

**NGK Copper-Nickel-Tin Alloy**

**GMX96**

**GMX215**



**NGK INSULATORS, LTD.**

**New Metals Division**

# GMX96



## NGK Cu-Ni-Sn Alloy Strip High Performance **Conductive Spring** Material

### Tensile Strength

GMX96 can achieve the strength of 1200 N/mm<sup>2</sup> through age hardening (Spinodal decomposition) and can withstand very high bending stress.

### Bending Formability

Age hardenable material can be formed into complicated shapes and heat treatment afterwards. Mill-hardened material, which does not require heat-treatment after stamping or forming, has well-balanced performance in strength and formability.

### Thermal Stability

Due to less stress relaxation at elevated temperature, GMX96 can be used in a wide range of temperature with little loss of mechanical properties.

### Corrosion Resistance

GMX96 has good corrosion resistance and can be used even under severe condition.

### Heat Distortion

Due to less deformation (heat distortion) after age hardening treatment, dimensional dispersion after heat treatment is small.

### Electrical Conductivity

Electrical conductivity is equivalent to that of phosphor bronze.

#### Applications

- Connectors
- Switches
- Sockets
- Ground terminals
- Motor Brushes
- Jacks
- EMI Shields
- Watch Gears

#### Specifications

CDA No.  
**C72700**

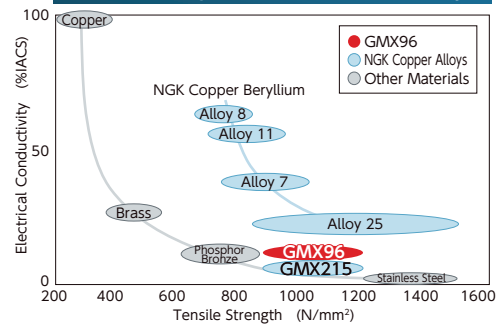
JIS  
**C7270**

### Chemical Composition

Unit: wt%

Alloy	Ni	Sn	Mn	Fe	Cu
GMX96	8.5-9.5	5.5-6.5	max. 0.5	max. 0.5	Bal.

### Tensile Strength vs. Electrical Conductivity



### Physical Properties

Alloy	Melting Point (Solidus) (°C)	Melting Point (Liquidus) (°C)	Density (g/cm <sup>3</sup> )	Specific Heat (J/(kg·K))	Electrical Conductivity (% IACS)	Thermal Expansion Coefficient (1/°C)	Modulus of Elasticity (kN/mm <sup>2</sup> )
GMX96	960	1090	8.93	375	12	17.1×10 <sup>-6</sup>	130

### Mechanical Properties

Alloy	Temper	Tensile Test <sup>(1)</sup>		Hardness Test <sup>(1)</sup> Vickers Hardness HV	Bending Formability, R/t (90°W)		Heat Treatment (Age hardening)
		Tensile Strength (N/mm <sup>2</sup> )	Elongation (%)		0° (Good way)	90° (Bad way)	
GMX96 Age Hardenable	1/4H	510 - 620	Min. 15	145 - 220	1.0	1.0	(Before H.T.)
	1/4HT	Min. 885	Min. 5	Min. 270	-	-	375°C×2h
	1/2H	590 - 695	Min. 10	180 - 240	1.0	1.0	(Before H.T.)
	1/2HT	Min. 930	Min. 5	Min. 285	-	-	375°C×2h
	H	685 - 835	Min. 4	210 - 270	1.0	1.5	(Before H.T.)
	HT	Min. 980	Min. 2	Min. 300	-	-	375°C×2h
GMX96 Mill Hardened	HM	835 - 980 <sup>(2)</sup>	Min. 15	Min. 250	1.5	1.5	No need
	EHM	930 - 1080 <sup>(2)</sup>	Min. 10	Min. 280	2.5	2.5	No need
	XHM	Min. 1060	Min. 3	Min. 320	4.0	6.0	No need

(1) Values are applicable to thickness 0.1 mm and over. (2) The upper limits of tensile strength of mill hardened material are for design guidance only.  
\*Contact us for purchase instructions, if you need a product other than above.

### Tolerances (GMX96/GMX215)

#### Thickness Tolerance

Specified thickness (mm)		Tolerance (mm)
Over	Up to and including	
from 0.08	0.1	±0.005
0.1	0.15	±0.006
0.15	0.2	±0.008
0.2	0.25	±0.010
0.25	0.4	±0.015

#### Width Tolerance

Specified width (mm)		Tolerance (mm)		
Specified thickness (mm)		Strip cut to length	Strip in coils	
from	Up to and including	max. 200	max. 100	Over 100 up to and including 200
0.08	0.4	+2 -0	±0.1	±0.2

# GMX215



## NGK Cu-Ni-Sn Alloy Strip High Performance Heat Resistant Spring Material

### Tensile Strength

GMX215 can achieve the strength of 1200 N/mm<sup>2</sup> through age hardening (Spinodal decomposition) and can withstand very high bending stress.

### Bending Formability

Age hardenable material can be formed into complicated shapes and heat treatment afterwards. Mill-hardened material, which does not require heat-treatment after stamping or forming, has well-balanced performance in strength and formability.

### Thermal Stability

Due to far less stress relaxation at elevated temperature, GMX215 can be used in wider range of temperature than GMX96 with little loss of mechanical properties.

### Corrosion Resistance

GMX215 has excellent corrosion resistance and can be used even under severe condition.

### Heat Distortion

Due to less deformation (heat distortion) after age hardening treatment, dimensional dispersion after heat treatment is small.

### Electrical Conductivity

Electrical conductivity is approximately twice that of stainless steel.

#### Applications

- Connectors
- Switches
- Sockets
- Spring Washers
- Motor Brushes
- Jacks
- Clips
- Thermostats

#### Specifications

CDA No.  
**C72950**

JIS

—

### Chemical Composition

Unit: wt%

Alloy	Ni	Sn	Mn	Fe	Cu
GMX215	20.0-22.0	4.5-5.7	max. 0.5	max. 0.5	Bal.

### Physical Properties

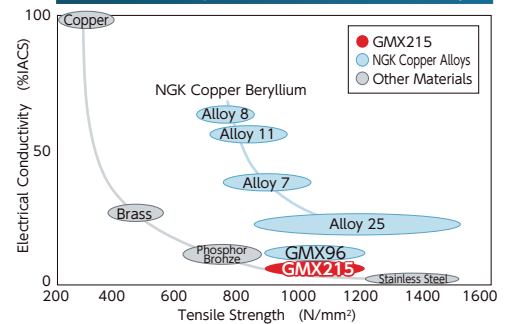
Alloy	Melting Point (Solidus) (°C)	Melting Point (Liquidus) (°C)	Density (g/cm <sup>3</sup> )	Specific Heat (J/(kg·K))	Electrical Conductivity (%IACS)	Thermal Expansion Coefficient (1/°C)	Modulus of Elasticity (kN/mm <sup>2</sup> )
GMX215	1040	1160	8.93	385	6	16.5×10 <sup>-6</sup>	150

### Mechanical Properties

Alloy	Temper	Tensile Test <sup>(1)</sup>		Hardness Test <sup>(1)</sup> Vickers Hardness HV	Bending Formability, R/t (90°W)		Heat Treatment (Age hardening)
		Tensile Strength (N/mm <sup>2</sup> )	Elongation (%)		0° (Good way)	90° (Bad way)	
GMX215 Age Hardenable	1/4H	510 - 620	Min. 10	145 - 220	1.0	1.0	(Before H.T.)
	1/4HT	Min. 885	Min. 2	Min. 270	-	-	450°C×2h
	1/2H	590 - 695	Min. 4	180 - 240	2.0	2.0	(Before H.T.)
	1/2HT	Min. 930	Min. 2	Min. 285	-	-	450°C×2h
	H	685 - 835	Min. 2	210 - 270	3.0	3.0	(Before H.T.)
	HT	Min. 980	-	Min. 300	-	-	450°C×2h
	SH	825 - 950	-	250 - 310	-	-	(Before H.T.)
GMX215 Mill Hardened	SHT	Min. 1080	-	Min. 330	-	-	450°C×2h
	HM	835 - 980 <sup>(2)</sup>	Min. 3	Min. 250	3.0	5.0	No need
	EHM	960 - 1110 <sup>(2)</sup>	Min. 3	Min. 280	-	-	No need
	XHM	Min. 1060	Min. 3	Min. 320	-	-	No need

(1) Values are applicable to thickness 0.1 mm and over. (2) The upper limits of tensile strength of mill hardened material are for design guidance only.  
\*Contact us for purchase instructions, if you need a product other than above.

### Tensile Strength vs. Electrical Conductivity

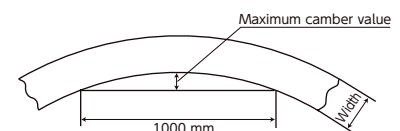


### Length Tolerance

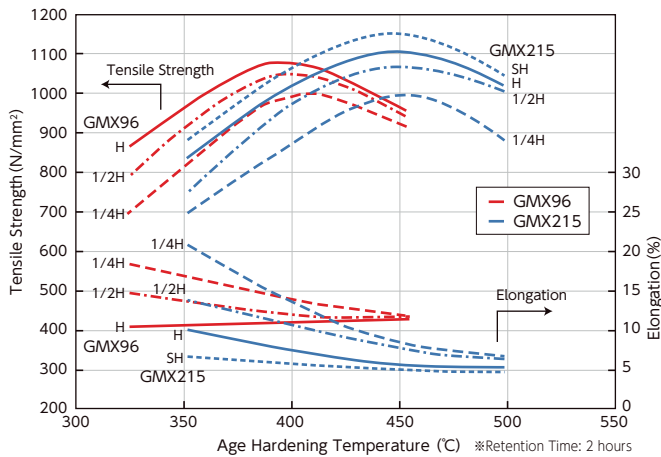
Specified length (mm)		Tolerance (mm)
Specified thickness (mm)	Up to and including	
from	Up to and including	max. 1200
0.08	0.40	+8 -0

### Camber Tolerance

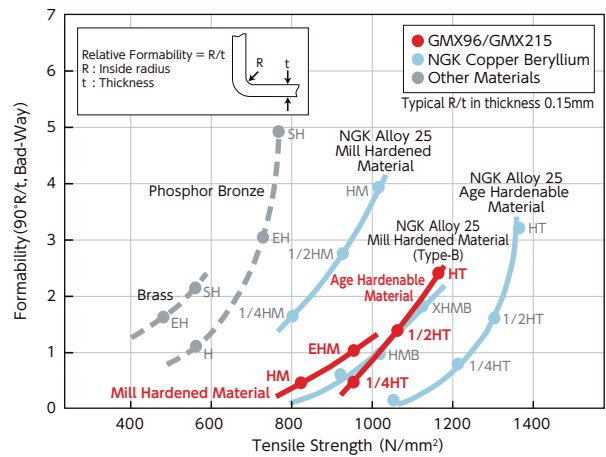
Specified width (mm)		Maximum value (mm)
Over	Up to and including	
from 4	13	4
13	50	3
50	100	2
100	200	1



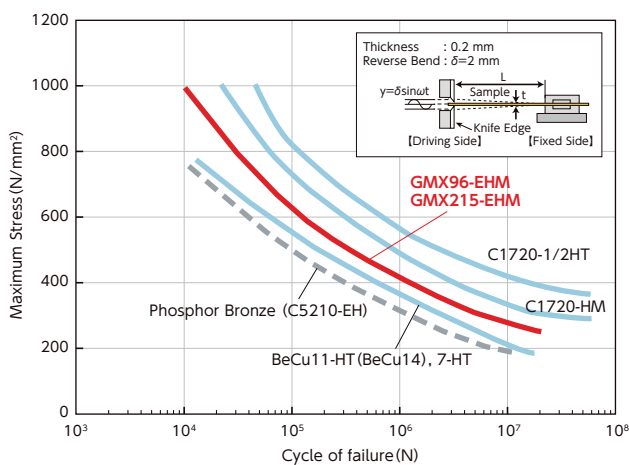
## Age Hardening Properties



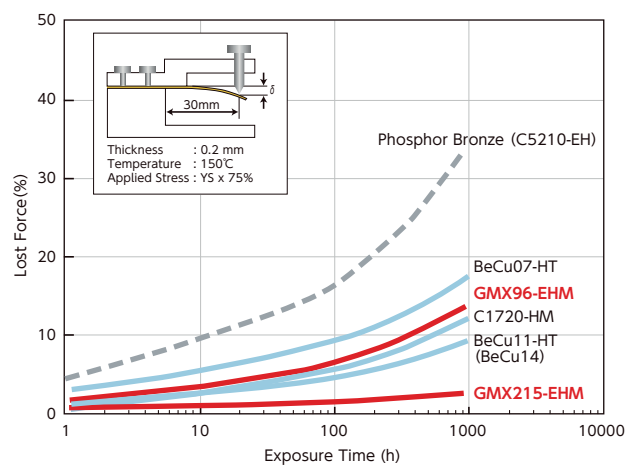
## Bending Formability



## Fatigue Strength



## Thermal Stability



# NGK INSULATORS, LTD. New Metals Division

Asia	Tokyo	Marunouchi Bldg. 25 Fl., 2-4-1, Marunouchi, Chiyoda-ku, Tokyo 100-6325, JAPAN Tel +81-(0) 3-6213-8913 Fax +81-(0) 3-6213-8972 URL : <a href="http://www.ngk.co.jp/english/products/electronics/berylliumcopper/index.html">http://www.ngk.co.jp/english/products/electronics/berylliumcopper/index.html</a> (English edition) <a href="https://www.ngk.co.jp/product/metal/beryllium/index.html">https://www.ngk.co.jp/product/metal/beryllium/index.html</a> (Japanese edition)
	Shanghai	Room 1903A, Dawning Centre Tower A, No.500 Hongbaoshi Road, Changning District, Shanghai 201103, China Tel +86-(0)21-6208-4488 URL : <a href="http://www.ngk.co.jp/cn/">http://www.ngk.co.jp/cn/</a> (Chinese edition)
	Shenzhen	Unit 7, Taiping Finance Tower Level 14, 6001 Yitian Road, Futian District, Shenzhen, Guangdong Province 518000, P.R.China Tel +86-(0) 755-3290-0287
India	803 & 804, 8th Floor, Vatika City Point, MG road, Gurgaon, Haryana, 122018, India Tel +91-(0)12-4448-8891	
North America	USA	NGK Metals Corporation 917 U.S. Highway 11, South Sweetwater, TN 37874 USA Tel +1 (423) 337 5500 Fax +1 (877) 645 2328 Email : <a href="mailto:marketing@ngkmetals.com">marketing@ngkmetals.com</a> URL : <a href="http://www.ngkmetals.com">www.ngkmetals.com</a>
Europe	France	NGK BERYLCO France 103 quai Jean-Pierre Fougerat, CS 20017, 44220 , Couëron, France Tel +33 (0)2 40 38 67 50 Fax +33 (0)2 40 38 09 95 Email : <a href="mailto:nbf@ngkbf.com">nbf@ngkbf.com</a> URL : <a href="http://www.ngk-alloys.com">www.ngk-alloys.com</a>
	United-Kingdom	NGK BERYLCO UK Ltd Houston Park, Montford Street, Salford, M50 2RP, U.K Tel +44 (0)161- 745-7162 Fax +44 (0)161- 745-7520 Email : <a href="mailto:enquiries@ngkberylco.co.uk">enquiries@ngkberylco.co.uk</a> URL : <a href="http://www.ngk-alloys.com">www.ngk-alloys.com</a>
Germany	NGK DEUTSCHE BERYLCO GmbH Westerbachstraße 32 61476 Kronberg Im Taunus Germany Tel +49 (0)6173/ 993-400 Fax +49 (0)6173/ 993-401 Email : <a href="mailto:sales@ngkdbg.de">sales@ngkdbg.de</a> URL : <a href="http://www.ngk-alloys.com">www.ngk-alloys.com</a>	
Italy	Tecnicom Via G Passeroni, 6 20135 MILANO Italy Tel +39(0)2 45506240 Fax +39(0)2 39304926 Email : <a href="mailto:tecnicom@mclink.it">tecnicom@mclink.it</a>	
Spain	Massague Rep. Ind. SA Calle la Ginesta, 6 Apt de Correos 47 08 830 Sant Boi de Llobregat, Spain Tel +34 93 640 0573 Fax +34 93 630 2865 Email : <a href="mailto:massaguesa@terra.es">massaguesa@terra.es</a> URL : <a href="http://www.massaguesa.com">www.massaguesa.com</a>	
Turkey	Promak Pres Otomasyon San. Perpa Ticaret merkezi B Block K11 No:1987, Okmeydani-34384 Istanbul, Turkey Tel +90 212 320 85 10 Fax +90 212 320 85 44 Email : <a href="mailto:makgol@promakmakina.com">makgol@promakmakina.com</a> URL : <a href="http://www.promakmakina.com">www.promakmakina.com</a>	

Distributor



For more information about NGK Products, Please see NGK Website.

1603TR8Rev4

18.09.200(TP)