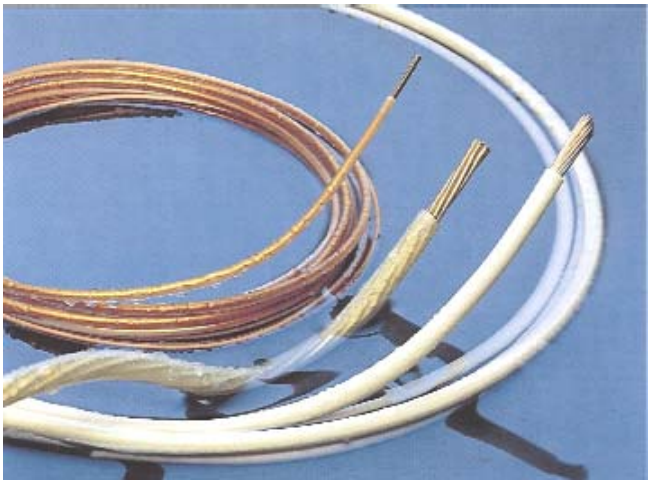
ERBA ISOLANTI srl

Via Liguria n. 34/31 - 20068 Peschiera Borromeo (MI)
telef. 0039(0)2/5530.3089 - fax 0039 (0)2/5530.3127

DATA: 04.Nov.98	**WINDING WIRE**	Codice UWM
Pag: 1 / 3	**FOR SUBMERSIBLE MOTORS**	Scheda tecnica 16.3 I
	UWM - XLPE-PA	Gruppo G

General information



Driving units of submersible pumps, so called «wet type motors», have been used to a large extent for many years. Due to their simple construction, these motors can be manufactured in comparably small series. This enables end-user countries to set up their own production. This is not possible for canned, oil-filled, motors.

Unlike an oil filled motors whose insulation would fail due to contact with moisture entering from without, the water filled unit will continue to operate. There is also no danger of polluting water with oil. The advantages of «wet type motors» in comparison to canned motors are known all over the world and production of such motors is increasing steadily. The application of this technology though, does not rest solely in the traditional field of submersible pumps. Nowadays, «wet type motors» are used more and more as driving units of special pumps, dredge boats, submarines, deep-sea research instruments etc.

The winding wires of «wet type motors» are continually in contact with liquids that are more or less aggressive. For this reason the extruded insulation of the winding wires has to be absolutely water tight and resistant to a number of different substances. The dielectric properties of the insulation (dielectric strength, insulation resistance, dielectric losses), have to meet high standards that, of course, have to be fulfilled under the influence of moisture for long periods of time.

Due to our longstanding experience and tests we have has developed suitable PVC compound for this special application. Other compounds have been carefully chosen from available products on the market and continue to be evaluated in our laboratories. Our insulating materials have excellent properties to assure longevity. Here are some of the main characteristics: - High dielectric strength - High insulation resistance - Low dielectric losses (tan ∂) - Good thermal and chemical resistance it goes without saying that our laboratory continues to test proven as well as new insulation materials in respect to the suitability for this very specific application. This will assure consistant quality and further improvement. Our company has been in the market of selling water-tight winding wires for submersible pump motors since 1950. We have, due to longstanding experience, the know-how to develop and use the proper materials. We guarantee the highest standards.

l. **Types of wires UWM**

Years of experience, developments and tests carried out in our plant enables us to offer the following types:

UWM-PVC	**600/1000V**	**70° C**
UWM-C2.2-PP	**1000V**	**80° C**
UWM-XLPE-PA	**1000V**	**90° C**

2. Conductor

UWM-PVC

Solid copper conductor, untinned, annealed, elongation 25% minimum. Diameter range: 0.50... 4.00 mm.

UWM-C2.2-PP

Solid copper conductor, enamelled, annealed, elongation 25% minimum. Diameter range: 0.50 ... 4.00 mm

UWM-XLPE-PA

Solid copper conductor, untinned, annealed, elongation 25% minimum. Diameter range: 1.10 ... 4.00 mm

Or concentric stranded conductor, untinned, annealed, elongation of individual wires in the strand 25% minimum. Section range: on request

Special constructions and other sizes: on request.

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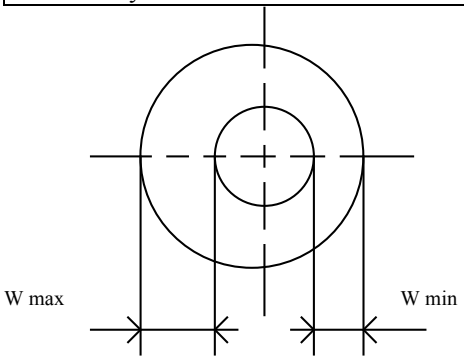
3.lnsulation/ Protection sheath

The wall thickness of insulation and protective sheath depends on the conductor diameters.

UWM-PVC	lnsulation:	Special PVC-compound	Wall thickness: 0.35 ... 0.80 mm
UWM-C2.2-PP	lnsulation:	Polypropylene	Wall thickness: 0.30 ... 0.80 mm
UWM-XLPE-PA	lnsulation:	Cross-linked Polyethylene	Insulation thickness: 0.35 ... 0.60 mm
	Protective sheath: Polyamide (Nylon		Sheath thickness: 0.10... 0.20 mm

4. Tolerances/Eccentricity

Outer diameter of the insulated wire	< 2.20 mm	2.21-3.00 mm	3.01-6.00 mm	> 6.01 mm
Tolerances on outer diameter of the insulated wire	± 0.05 mm	± 0.07 mm	± 0.10 mm	± 0.15
Eccentricity	≤10%	≤12%	≤15%	≤15%



$$E\ \% = \frac{W_{max} - W_{min}}{W_{max} + W_{min}} \times 100\ \%$$

6. Test

The following tests are carried out on 100% of every production lot:

6.1 Mechanical tests

a) Dimension of the bare copper conductor
b) Dimension of the insulated wire
c) Eccentricity
d) Surface

6.2 Electrical tests

Test voltage, duration of test and technical data on:

page 3 for UWM-PVC
page 4 for UWM-C2.2PP
page 5 for UWM-XLPE-PA

Winding wires for submersible motors Type XLPE-PA

Electrical characteristics

Working voltage		50 Hz	1000 V
Test voltage after 2 x 24 h in water at 20°C		15 min/50 Hz	3000 V
Operating temperature			90° C
Loss factor tan ∂	Acc. To DIN 53483	20°C/800Hz	$6x10^{-3}$
		90°C/800Hz	$14x10^{-3}$
Relative dielectric constant	Acc. To DIN 53483	20°C/800Hz	2,7
	Acc. To DIN 53483	70°C/800Hz	2,8
Volume resistivity	Acc. To VDE 0472 part 502	20°C/500 V Dz	10_{15} Ωcm
		90°C/500 V Dz	10^{15} Ωcm
Breakdown voltage measured on wire	1,6 - 2,4	20°C	≥60 KV/mm
		90°C	≥50 KV/mm

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UWM - XLPE-PA

Gruppo G

Mechanical characteristics

Tensile strenth on delivery		σ B	>20N/mm^2
Tensile strength after aging	28 d/90°C.	$\Delta \sigma$ B	< ± 15%
Elongation at break on delivery		ε B	< ± 200%
Elongation at break after aging (VDE 0472/602)	28 d/90°C.	$\Delta \varepsilon$ B	< ± 15%
Hot deformation (reduction of wall thickness)		100°C./4h	< 10% (VDE
0472/602)		90°C./4h	< 2%

DIAMETER OF CONDUCTOR mm	SECTION mm^2	OUTER DIAMETER mm	WEIGHT OF COPPER Kg/Km	WEIGHT OF INSULATED WIRE Kg/Km	LENGHT OF COIL m
1,10	0,905	2,00	8,460	10,610	600
1,20	1,131	2,10	10,065	12,355	600
1,30	1,330	2,20	11,815	14,240	600
1,40	1,540	2,40	13,700	16,610	500
1,50	1,770	2,50	15,730	18,795	500
1,60	2,010	2,60	17,895	21,110	500
1,70	2,270	2,70	20,200	23,570	500
1,80	2,540	2,80	22,650	26,170	500
1,90	2,830	2,90	25,235	28,905	500
2,00	3,140	3,10	27,960	32,230	500
2,10	3,460	3,30	30,825	35,850	400
2,20	3,800	3,40	33,830	39,040	400
2,30	4,150	3,50	36,980	42,375	400
2,40	4,520	3,70	40,260	46,375	400
2,50	4,900	3,80	43,690	50,000	300
2,60	5,300	3,90	47,250	53,760	300
2,70	5,726	4,10	50,960	58,265	300
2,80	6,150	4,20	54,800	62,320	300
2,90	6,650	4,30	58,785	66,520	300
3,00	7,060	4,50	62,910	71,660	300
3,10	7,574	4,60	67,175	76,155	300
3,20	8,040	4,70	71,580	80,790	300
3,30	8,550	4,80	76,120	85,565	300
3,40	9,079	4,90	80,800	90,475	300
3,50	9,620	5,10	85,600	96,280	300
3,60	10,179	5,20	90,590	101,485	300
3,70	10,752	5,30	95,695	106,835	300
3,80	11,340	5,40	100,935	112,320	300
3,90	11,950	5,50	106,320	117,955	300
4,00	12,560	5,70	111,840	124,550	300