



KLJ GROUP

# ZHFR COMPOUND



9001:2015



14001:2015

September 2022, Ed7

## TECHNICAL INFORMATION

### KLJ ZHFR 311 CL

#### THERMOSET HALOGEN FREE, FLAME RETARDANT AND LOW SMOKE EMISSION COMPOUND FOR CABLE INSULATION AND SHEATHING

#### Description:

KLJ ZHFR 311 CL / KLJ XL ZH MB 01 is a Polyolefin base Silane cross-linkable thermo-set compound; containing a fire retardant system, that contributes to give the cable self-extinguish properties without halogen acids evolution, toxic and corrosive gases and dark smoke emission. This material complies with RoHS requirements.

This cable insulation compounding system, with a proper mixture of KLJ ZHFR 311 CL (95 parts) and Catalyst Master Batch KLJ XL ZH MB 01 (5 Parts), exhibit excellent thermo-oxidative stability. The combination is suitable for both copper and aluminum conductors. Sufficient anti-oxidant has been added to meet specific ageing requirements.

#### Standard complying:

The properties of this compound comply with the requirement of BS EN 50363-0 , BS EN 50618 Type M1 & TI7, VDE 0270 part 24 type HM2 & HM4, IEC 60502 ST8, IEC 332-1/2/3, BS 7655 LTS 1, LTS2, LTS3 & LTS4.

The standards referred above are a short selection of standards and does not cover all applicable standards. Contact KLJ representative for additional information.

#### Technical Characteristics:

##### A) KLJ ZHFR 311 CL

Properties	Unit	Test Method	KLJ Specification	Typical Value
<b>Physical Properties</b>				
Density	gm/cm <sup>3</sup>	ASTM D 792	1.50±0.03	1.51
Melt Flow Index (160°C, 21.6 Kg Load)	gm/10min	ASTM D 1238	2.5± 1.0	2.5
Contamination (Visual)	No./kg	KLJ TM	<5	0

##### B) KLJ ZHFR 311 CL / KLJ XL ZH MB 01

Test Procedure: After mixing in proportion of 95:5 and extruded into a tape of 1.2 mm thickness, the tape is immersed in water at 95°C for 3 hours. The testing is carried out after conditioning this tape for further 3 hrs at ambient conditions.



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September 2022, Ed7

Properties	Unit	Test Method	KLJ Specification	Typical Value
<b>Physical Properties</b>				
Water absorption, 24 hrs @ 100°C	mg/cm <sup>2</sup>	EN 60811	<4	2
Hardness	Shore D	ASTM-D-2240	48±2	46
<b>Mechanical Properties</b>				
Tensile Strength at Break	MPa	IEC-811-1-1	≥ 13	14
Elongation at Break	%	IEC-811-1-1	≥ 150	190
Tear Strength	N/mm	BS 6469-99.1	≥5	8.5
<b>Thermal Properties</b>				
Hot Set at 200°C				
Hot Elongation after 15 min	%	IEC-811-2-1	≤ 70	35
Permanent Set after 5 min	%	IEC-811-2-1	± 5	1.0
Hot Set at 250°C				
Hot Elongation after 15 min	%	IEC-811-2-1	≤ 100	80
Permanent Set after 5 min	%	IEC-811-2-1	± 10	3.0
Pressure Test at 80°C max indentation	%	IEC 811-3-1	≤50	8
Pressure Test at 100°C max indentation	%	IEC 811-3-1	≤50	25
Bending Test at Low Temperature (-40± 2°C for 16hrs)		BS EN 60811-504	No Crack	No Crack
Impact Test at Low Temperature (-40± 2°C for 16hrs)		BS EN 60811-506	No Crack	No Crack
Elongation at Low temperature	%	BS EN 60811-404	≥50	65
Ozone Resistance Test		IEC 60811-403	No Crack	No Crack
Compatibility at 135°C, 168 hours		BS 6724		
Tensile Strength at Break	%	IEC 60811-1-1	± 30	<±25
Elongation at Break	%	IEC 60811-1-1	± 30	<±25
<b>Ageing</b>				
<b>Mechanical Properties after Ageing in Air Oven (168H, 135°C)</b>				
Change of Tensile Properties	%	IEC-811-1-2	± 25	-12
Change of Elongation Properties	%	IEC-811-1-2	± 25	-14
<b>Mechanical Properties after Ageing in Air Oven (240H, 150°C)</b>				
Change of Tensile Properties	%	IEC-811-1-2	± 30	± 25
Change of Elongation Properties	%	IEC-811-1-2	± 30	± 25
<b>Mechanical Properties after Ageing in Air Bomb (240H, 127°C)</b>				
Change of Tensile Properties	%	IEC-811-1-2	± 30	± 25
Change of Elongation Properties	%	IEC-811-1-2	± 30	± 25
<b>Mechanical Properties after Ageing in Water Immersion (168H, 70°C)</b>				
Change of Tensile Properties	%	IEC-811-1-2	± 25	± 25
Change of Elongation Properties	%	IEC-811-1-2	± 25	± 25
<b>Mechanical Properties after Oil Ageing in ASTM Oil No.2 (24H, 23°C)</b>				
Change of Tensile Properties	%	IEC-811-1-2	± 30	± 20
Change of Elongation Properties	%	IEC-811-1-2	± 30	± 20



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## Mechanical Properties after against

### acid ( N -oxalic acid)and alkaline solution (N- sodium hydroxide) (1684H, 23°C)

Variation of tensile strength	%	IEC-811-1-2	± 30	± 30
Value obtained for the elongation at break	%	IEC-811-1-2	≥100	≥100

## Chemical Resistance

### Environmental Stress Cracking Resistance

Condition A, 50°C, 3.0mm, 10% Igepal	Hours	ASTM D 1693	>1000	>1000
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## Electrical Properties

Volume Resistivity at 20°C	Ohm-cm	IEC 60502	≥ 5 X 10 <sup>14</sup>	2.5 x 10 <sup>15</sup>
Insulation Resistance Constant at 20°C	GΩ.m	IEC 60502	≥40	150
Insulation Resistance Constant at 90°C	GΩ.m	IEC 60502	≥2	10

Properties	Unit	Test Method	Specification	Typical Value
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## Burning Properties

Oxygen Index	%	ASTM D-2863	33±1	33
Temperature Index	°C	ASTM D 2843	≥300	310
Smoke Density Rating	%	ASTM D-2843	≤20	4
Optical Density of Smoke, Transmittance	%	IEC 61034-1	≥40	82
Acid Gas Emission Test (% HCL Emission)	%	IEC-60754 Part-1	<0.5	Nil
pH	-	IEC 60754-2	≥4.3	7.9
Conductivity	μS/mm	IEC 60754-2	<2.5	1.2
Fluorine Content	%	BS EN 50525 -1	<0.1	ND

## After Exposure to UV radiation

Retention of Tensile strength	%	ASTM G 154-12a, G151		89
Retention of Elongation at break	%	ASTM G 154-12a, G151		90

\* The typical values reported in the table have been obtained from measurements made on 1.2 mm extruded tape @ temp. 135-165°, Die 165-170°C and cured in water at temp. of 95°C for 3 Hrs. and then conditioned at ambient condition for 3 Hrs.

\* Burning behavior to be assessed accordingly to performances required by specific cable construction.

## Processing Guidelines:

Before processing of this Compound, should be blended with Catalyst Master Batch KLJ XL ZH MB 01 (95:5), just before using, properly in extruder hopper.

### Do not dry the Compound under any circumstances.

It has been designed for easy processing, while maintaining good mechanical–thermal properties and stated LOI value. It can be processed using extruder with a low screw compression and low shear screw, with 22–25 L/D ratio of the extruder. Screw compression ratio is 1.15:1 or 1.25:1. There should not be any stagnant area in the die and cross-head. Recommended DDR is 2:1, or less than 2 with a temperature



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profile as that given below, which is however indicative, as it may depend on the equipment design adopted.

Zone 1	Zone 2	Zone 3	Zone 4	Flange	Head	Die
130 -150	130 -160	140 -160	140 -160	150 -160	150 -160	150 -170

After extrusion, this compound can be cross linked by immersion in hot water at temperature of 85-90°C for a period of 4-6 hrs. This duration can be adjusted depending upon insulation thickness, reel size etc. [Specific recommendations for processing conditions can be determined only when the application and type of equipment are known]. Ensure that the layers of the core do not stick with each other during cross linking process.

## Colouring:

This compound is natural compound. EVA or polyolefin based master batch can be added for colouring.

## Storage:

- KLJ ZHFR 311 CL can be stored for 180 Days from the date of manufacturing, however it is suggested to use within 90 days from the date of receipt. Shelf life is subject to storage in original intact packing, in cool and dry place, away from sunlight and weathering, storage temperature not generally exceeding 35°C.
- Use the compound immediately, may be within 1 to 2 hours, after opening the bag.

## Packaging:

### KLJ ZHFR 311 CL (Base Compound)

Form: Granules

Package: 25 Kg aluminium multilayer bag and 550 Kg Octabin with aluminium liner with Top & Bottom discharge as required by the customer.

### KLJ XL ZH MB 01 (Catalyst Master Batch)

Form: Granules

Package: 25 Kg aluminium multilayer bag and in smaller aluminium pouch, as required by the customer.

## Safety:

This compound is not classified as dangerous preparation.

The products are supplied in the form of free-flowing granules of approx. 2-3 mm size and can be readily handled with commercially available equipment. Handling and transport of the products may generate some dust and fines, which constitute a potential hazard for dust explosion. All metal parts in the system should, therefore, be properly grounded. Properly designed equipment and good housekeeping will reduce the risk. Inhalation of any type of dust should be avoided as it may cause irritation of the respiratory system.



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The product is intended for industrial use only. MSDS is available on request.

For technical service & further information and assistance:

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Disclaimer: The data given above are for the guidelines purpose only. Above compound is suitable to run on different machines; however some adjustments may be required on individual machine. All properties are tested as per ASTM/IS/IEC standards. Any data may change without prior information. The customers are advised to check the quality, prior to commercial use. There is no guarantee and/or warrantee what so ever, after processing.