# **RELIABILITY TEST CONDITIONS (Environmental Testing)**

The reliability of products are tested under the following conditions. (Not including some cut cores)

TEST TITLE	COMPLIANT STANDARD	CONDITIONS			
Vibration (Sinusoidal)	JISC 60068-2-6	Amplitude: 1.5mm Frequency Range: 10-55Hz (1 minute/sweep cycle) Test Duration: Total 6 hours (2 hours each per X・Y・Z axis)			
Free Fall	JISC 60068-2-32	Three consecutive drops from 1m height onto veneer plywood (width 10mm)			
Cold	JISC 60068-2-1	Temperature: -25℃ 500 hours			
Dry Heat	JISC 60068-2-2	Temperature: 120°C 500 hours			
Damp Heat, Steady State	JISC 60068-2-3	Temperature: 55°C Relative Humidity: 95% Test Duration: 500 hours			
Change of Temperature	JISC 0025	Temperature	Conditioning Times		
		-25°C	30 minutes		
		Room Temperature	Less than 1 minute		
		+120°C	30 minutes	Number of cycles: 25	
		Room Temperature	Less than 1 minute		

## CUSTOM DESIGN CONDITIONS

Nippon Chemi-Con's amorphous choke coils are available in a wide variety of standard products, but we also offer custommade products upon request. Here, we will introduce how our choke coils are designed, with reference to various data listed in the catalog.

(1) Required Specifications for Choke Coil

Rated Inductance	Ln	[μH]
Rated Current	l n	[A]
Voltage across coil	Vо	[V]
Conversion Frequency	fsw	[ kHz ]

### (2) Selection of Core

With reference to the graph of "Coil Volume and Energy Product"(Fig. 1), select a core with a similar energy product. The required energy product is calculated as below.

### $Ln \cdot ln^{2}/1000$

### (3) Determining the Number of Turns

The specifications of the selected cores are listed at the beginning of each series. Find the inductance coefficient (AL value) from the core specification table and determine the number of turns (N).

## $N = \sqrt{Ln /AL}$

### (4) Determining Diameter of Winding

As a guide, the current density is around 6 [A / mm<sup>2</sup>] with respect to the effective value (Irms) of the current flowing through the choke coil.

Irms	Diameter	
2 A	0.6mmφ	
3 A	0.8mm	
5 A	1.0mm	
8 A	1.3mm	
10 A	1.0mmx2P	

Fig.1 Relationship between Coil Volume and Energy Product (Amount of energy that can be handled)



### (5) Confirming the Winding

Check if the winding specifications set in (3) and (4) can be applied to the core. When winding is possible, the winding space factor is 30% or less. It is important to confirm the winding based on actual performance.

Winding Space Factor = 
$$\frac{(\text{Winding Diameter})^2}{(\text{Inner Diameter of Core Exterior})^2} \times \# \text{ of Turns x 100[%]}$$

If winding is not possible, reselect larger core size or choose from another series.

### (6) Calculation of Core Loss

Calculate the magnetic flux density ( $\triangle$ Bp-p, [mT]) from the voltage across coil (Vo), the conversion frequency (fsw), and the maximum duty (D [%]). Please refer to the core reference table for the cross-sectional area of the core (Ae [cm<sup>2</sup>]).

### $\Delta$ Bp-p = Vo·D/fsw/Ae/N×100

Based on the magnetic flux density, find the core loss per unit weight from the Core Loss Characteristics graph of each series. Multiply this by the core weight to calculate core loss.

# CHOKE COIL CHARACTERISTICS

### Characteristics comparison of magnetic materials

Application	Material shape	Product name	Composition	Saturation magnetic flux density Bs [mT]	Magnetic permeability μ(100[kHz])	Curie point Tc [°C]	Frequency Characteristics (Reference) [kHz]
Power system	Foil strip	Amorphous	Fe-Si-B	1.56	- 5,000	415	- 150
			Co-Fe-Ni-Si-B	0.6	- 18,000	180	
		Silicon steel plate	Fe-Si	1.3	- 800	700	- 20
	Powder	Alloy dust	Fe-Ni (High Flux)	1.5	26 to 160	420	- 300
			Fe-Si-Al (Sendust)	1.1	26 to 125	570	- 150
			Fe-Si (Mega flax)	1.6	26 to 90	500	- 50
			Fe-Si-B (Amorphous dust)	1.56	60 to 200	415	- 300
		ferrite	Mn-Zn	0.4	- 2,400	250	- 500
			Ni-Zn	0.3	10 to 500	350	- 1,000
Normal	Powder	Fe dust	Fe	1.0	75	770	- 20
Common	Foil strip	Nanocrystalline	Fe-Si-Br-Nb-Cu	1.23	15,000 to 31,000	570	- 1,000
	Powder	ferrite	Mn-Zn	0.5	5,000 to 16,000	130	- 1,000

### Magnetic material map



#### D.C. bias of amorphous choke coil ●Temperature dependence : Core temperature 25, 100°C



### **Recommended Soldering Conditions**

### SURFACE MOUNT TYPE

Recommended soldering heat conditions



### RADIAL LEAD TYPE

Recommended soldering heat conditions

Preheat: 110 to 150°C 120 seconds max.

Flow soldering: 260+5°C 10+1 seconds max. (Or hand soldering: 380±10°C 10±1 seconds max.)

D.C. bias of normal mode choke coil



Preheat	Time maintained above 217°C	Time maintained above 230°C	Peak temp.	Reflow number
150 to 180°C 120 sec. max.	60 sec. max.	30 sec. max.	245°C max.	2 times or less

Reflow should be performed twice or less.

Please ensure that the coil became cold enough to the room temperature before the second reflow.

# Notes on Use

- The indicated heat-resistant temperatures are the guaranteed temperatures including coil self-generated heat.
- •In high-temperature,-humidity environment, There is a possibility to occur hydrolyze and insulation deterioration.
- Common mode coils, by the unbalanced current, it may cause a magnetic saturation.
- •We do not acquire safety standards with coil only.
- •Ensure that you do not repeatedly apply excessive force to the lead wires or repeatedly bend them.
- •Do not bang the coil against hard objects. Scratch on the coating, possibly impairing performance.
- Contact NIPPON CHEMI-CON for how to clean the substrate on which the coil is mounted.
- •When infra-acoustic frequency component is impressed, a beat sound sometimes occurs.
- •The products described in this catalog have been designed and manufactured for general electronic devices, therefore, if you intend to use our products for purposes that may endanger or threaten human lives and cause damage to property if such electronic devices fail or malfunction, or have a significant impact on society, please contact our information counter in advance to consult with us before using our products.
- Response to the Substances of Concern
- (1) Nippon Chemi-Con aims for developing products that meet laws and regulations concerning substances of concern. (Some products may contain regulated substances for exempted application.) Please contact us for more information about law-compliance status.
- (2) According to the content of REACH handbook (Guidance on requirements for May 2008), our electronic components are "articles without any intended release". Therefore they are not applicable for Registration for EU REACH Regulation Article 7 (1). Reference: Electrolytic Condenser Investigation Society Study of REACH Regulation in EU about Electrolytic Capacitor (publicized on 13 March 2008)

# Inductor (Coil) AEC-Q200 Compliance

The Automotive Electronics Council (AEC) was originally established by major American automotive related manufactures. Today, it is composed of representatives from the manufacturing companies in automotive electronic devices and components. It standardizes the certification criteria and reliability tests for electronic components.

AEC-Q200 is the reliability test standard for approval of passive components in automotive applications. It specifies the test type, parameters, quantity, etc. for each component. The criteria used in reliability tests for "Inductors(Coils/Cores)" are described in this standard.

Pursuant to the customer's specific testing requirements, Chemi-Con submits the test results according to AEC-Q200 for Inductors(Coils/Cores) used in automotive applications on request.

An electronic component manufacturer cannot simply claim that their product is "AEC-Q200 Qualified". Instead, the manufacturer may claim their components as "Compliant", "Capable", "Available", etc.

Each component must be tested depending on the customer's "Qualification Test Plan" in order to claim AEC-Q200 Qualification.

The standard products listed in the catalog are designed for general electronic equipment. If you are considering using the products for automotive use, it may be necessary to change the specifications. Please contact our sales representative for more information.