration: C_{14} ~ C_1: ≤ 0.15 C_1 C_{14} ~ C_7: ≤ 0.05 C_7 Specific volume resistivity(ρ_{14}): ≥10^{11}Ω·cm at 50℃	IEC600092-350 12.3 clause
22. Corrosivity of combustion gases	PH-value: min 4.3 Conductivity of the solution : Max. 10μS/mm	VG 95218-2 5.5.3 clause
23. Non Halogen verification		VG 95218-2 5.5.4.1 clause
24. In-service life (Temperature: 85℃)	Insulation: 20,000 h Sheath: 20,000 h	VG 95218-2 5.5.5 clause
25. Toxicity index	Max 5	VG 95218-2 5.5.12 clause

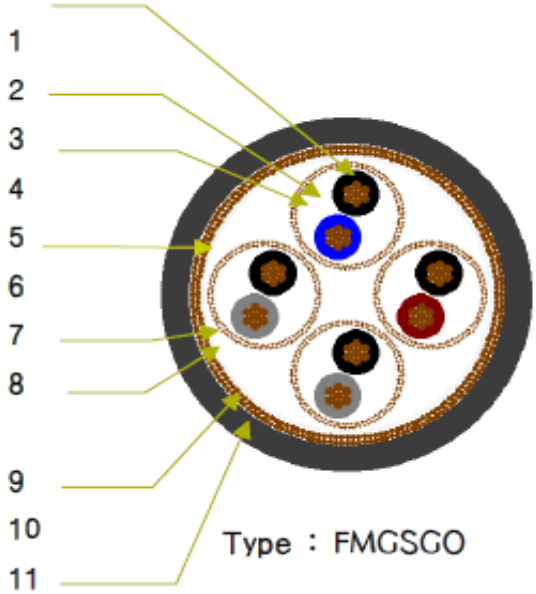
(Continue)

Test items	Standard	Test method
26. Resistance against chemicals(Sheath) ※ Test mediums refer to VG 95214-4	1.7(H-515) (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±60% 3.3 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±40% 4.2 (Max. permissible changes) Tensile strength: -20% Elongation at break: -20% Mass: ±10% Diesel fuel according to DIN 51601 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±50% IRM 902 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±40% Mass: ±50% Lubricating oil (O-278) (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±40% Mass: ±50% (At 100±2℃, 168±4h) Mass: ±30% (At 50±2℃, 672±4h) Acionat with 3.5% NaCl (Max. permissible changes) Tensile strength: -20% Elongation at break: -20% Mass: ±10%	VG 95218-2 5.5.7 clause 1.7: Test temperature : 50±2℃ Test duration : 168±4h, 672±4h 3.3: Test temperature : 23+2℃, 23-5℃ Test duration : 24±1h 4.2: Test temperature : 50±2℃ Test duration : 672±4h Diesel fuel: Test temperature and Test duration : (50±2℃, 168±4h), (23+2℃, 23-5℃, 672±4h) IRM 902: Test temperature and Test duration : (100±2℃, 24±1h) (90±2℃, 672±4h) Lubricating oil: Test temperature and Test duration : (100±2℃, 168±4h) (50±2℃, 672±4h) Acionat: Test temperature : 50±2℃ Test duration : 672±4h

FMGSGO (Ships Telecommunications Cables)

According to VG 95218 part 62

With screen and sheath, pair formation, not screened, halogen-free, low fire hazard



▶ Applied Standard

1) IEC 60228 for conductor
2) VG 95218-62 for design guideline, insulation, Polyalkene, sheath, and XLPO
3) VG 95218-2 for test method

▶ Lowest permissible temperature for installation

- -15℃

▶ Design

1) Conductor: Copper for electrical application, Class 2
2) Separator
3) Insulation: Halogen free cross-linked polyalkene
4) Pair composition
5) Binder tape
6) Assembly
7) Covering of cores: Elastic or plastic compound halogen free
8) Binder tape
9) Screen: Copper for electrical application
10) Binder tape
11) Sheath: Cross-linked Polyolefin

▶ Color of sheath

- Black

▶ Core Identification1

- 2 and 6~16 paired cable(1 Quad and 3 till 8 Quads)
  Each quad: Black/Blue/Grey/Brown
- 4 paired cable(4 Pairs)
  1 pair: Black/Blue
  2 pair: Black/Brown
  3 pair: Black/Grey
  4 pair: Black/Grey

FMGSGO

- **Cable, operating voltage up to AC 250V, DC 355V, operating temperature up to 85℃**
- **Type A**

Dash -No.	Number of core x Nominal cross-section (mm2)	Number of the single wires (min)	Diameter of the conductor (max) (mm)	Wall thickness of insulation (Nominal value) (mm)	Wall thickness of common covering of cores (Standard value) (mm)	Diameter of the single screen wire (mm)	Wall thickness of sheath (Nominal value) (mm)	Diameter				Conductor resistance (20℃) (max) (Ω/km)	Insulation resistance (20℃) (min) (MΩ·km)
								Covering		Overall			
								min (mm)	max (mm)	min (mm)	max (mm)		
008	1X2X0.75	7	1.2	0.4	0.1	0.15	0.8	3.8	4.8	6.0	7.0	53.2	800
001	2X2X0.75	7	1.2	0.4	0.1	0.15	0.8	4.7	5.8	6.7	7.8	53.2	800
002	4X2X0.75	7	1.2	0.4	0.1	0.20	1.0	8.0	9.4	9.6	11.0	53.2	800
003	6X2X0.75	7	1.2	0.4	0.1	0.20	1.0	8.2	9.7	10.8	12.3	53.2	800
004	8X2X0.75	7	1.2	0.4	0.1	0.20	1.0	10.0	11.5	11.9	13.4	53.2	800
005	10X2X0.75	7	1.2	0.4	0.1	0.20	1.0	10.2	11.7	13.7	15.2	53.2	800
006	14X2X0.75	7	1.2	0.4	0.1	0.20	1.0	13.6	15.2	14.9	16.5	53.2	800
007	16X2X0.75	7	1.2	0.4	0.1	0.20	1.0	13.8	15.6	16.1	17.9	53.2	800

FMGSGO (tests)

Test items	Standard	Test method
1. Appearance and size	Test Ok	VG 95218-2 5.1 clause
2. Tensile strength and elongation At break of insulations and sheaths	Insulation Tensile strength: min. 10.0 N/mm^2 Elongation at break: 150% ~ 200% Sheath Tensile strength: min. 10.0 N/mm^2 Elongation at break: min. 150%	VG 95218-2 5.2.2 clause
3. Abrasion of sheath	Number of double-strokes: min. 1000	VG 95218-2 5.2.5 clause
4. Indelibility of markings	No stripes	VG 95218-2 5.2.10 clause
5. Notch sensitivity	No cracks	VG 95218-2 5.2.13 clause
6. Tear resistance	Min. 6N/mm	VG 95218-2 5.2.19 clause
7. Coiling test at low temperature (At -30±2℃)	No cracks	VG 95218-2 5.3.1 clause
8. Cold bend (At -30±2℃)	No cracks	VG 95218-2 5.3.1 clause
9. Thermal expansion (Tensile stress: 20N/cm^2) (Test temperature: 200±3℃) (Test duration: 15min)	Insulation and sheath Elongation at tensile stress: max. 175% Elongation after tensile stress: max. 25%	VG 95218-2 5.3.3 clause
10. Behavior under fire conditions	Naturally dying out a flame	VG 95218-2 5.3.4 clause
11. Ageing of prepared specimen in air oven (Ageing duration: 168±4h) (Ageing temperature: 100±2℃)	Sheath Tensile strength: -30% Elongation at break: ±40%	VG 95218-2 5.3.8 clause
12. Ageing of prepared specimen in air bomb (Ageing duration: 40±1h) (Ageing temperature: 127±1℃) (Air pressure: 5.5 ± 0.2bar)	Insulation Tensile strength and elongation at break : ±30%	VG 95218-2 5.3.8 clause

(Continue)

Test items	Standard	Test method
13. Ageing of specimen of complete Cords or cables in air oven (Ageing duration: 168±4h) (Ageing temperature: 95±2℃)	Tensile strength for the insulation : ±30% Elongation at break for the insulation : ±30% Tensile strength for the sheath: -30% Elongation at break for the sheath : ±40%	VG 95218-2 5.3.8 clause
14. Ageing of cores(Insulation with conductor) in air oven (Ageing duration(168±4)h) (Ageing temperature(120±2)℃)	Tensile strength and elongation at break: ±30%	VG 95218-2 5.3.8 clause
15. Ozone resistance	No cracks	VG 95218-2 5.3.9 clause
16. Heat shock (Test temperature: 105±2℃) (Test duration: 4h)	Test OK	VG 95218-2 5.3.11 clause
17. Smoke density	Min. 60%	VG 95218-2 5.3.14 clause
18. Conductor resistance	Referring to above mentioned tables	VG 95218-2 5.4.1 clause
19. Voltage test on cables and insulated wires for telecommunication and data processing systems in air	Test voltage AC 50Hz. 2.0 kV Test duration: 5 minutes Test temperature: room temperature Specimen length: Manufacture length	VG 95218-2 5.4.2 clause
20. Insulation resistance	Referring to above mentioned tables	VG 95218-2 5.4.3 clause
21. Transfer impedance	Max. 30mΩ/m at 10MHz	VG 95218-2 5.4.8.2 clause
22. Capacitance alteration and insulation Resistance after water storage (Test voltage: AC 50Hz, 1000V)	Capacitance alteration: C_{14} ~ C_1: ≤ 0.15 C_1 C_{14} ~ C_7: ≤ 0.05 C_7 Specific volume resistivity(ρ_{14}): ≥10^{11}Ω·cm at 50℃	IEC600092-350 12.3 clause
23. Corrosivity of combustion gases	PH-value: min 4.3 Conductivity of the solution : Max. 10μS/mm	VG 95218-2 5.5.3 clause
24. Non Halogen verification		VG 95218-2 5.5.4.1 clause
25. In-service life (Temperature: 85℃)	Insulation: 20,000 h Sheath: 20,000 h	VG 95218-2 5.5.5 clause
26. Toxicity index	Max 5	VG 95218-2 5.5.12 clause

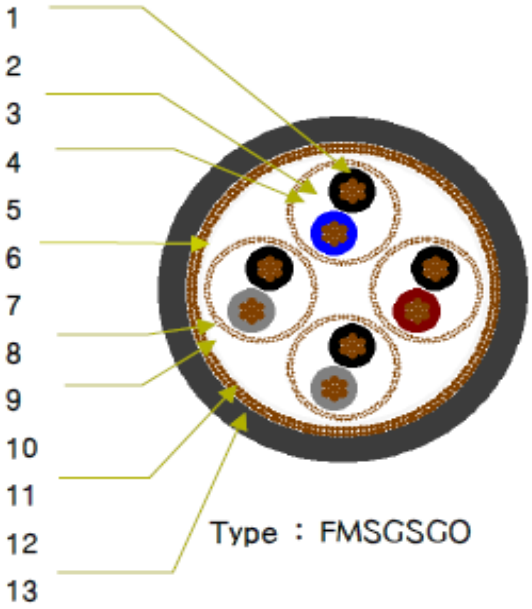
(Continue)

Test items	Standard	Test method
27. Resistance against chemicals(Sheath) ※ Test mediums refer to VG 95214-4	1.7(H-515) (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±60% 3.3 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±40% 4.2 (Max. permissible changes) Tensile strength: -20% Elongation at break: -20% Mass: ±10% Diesel fuel according to DIN 51601 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±50% IRM 902 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±40% Mass: ±50% Lubricating oil (O-278) (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±40% Mass: ±50% (At 100±2℃, 168±4h) Mass: ±30% (At 50±2℃, 672±4h) Acionat with 3.5% NaCl (Max. permissible changes) Tensile strength: -20% Elongation at break: -20% Mass: ±10%	VG 95218-2 5.5.7 clause 1.7: Test temperature : 50±2℃ Test duration : 168±4h, 672±4h 3.3: Test temperature : 23+2℃, 23-5℃ Test duration : 24±1h 4.2: Test temperature : 50±2℃ Test duration : 672±4h Diesel fuel: Test temperature and Test duration : (50±2℃, 168±4h), (23+2℃, 23-5℃, 672±4h) IRM 902: Test temperature and Test duration : (100±2℃, 24±1h) (90±2℃, 672±4h) Lubricating oil: Test temperature and Test duration : (100±2℃, 168±4h) (50±2℃, 672±4h) Acionat: Test temperature : 50±2℃ Test duration : 672±4h

FMSGSGO (Ships Telecommunications Cables)

According to VG 95218 part 63

With screen and sheath, pair formation, screened, halogen-free, low fire hazard



▶ Applied Standard

1) IEC 60228 for conductor
2)) VG 95218-61 for design guideline, insulation, Polyalkene, sheath, and XLPO
4) VG 95218-2 for test method

▶ Lowest permissible temperature for installation

- -15℃

▶ Design

1) Conductor: Copper for electrical application, Class 2
2) Separator
3) Insulation: Halogen free cross-linked polyalkene
4) Pair composition
5) Binder tape
6) Screen: Copper for electrical application
7) Binder tape
8) Assembly
9) Covering of cores: Elastic or plastic compound halogen free
10) Binder tape
11) Screen: Copper for electrical application
12) Binder tape
13) Sheath: Cross-linked Polyolefin

▶ Color of sheath

- Black

▶ Core Identification

1) 2 paired cable (1 Quad)
   1 pair: Black, Blue
   2 pair: Black, Brown
2) 4 paired to 24 paired cables in each layer
   1 pair: Black/Blue (pilot pair)
   2 pair: Black/Brown (direction pair)
   3 pair and others: Black/Grey

※ Pilot and direction shall be the same in all layers

FMSGSGO

- **Cable, operating voltage up to AC 250V, DC 355V, operating temperature up to 85℃**
- **Type A**

Dash -No.	Number of core x Nominal cross-section (mm2)	Number of the single wires (min)	Diameter of the conductor (max) (mm)	Wall thickness of insulation (Nominal value) (mm)	Wall thickness of common covering of cores (Standard value) (mm)	Diameter of the single screen wire		Wall thickness of sheath (Nominal value) (mm)	Diameter				Conductor resistance (20℃) (max) (Ω/km)	Insulation resistance (20℃) (min) (MΩ·km)
									Covering		Overall			
						A (mm)	B (mm)		min (mm)	max (mm)	min (mm)	max (mm)		
001	2X2X0.75	7	1.2	0.4	0.1	0.15	0.20	0.8	8.8	10.2	11.1	12.5	53.2	800
002	4X2X0.75	7	1.2	0.4	0.1	0.15	0.20	1.0	10.6	12.2	12.9	14.5	53.2	800
003	7X2X0.75	7	1.2	0.4	0.1	0.15	0.20	1.0	12.4	13.9	14.9	16.4	53.2	800
004	11X2X0.75	7	1.2	0.4	0.1	0.15	0.20	1.2	16.4	18.2	19.6	21.4	53.2	800
005	14X2X0.75	7	1.2	0.4	0.1	0.15	0.20	1.2	17.7	19.7	20.8	22.8	53.2	800
006	19X2X0.75	7	1.2	0.4	0.1	0.15	0.25	1.4	21.0	23.0	23.4	25.4	53.2	800
007	24X2X0.75	7	1.2	0.4	0.1	0.15	0.25	1.4	23.3	25.3	26.4	28.4	53.2	800

FMSGSGO (tests)

Test items	Standard	Test method
1. Appearance and size	Test Ok	VG 95218-2 5.1 clause
2. Tensile strength and elongation At break of insulations and sheaths	Insulation Tensile strength: min. 10.0 N/mm^2 Elongation at break: 150% ~ 200% Sheath Tensile strength: min. 10.0 N/mm^2 Elongation at break: min. 150%	VG 95218-2 5.2.2 clause
3. Abrasion of sheath	Number of double-strokes: min. 1000	VG 95218-2 5.2.5 clause
4. Indelibility of markings	No stripes	VG 95218-2 5.2.10 clause
5. Notch sensitivity	No cracks	VG 95218-2 5.2.13 clause
6. Tear resistance	Min. 6N/mm	VG 95218-2 5.2.19 clause
7. Coiling test at low temperature (At -30±2℃)	No cracks	VG 95218-2 5.3.1 clause
8. Cold bend (At -30±2℃)	No cracks	VG 95218-2 5.3.1 clause
9. Thermal expansion (Tensile stress: 20N/cm^2) (Test temperature: 200±3℃) (Test duration: 15min)	Insulation and sheath Elongation at tensile stress: max. 175% Elongation after tensile stress: max. 25%	VG 95218-2 5.3.3 clause
10. Behavior under fire conditions	Naturally dying out a flame	VG 95218-2 5.3.4 clause
11. Ageing of prepared specimen in air oven (Ageing duration: 168±4h) (Ageing temperature: 100±2℃)	Sheath Tensile strength: -30% Elongation at break: ±40%	VG 95218-2 5.3.8 clause
12. Ageing of prepared specimen in air bomb (Ageing duration: 40±1h) (Ageing temperature: 127±1℃) (Air pressure: 5.5 ± 0.2bar)	Insulation Tensile strength and elongation at break : ±30%	VG 95218-2 5.3.8 clause

(Continue)

Test items	Standard	Test method
13. Ageing of specimen of complete cords or cables in air oven (Ageing duration: 168±4h) (Ageing temperature: 95±2℃)	Tensile strength for the insulation : ±30% Elongation at break for the insulation : ±30% Tensile strength for the sheath: -30% Elongation at break for the sheath : ±40%	VG 95218-2 5.3.8 clause
14. Ageing of cores (Insulation with conductor) in air oven	Ageing duration(168±4)h Ageing temperature(120±2)℃ Tensile strength and elongation at break: ±30%	VG 95218-2 5.3.8 clause
15. Ozone resistance	No cracks	VG 95218-2 5.3.9 clause
16. Heat shock behavior (Test temperature: 105±2℃) (Test duration: 4h)	Test OK	VG 95218-2 5.3.11 clause
17. Smoke density	Min. 60%	VG 95218-2 5.3.14 clause
18. Conductor resistance	Referring to above mentioned tables	VG 95218-2 5.4.1 clause
19. Voltage test on cables and insulated wires for telecommunication and data processing systems in air	Test voltage AC 50Hz. 2.0 kV Test duration: 5 minutes Test temperature: room temperature Specimen length: Manufacture length	VG 95218-2 5.4.2 clause
20. Insulation resistance	Referring to above mentioned tables	VG 95218-2 5.4.3 clause
21. Transfer impedance	Screen A: Max. 50mΩ/m at 10MHz Screen B, Screen A and B Max. 30mΩ/m at 10MHz	VG 95218-2 5.4.8.2 clause
22. Capacitance alteration and insulation Resistance after water storage (Test voltage: AC 50Hz, 1000V)	Capacitance alteration: C_{14} ~ C_1: ≤ 0.15 C_1 C_{14} ~ C_7: ≤ 0.05 C_7 Specific volume resistivity(ρ_{14}): $\geq 10^{11}\Omega \cdot cm$ at 50℃	IEC600092-350 12.3 clause
23. Corrosivity of combustion gases	PH-value: min 4.3 Conductivity of the solution : Max. 10μS/mm	VG 95218-2 5.5.3 clause
24. Non Halogen verification		VG 95218-2 5.5.4.1 clause
25. In-service life (Temperature: 85℃)	Insulation: 20,000 h Sheath: 20,000 h	VG 95218-2 5.5.5 clause

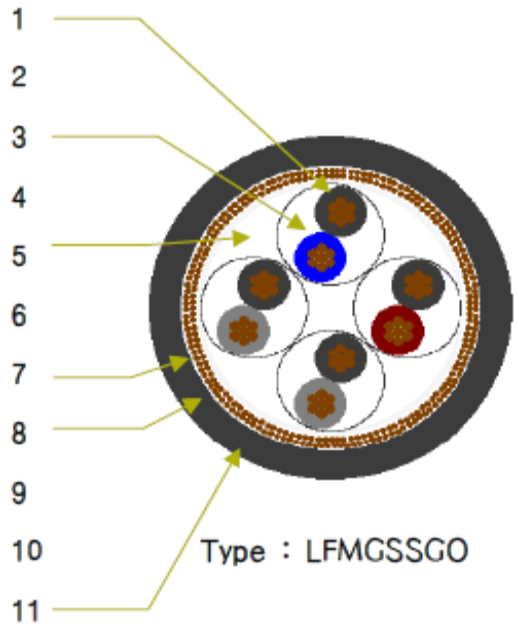
(Continue)

Test items	Standard	Test method
26. Resistance against chemicals(Sheath) ※ Test mediums refer to VG 95214-4	1.7(H-515) (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±60% 3.3 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±40% 4.2 (Max. permissible changes) Tensile strength: -20% Elongation at break: -20% Mass: ±10% Diesel fuel according to DIN 51601 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±50% IRM 902 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±40% Mass: ±50% Lubricating oil (O-278) (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±40% Mass: ±50% (At 100±2℃, 168±4h) Mass: ±30% (At 50±2℃, 672±4h) Acionat with 3.5% NaCl (Max. permissible changes) Tensile strength: -20% Elongation at break: -20% Mass: ±10%	VG 95218-2 5.5.7 clause 1.7: Test temperature : 50±2℃ Test duration : 168±4h, 672±4h 3.3: Test temperature : 23+2℃, 23-5℃ Test duration : 24±1h 4.2: Test temperature : 50±2℃ Test duration : 672±4h Diesel fuel: Test temperature and Test duration : (50±2℃, 168±4h), (23+2℃, 23-5℃, 672±4h) IRM 902: Test temperature and Test duration : (100±2℃, 24±1h) (90±2℃, 672±4h) Lubricating oil: Test temperature and Test duration : (100±2℃, 168±4h) (50±2℃, 672±4h) Acionat: Test temperature : 50±2℃ Test duration : 672±4h
26. Toxicity index	Max 5	VG 95218-2 5.5.12 clause

LFMGSSGO and LFMGSGO

(Light weight Ships Telecommunications Cables) **According to VG 95218 part 64**

With single and double screen, with sheath, pair formation, not screened, halogen-free, low fire hazard



▶ Applied Standard

1) IEC 60228 for conductor
2) VG 95218-64 for design guideline
3) VG 95218-64 for polyalkene, sheath, and XLPO
4) VDE 0207-22 for insulation
5) VG 95218-2 for test method

▶ Lowest permissible temperature for installation

- -15℃

▶ Design

1) Conductor: Copper for electrical application,
2) Separator: Halogen free plastic foil
3) Insulation: Halogen free cross-linked polyethylene
4) Pair composition
5) Assembly
6) Covering of cores
7) Screen: Copper for electrical application
8) Binder tape
9) Screen: Copper for electrical application
(Except Type B)
10) Binder tape
11) Sheath: Cross-linked Polyolefin

▶ Core Identification

1) 2 paired cable (1 Quad)
Black, Blue, Grey, Grown

2) 4 paired to 45 paired cables in each layer
1 pair: Black, Blue (pilot pair)
2 pair: Black, Brown (direction pair)
3 pair and others: Black, Grey

※ Pilot and direction shall be the same in all layers

▶ Color of sheath

- Black

LFMGSSGO

- **Cable, operating voltage up to AC 250V, DC 355V, double screened operating temperature up to 85℃**
- **Type A**

Dash -No.	Number of core x Nominal cross-section (mm2)	Number of the single wires (min)	Diameter of the conductor (max) (mm)	Wall thickness of insulation (Nominal value) (mm)	Wall thickness of common covering of cores (Standard value) (mm)	Diameter of the single screen wire		Wall thickness of sheath (Nominal value) (mm)	Diameter				Conductor resistance (20℃) (max) (Ω/km)	Insulation resistance (20℃) (min) (MΩ·km)
									Covering		Overall			
						A (mm)	B (mm)		min (mm)	max (mm)	min (mm)	max (mm)		
001	2X2X0.4	7	0.85	0.2	0.1	0.15	0.15	0.8	3.6	4.6	5.8	6.8	115	1500
002	4X2X0.4	7	0.85	0.2	0.1	0.15	0.15	0.8	5.3	6.3	7.7	8.8	115	1500
003	7X2X0.4	7	0.85	0.2	0.1	0.20	0.20	0.9	6.0	7.4	9.4	10.8	115	1500
004	12X2X0.4	7	0.85	0.2	0.1	0.20	0.20	1.0	9.3	10.8	12.8	14.5	115	1500
005	19X2X0.4	7	0.85	0.2	0.1	0.20	0.20	1.0	11.6	13.4	13.8	15.5	115	1500
006	27X2X0.4	7	0.85	0.2	0.1	0.20	0.20	1.1	11.8	13.6	15.5	17.3	115	1500

LFMGSGO

- **Cable, operating voltage up to AC 250V, DC 355V, single screened operating temperature up to 85℃**
- **Type B**

Dash -No.	Number of core x Nominal cross-section (mm2)	Number of the single wires (min)	Diameter of the conductor (max) (mm)	Wall thickness of insulation (Nominal value) (mm)	Wall thickness of covering of cabling (Standard value) (mm)	Diameter of the single screen wire		Wall thickness of sheath (Nominal value) (mm)	Diameter				Conductor resistance (20℃) (max) (Ω/km)	Insulation resistance (20℃) (min) (MΩ·km)
									Covering		Overall			
						A (mm)	B (mm)		min (mm)	max (mm)	min (mm)	max (mm)		
001	30X2X0.4	7	0.85	0.2	0.1	0.2	-	1.4	14.1	15.9	17.5	19.3	115	1500
002	45X2X0.4	7	0.85	0.2	0.1	0.2	-	1.6	16.7	18.6	20.6	22.5	115	1500

LFMGSSGO and LFMGSGO (tests)

Test items	Standard	Test method
1. Appearance and size	Test Ok	VG 95218-2 5.1 clause
2. Tensile strength and elongation At break of insulations and sheaths	Sheath Tensile strength: min. 10.0 N/mm^2 Elongation at break: min. 150%	VG 95218-2 5.2.2 clause
3. Abrasion of sheath	Number of double-strokes: min. 1000	VG 95218-2 5.2.5 clause
4. Indelibility of markings	No stripes	VG 95218-2 5.2.10 clause
5. Notch sensitivity	No cracks	VG 95218-2 5.2.13 clause
6. Tear resistance	Min. 6N/mm	VG 95218-2 5.2.19 clause
7. Coiling test at low temperature (At -30±2℃)	No cracks	VG 95218-2 5.3.1 clause
8. Cold bend (At -30±2℃)	No cracks	VG 95218-2 5.3.1 clause
9. High temperature indentation test (Test temperature: (150±3℃) (Storage duration: 4h) (Test load: 0.28N)	Indentation depth: max. 50%)	VG 95218-2 5.3.2 clause
10. Thermal expansion (Tensile stress: 20N/cm^2) (Test temperature: 200±3℃) (Test duration: 15min)	sheath Elongation at tensile stress: max. 175% Elongation after tensile stress: max. 25%	VG 95218-2 5.3.3 clause
11. Behavior under fire conditions	Naturally dying out a flame	VG 95218-2 5.3.4 clause
12. Ageing of prepared specimen in air oven (Ageing duration: 168±4h) (Ageing temperature: 100±2℃)	Sheath Tensile strength: -30% Elongation at break: ±40%	VG 95218-2 5.3.8 clause
13. Ageing of specimen of complete Cords or cables in air oven (Ageing duration: 168±4h) (Ageing temperature: 95±2℃)	Tensile strength for the sheath: -30% Elongation at break for the sheath : ±40%	VG 95218-2 5.3.8 clause

(Continue)

Test items	Standard	Test method
14. Ozone resistance	No cracks	VG 95218-2 5.3.9 clause
15. Heat shock behavior (Test temperature: 150±2℃) (Test duration: 4h)	Test OK	VG 95218-2 5.3.11 clause
16. Smoke density	Min. 60%	VG 95218-2 5.3.14 clause
17. Conductor resistance	Referring to above mentioned tables	VG 95218-2 5.4.1 clause
19. Voltage test on cables and insulated wires for telecommunication and data processing	Test voltage: DC 100V to 500V	VG 95218-2 5.4.2 clause
20. Insulation resistance	Referring to above mentioned tables	VG 95218-2 5.4.3 clause
21. Transfer impedance	Max. 15mΩ/m at 10MHz	VG 95218-2 5.4.8.2 clause
22. Corrosivity of combustion gases	PH-value: min 4.3 Conductivity of the solution : Max. 10μS/mm	VG 95218-2 5.5.3 clause
23. Non Halogen verification		VG 95218-2 5.5.4.1 clause
24. In-service life (Temperature: 85℃)	Insulation: 20,000 h Sheath: 20,000 h	VG 95218-2 5.5.5 clause
25. Toxicity index	Max 5	VG 95218-2 5.5.12 clause

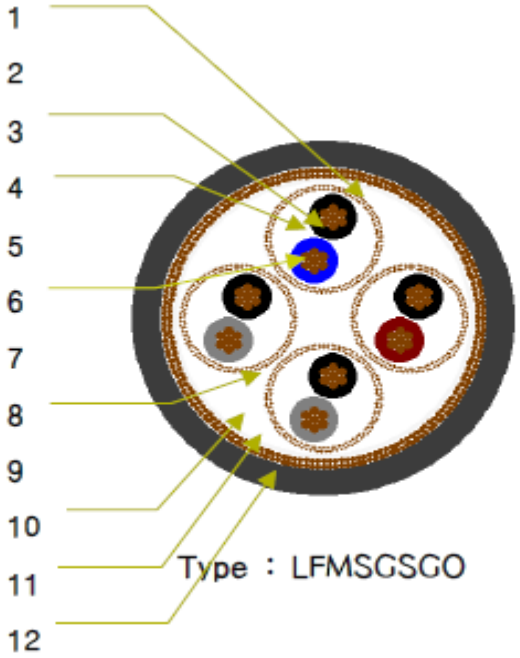
(Continue)

Test items	Standard	Test method
26. Resistance against chemicals(Sheath) ※ Test mediums refer to VG 95214-4	1.7(H-515) (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±60% 3.3 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±40% 4.2 (Max. permissible changes) Tensile strength: -20% Elongation at break: -20% Mass: ±10% Diesel fuel according to DIN 51601 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±50% IRM 902 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±40% Mass: ±50% Lubricating oil (O-278) (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±40% Mass: ±50% (At 100±2℃, 168±4h) Mass: ±30% (At 50±2℃, 672±4h) Acionat with 3.5% NaCl (Max. permissible changes) Tensile strength: -20% Elongation at break: -20% Mass: ±10%	VG 95218-2 5.5.7 clause 1.7: Test temperature : 50±2℃ Test duration : 168±4h, 672±4h 3.3: Test temperature : 23+2℃, 23-5℃ Test duration : 24±1h 4.2: Test temperature : 50±2℃ Test duration : 672±4h Diesel fuel: Test temperature and Test duration : (50±2℃, 168±4h), (23+2℃, 23-5℃, 672±4h) IRM 902: Test temperature and Test duration : (100±2℃, 24±1h) (90±2℃, 672±4h) Lubricating oil: Test temperature and Test duration : (100±2℃, 168±4h) (50±2℃, 672±4h) Acionat: Test temperature : 50±2℃ Test duration : 672±4h

LFMSGSGO

(Light weight Ships Telecommunications Cables) **According to VG 95218 part 65**

With screen and sheath, cabled single elements screened, halogen-free, low fire hazard



▶ Design

1) Conductor: Copper for electrical application,
2) Separator: Halogen free plastic foil
3) Insulation: Halogen free cross-linked polyethylene
4) Pair composition
5) Binder tape
6) Screen: Copper for electrical application
7) Binder tape
8) Assembly
9) Covering
10) Screen: Copper for electrical application
11) Binder tape
12) Sheath: Cross-linked Polyolefin

▶ Lowest permissible temperature for installation

- -15℃

▶ Color of sheath

- Black

▶ Applied Standard

1) IEC 60228 for conductor
2) VG 95218-65 for design guideline,
3) VG 95218-65 for sheath and XLPO and polyethylene
   VDE 0207-22 Insulation
4) VG 95218-2 for test method

▶ Core Identification

1) Core and pair marking cable type A
   In each layer
   1Pair: Black, Blue (Pilot pair)
   2Pair: Black, Brown (Direction pair)
   3Pair and others: Black, Grey

※ Pilot and direction shall be the same in all layers

2) Core and pair marking cable type B
   Cores in each pair: Black, White
   1Pair with 1.2mm^2: Red
   2Pair with 1.2mm^2: Green
   3Pair with 1.2mm^2: Nature

   In each layer:
   1Pair with 0.25mm^2: Red
   2Pair with 0.25mm^2: Green
   3Pair with 1,2mm^2: Nature

3) Core and quad marking, cable type C
   1Quad: Black, white, grey blue, filler strip: red (Pilot quad)
   2Quad: Black, white, grey blue, filler strip: red (Direction quad)
   3Quad and others: Black, white, grey blue

※ Pilot and direction shall be the same in all layers

LFMSGSGO

- **Cable, operating voltage up to AC 250V, DC 355V, operating temperature up to 85℃**
- **Type A**

Dash -No.	Number of core x Nominal cross-section (mm^2)	Number of the single wires (min)	Diameter of the conductor (max) (mm)	Wall thickness of insulation (Nominal value) (mm)	Wall thickness of covering of cabling (Standard value) (mm)	Diameter of the single screen wire		Wall thickness of sheath (Nominal value) (mm)	Diameter						Conductor resistance (20℃) (max) (Ω/km)	Insulation resistance (20℃) (min) (MΩ·km)
									Insulation		Covering		Overall			
						A (mm)	B (mm)		min (mm)	max (mm)	min (mm)	max (mm)	min (mm)	max (mm)		
001	2X2X0.4	7	0.85	0.2	0.1	0.12	0.2	0.8	3.1	3.8	6.6	7.8	9.3	10.5	115	1500
002	4X2X0.4	7	0.85	0.2	0.1	0.12	0.2	0.8	3.1	3.8	7.8	9.1	10.0	11.3	115	1500
003	7X2X0.4	7	0.85	0.2	0.1	0.12	0.2	0.9	3.1	3.8	9.4	10.9	12.0	13.5	115	1500
004	12X2X0.4	7	0.85	0.2	0.1	0.12	0.2	1.0	3.1	3.8	12.8	14.3	15.5	17.0	115	1500
005	19X2X0.4	7	0.85	0.2	0.1	0.12	0.2	1.0	3.1	3.8	16.0	18.0	18.4	20.4	115	1500
006	27X2X0.4	7	0.85	0.2	0.1	0.12	0.2	1.1	3.1	3.8	19.4	21.1	22.5	24.5	115	1500

LFMSGSGO

- **Cable, operating voltage up to AC 250V, DC 355V, operating temperature up to 85℃**
- **Type B**

Dash -No.	Number of core x Nominal cross-section (mm^2)	Number of the single wires (min)	Diameter of the conductor (max) (mm)	Wall thickness of insulation (Nominal value) (mm)	Wall thickness of covering of cabling (Standard value) (mm)	Diameter of the single screen wire		Wall thickness of sheath (Nominal value) (mm)	Diameter						Conductor resistance (20℃) (max) (Ω/km)	Insulation resistance (20℃) (min) (MΩ·km)
									Insulation		Covering		Overall			
						A (mm)	B (mm)		min (mm)	max (mm)	min (mm)	max (mm)	min (mm)	max (mm)		
001	3X2X0.4	7	1.5	0.25	0.1	0.15	0.2	1.2	4.8	5.5	18.5	20.5	20.0	22.2	32	1500
	18X2X0.4	7	0.65	0.2	0.1	0.12	0.2	1.2	3.0	3.7	18.5	20.5	20.0	22.2	167	1500

LFMSGSGO

- **Cable, operating voltage up to AC 250V, DC 355V, operating temperature up to 85℃**
- **Type C**

Dash -No.	Number of core x Nominal cross-section (mm^2)	Number of the single wires (min)	Diameter of the conductor (max) (mm)	Wall thickness of insulation (Nominal value) (mm)	Wall thickness of covering of cabling (Standard value) (mm)	Diameter of the single screen wire		Wall thickness of sheath (Nominal value) (mm)	Diameter						Conductor resistance (20℃) (max) (Ω/km)	Insulation resistance (20℃) (min) (MΩ·km)
									Insulation		Covering		Overall			
						A (mm)	B (mm)		min (mm)	max (mm)	min (mm)	max (mm)	min (mm)	max (mm)		
001	27X4X0.25	7	0.21	0.2	0.1	0.12	0.2	1.2	3	4	18.9	20.9	22.0	26.0	167	1500

LFMSGSGO (tests)

Test items	Standard	Test method
1. Appearance and size	Test Ok	VG 95218-2 5.1 clause
2. Tensile strength and elongation At break of insulations and sheaths	Sheath Tensile strength: min. 10.0 N/mm^2 Elongation at break: min. 150%	VG 95218-2 5.2.2 clause
3. Abrasion of sheath	Number of double-strokes: min. 1000	VG 95218-2 5.2.5 clause
4. Indelibility of markings	No stripes	VG 95218-2 5.2.10 clause
5. Notch sensitivity	No cracks	VG 95218-2 5.2.13 clause
6. Tear resistance	Min. 6N/mm	VG 95218-2 5.2.19 clause
7. Coiling test at low temperature (At -30±2℃)	No cracks	VG 95218-2 5.3.1 clause
8. Cold bend (At -30±2℃)	No cracks	VG 95218-2 5.3.1 clause
9. High temperature indentation test (Test temperature: (150±3℃) (Storage duration: 4h) (Test load(0.25mm^2): 0.25N) (Test load(0.4mm^2): 0.28N) (Test load(1.2mm^2): 0.39N)	Indentation depth: max. 50%	VG 95218-2 5.3.2 clause
10. Thermal expansion (Tensile stress: 20N/cm^2) (Test temperature: 200±3℃) (Test duration: 15min)	sheath Elongation at tensile stress: max. 175% Elongation after tensile stress: max. 25%	VG 95218-2 5.3.3 clause
11. Behavior under fire conditions	Naturally dying out a flame	VG 95218-2 5.3.4 clause
12. Ageing of prepared specimen in air oven Cords or cables in air oven (Ageing duration: 168±4h) (Ageing temperature: 100±2℃)	Tensile strength for the sheath: -30% Elongation at break for the sheath : ±40%	VG 95218-2 5.3.8 clause
13. Ageing of specimen of complete cords or cables in air oven (Ageing duration: 168±4h) (Ageing temperature: 95±2℃)	Tensile strength for the sheath: -30% Elongation at break for the sheath : ±40%	VG 95218-2 5.3.8 clause

Continue)

Test items	Standard	Test method
14. Ozone resistance	No cracks	VG 95218-2 5.3.9 clause
15. Heat shock (Test temperature: 150±2℃) (Test duration: 4h)	Test OK	VG 95218-2 5.3.11 clause
16. Smoke density	Min. 60%	VG 95218-2 5.3.14 clause
17. Conductor resistance	Referring to above mentioned tables	VG 95218-2 5.4.1 clause
18. Voltage test on cables and insulated wires for telecommunication and data processing systems in air	Test voltage: AC 50Hz to 2.0kV	VG 95218-2 5.4.2 clause
19. Insulation resistance	Referring to above mentioned tables	VG 95218-2 5.4.3 clause
20. Transfer impedance	Screen A Max. 50mΩ/m at 10 MHz Screen B Max. 30mΩ/m at 10 MHz Screen A and B Max. 30mΩ/m at 10 MHz	VG 95218-2 5.4.8.2 clause
21. Corrosivity of combustion gases	PH-value: min 4.3 Conductivity of the solution : Max. 10μS/mm	VG 95218-2 5.5.3 clause
22. Non Halogen verification		VG 95218-2 5.5.4.1 clause
23. In-service life (Temperature: 85℃)	Insulation: 20,000 h Sheath: 20,000 h	VG 95218-2 5.5.5 clause

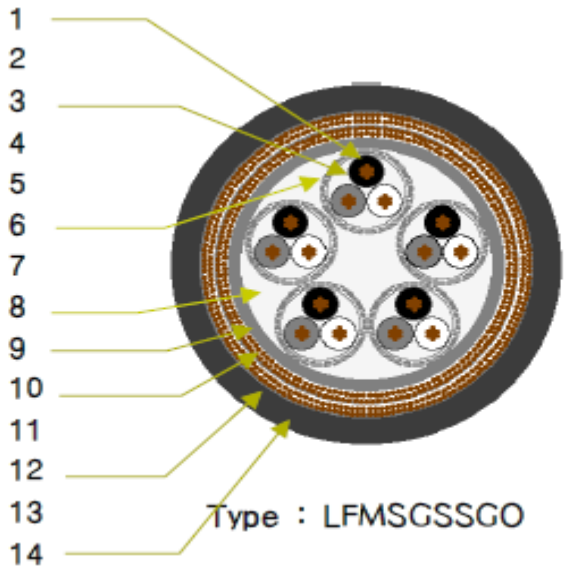
(Continue)

Test items	Standard	Test method
25. Resistance against chemicals(Sheath) ※ Test mediums refer to VG 95214-4	1.7(H-515) (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±60% 3.3 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±40% 4.2 (Max. permissible changes) Tensile strength: -20% Elongation at break: -20% Mass: ±10% Diesel fuel according to DIN 51601 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±50% IRM 902 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±40% Mass: ±50% Lubricating oil (O-275) (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±40% Mass: ±50% (At 100±2℃, 168±4h) Mass: ±30% (At 50±2℃, 672±4h) Acionat with 3.5% NaCl (Max. permissible changes) Tensile strength: -20% Elongation at break: -20% Mass: ±10%	VG 95218-2 5.5.7 clause 1.7: Test temperature : 50±2℃ Test duration : 168±4h, 672±4h 3.3: Test temperature : 23+2℃, 23-5℃ Test duration : 24±1h 4.2: Test temperature : 50±2℃ Test duration : 672±4h Diesel fuel: Test temperature and Test duration : (50±2℃, 168±4h), (23+2℃, 23-5℃, 672±4h) IRM 902: Test temperature and Test duration : (100±2℃, 24±1h) (90±2℃, 672±4h) Lubricating oil: Test temperature and Test duration : (100±2℃, 168±4h) (50±2℃, 672±4h) Acionat: Test temperature : 50±2℃ Test duration : 672±4h
26. Toxicity index	Max 5	VG 95218-2 5.5.12 clause

LFMSGSSGO

(Light weight Ships Telecommunications Cables) **According to VG 95218 part 66**

With double screen, with sheath, triple formation, screened, halogen-free, low fire hazard



▶ Applied Standard

1) IEC 60228 for conductor
2) VG 95218-66 for design guideline,
3) VG 95218-66 for sheath, XLPO, polyethylene
   VDE 0207-22 Insulation
4) VG 95218-2 for test method

▶ Lowest permissible temperature for installation

- -15℃

▶ Design

1) Conductor: Copper for electrical application,
2) Separator: Halogen free plastic foil
3) Insulation: Halogen free cross-linked polyethylene
4) Pair composition
5) Binder tape
6) Screen: Copper for electrical application
7) Binder tape
8) Assembly
9) Covering
10) Screen: Copper for electrical application
11) Binder tape
12) Screen: Copper for electrical application
13) Binder tape
14) Sheath: Cross-linked Polyolefin

▶ Core Identification

The cores are to be marked by coloring the insulation or its surface. The triples shall have colored separators C or colored stripes

Core in each triple: Black, White, Grey

Triple marking:

In each layer:
1 Triple: Red
2 Triple: Green
3 Triple: Nature

※ Pilot and direction shall be the same in all layers

▶ Color of sheath

- Black

LFMSGSSGO

- **Cable, operating voltage up to AC 250V, DC 355V, operating temperature up to 85℃**
- **Type A**

Dash -No.	Number of core x Nominal cross-section (mm^2)	Number of the single wires (min)	Diameter of the conductor (max) (mm)	Wall thickness of insulation (Nominal value) (mm)	Wall thickness of covering of cabling (Standard value) (mm)	Diameter of the single screen wire		Wall thickness of sheath (Nominal value) (mm)	Diameter						Conductor resistance (20℃) (max) (Ω/km)	Insulation resistance (20℃) (min) (MΩ·km)
									Insulation		Covering		Overall			
						A (mm)	B (mm)		min (mm)	max (mm)	min (mm)	max (mm)	min (mm)	max (mm)		
001	5X3X0.4	7	0.85	0.2	0.1	0.12	0.2	1.0	3.3	4.0	8.4	10.1	12.2	13.9	57.5	1500
002	12X3X0.4	7	0.85	0.2	0.1	0.12	0.2	1.2	3.3	4.0	12.0	14.0	16.9	18.9	57.5	1500

LFMSGSGO (tests)

Test items	Standard	Test method
1. Appearance and size	Test Ok	VG 95218-2 5.1 clause
2. Tensile strength and elongation At break of insulations and sheaths	Sheath Tensile strength: min. 10.0 N/mm^2 Elongation at break: min. 150%	VG 95218-2 5.2.2 clause
3. Abrasion of sheath	Number of double-strokes: min. 1000	VG 95218-2 5.2.5 clause
4. Indelibility of markings	No stripes	VG 95218-2 5.2.10 clause
5. Notch sensitivity	No cracks	VG 95218-2 5.2.13 clause
6. Tear resistance	Min. 6N/mm	VG 95218-2 5.2.19 clause
7. Coiling test at low temperature (At -30±2℃)	No cracks	VG 95218-2 5.3.1 clause
8. Cold bend (At -30±2℃)	No cracks	VG 95218-2 5.3.1 clause
9. High temperature indentation test (Test temperature: (150±3℃) (Storage duration: 4h) (Test load: 0.28N)	Indentation depth: max. 50%	VG 95218-2 5.3.2 clause
10. Thermal expansion (Tensile stress: 20N/cm^2) (Test temperature: 200±3℃) (Test duration: 15min)	sheath Elongation at tensile stress: max. 175% Elongation after tensile stress: max. 25%	VG 95218-2 5.3.3 clause
11. Behavior under fire conditions	Naturally dying out a flame	VG 95218-2 5.3.4 clause
12. Ageing of prepared specimen in air oven Cords or cables in air oven (Ageing duration: 168±4h) (Ageing temperature: 100±2℃)	Tensile strength for the sheath: -30% Elongation at break for the sheath : ±40%	VG 95218-2 5.3.8 clause
13. Ageing of specimen of complete cords or cables in air oven (Ageing duration: 168±4h) (Ageing temperature: 95±2℃)	Tensile strength for the sheath: -30% Elongation at break for the sheath : ±40%	VG 95218-2 5.3.8 clause

Continue)

Test items	Standard	Test method
14. Ozone resistance	No cracks	VG 95218-2 5.3.9 clause
15. Heat shock (Test temperature: 105±2℃) (Test duration: 4h)	Test OK	VG 95218-2 5.3.11 clause
16. Smoke density	Min. 60%	VG 95218-2 5.3.14 clause
17. Conductor resistance	Referring to above mentioned tables	VG 95218-2 5.4.1 clause
18. Voltage test on cables and insulated wires for telecommunication and data processing systems in air	Test voltage: AC 50Hz to 2.0kV	VG 95218-2 5.4.2 clause
19. Insulation resistance	Referring to above mentioned tables	VG 95218-2 5.4.3 clause
20. Transfer impedance	Screen A Max. 50mΩ/m at 10 MHz Screen B and C Max. 15mΩ/m at 10 MHz	VG 95218-2 5.4.8.2 clause
21. Corrosivity of combustion gases	PH-value: min 4.3 Conductivity of the solution : Max. 10μS/mm	VG 95218-2 5.5.3 clause
22. Non Halogen verification		VG 95218-2 5.5.4.1 clause
23. In-service life (Temperature: 85℃)	Insulation: 20,000 h Sheath: 20,000 h	VG 95218-2 5.5.5 clause

(Continue)

Test items	Standard	Test method
25. Resistance against chemicals(Sheath) ※ Test mediums refer to VG 95214-4	1.7(H-515) (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±60% 3.3 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±40% 4.2 (Max. permissible changes) Tensile strength: -20% Elongation at break: -20% Mass: ±10% Diesel fuel according to DIN 51601 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±50% Mass: ±50% IRM 902 (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±40% Mass: ±50% Lubricating oil (O-278) (Max. permissible changes) Tensile strength: ±40% Elongation at break: ±40% Mass: ±50% (At 100±2℃, 168±4h) Mass: ±30% (At 50±2℃, 672±4h) Acionat with 3.5% NaCl (Max. permissible changes) Tensile strength: -20% Elongation at break: -20% Mass: ±10%	VG 95218-2 5.5.7 clause 1.7: Test temperature : 50±2℃ Test duration : 168±4h, 672±4h 3.3: Test temperature : 23+2℃, 23-5℃ Test duration : 24±1h 4.2: Test temperature : 50±2℃ Test duration : 672±4h Diesel fuel: Test temperature and Test duration : (50±2℃, 168±4h), (23+2℃, 23-5℃, 672±4h) IRM 902: Test temperature and Test duration : (100±2℃, 24±1h) (90±2℃, 672±4h) Lubricating oil: Test temperature and Test duration : (100±2℃, 168±4h) (50±2℃, 672±4h) Acionat: Test temperature : 50±2℃ Test duration : 672±4h
26. Toxicity index	Max 5	VG 95218-2 5.5.12 clause