

CHIP COIL (CHIP INDUCTORS) LQH31HN□□□□03L REFERENCE SPECIFICATION**1.Scope**

This reference specification applies to LQH31HN series, Chip coil (Chip Inductors).

2.Part Numbering

(ex)	LQ	H	31	H	N	54N	K	0	3	L
	Product ID	Structure	Dimension (L×W)	Applications and Characteristics	Category	Inductance	Tolerance	Features	Electrode	Packaging L:Taping

3.Rating

- Operating Temperature Range. $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$
- Storage Temperature Range. $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$

Customer Part Number	MURATA Part Number	Inductance		Q (min)	DC Resistance (Ω)	Self Resonant Frequency (MHz min)	Rated Current (mA)	
		(nH)	Tolerance					
	LQH31HN54NK03L	54	K:±10%	50	0.035±30%	800	920	
	LQH31HN95NK03L	95				0.047±30%	650	790
	LQH31HNR14J03L	145	J: ± 5 % K:±10 %	60		0.061±30%	500	700
	LQH31HNR14K03L							
	LQH31HNR21J03L	215				0.11±30%	430	520
	LQH31HNR21K03L							
	LQH31HNR29J03L	290				0.17±30%	360	420
	LQH31HNR29K03L							
	LQH31HNR39J03L	390				0.26±30%	300	330
	LQH31HNR39K03L							
	LQH31HNR50J03L	500				0.44±30%	270	260
	LQH31HNR50K03L							
	LQH31HNR61J03L	610				0.48±30%	240	250
	LQH31HNR61K03L							
	LQH31HNR75J03L	750				0.79±30%	220	190
	LQH31HNR75K03L							
	LQH31HNR88J03L	880				0.86±30%	200	180
	LQH31HNR88K03L							

4. Testing Conditions

《Unless otherwise specified》

Temperature : Ordinary Temperature / $15\text{ }^{\circ}\text{C}$ to $35\text{ }^{\circ}\text{C}$

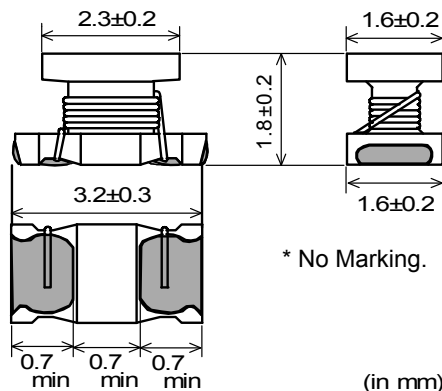
Humidity : Ordinary Humidity / 25%(RH) to 85%(RH)

《In case of doubt》

Temperature : $20 \pm 2\text{ }^{\circ}\text{C}$

Humidity : 60%(RH) to 70%(RH)

Atmospheric Pressure : 86kPa to 106 kPa

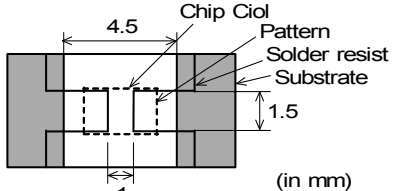
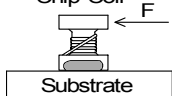
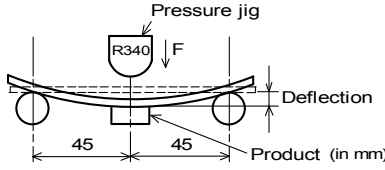
5. Appearance and Dimensions

■ Unit Mass (Typical value)
0.029g

6. Electrical Performance

No.	Item	Specification	Test Method
6.1	Inductance	Inductance shall meet item 3.	Measuring Equipment : KEYSIGHT E4991A or equivalent Measuring Frequency : 1MHz Measuring Method:See P.8 <Electrical Performance:Measuring Method of Inductance>
6.2	Q	Q shall meet item 3.	Measuring Equipment : KEYSIGHT E4991A or equivalent Measuring Frequency : 100MHz
6.3	DC Resistance	DC Resistance shall meet item 3.	Measuring Equipment : Digital multi meter
6.4	Self Resonant Frequency(S.R.F)	S.R.F shall meet item 3.	Measuring Equipment : KEYSIGHT E4991A or equivalent
6.5	Rated Current	Self temperature rise shall be limited to 20 °C max. Inductance Change : within $\pm 10 \%$	The rated Current is applied.

7. Mechanical Performance

No.	Item	Specification	Test Method
7.1	Shear Test	Chip coil shall not be damaged after tested as test method.	<p>Substrate : Glass-epoxy substrate</p>  <p>Applied Direction :</p>  <p>Force : 10 N Hold Duration : 5s \pm 1s</p>
7.2	Bending Test		<p>Substrate : Glass-epoxy substrate (100mm \times 40mm \times 1.6mm) Speed of Applying Force : 1mm / s Deflection : 2mm Hold Duration : 30 s</p> 
7.3	Vibration		<p>Oscillation Frequency : 10Hz ~ 55Hz ~ 10Hz for 1 min Total Amplitude : 1.5mm Testing Time : A period of 2 hours in each of 3 mutually perpendicular directions.(Total 6 hours)</p>
7.4	Solderability	The wetting area of the electrode shall be at least 90% covered with new solder coating.	<p>Flux: Ethanol solution of rosin,25(wt)% (Immersed for 5s to 10s) Solder : Sn-3.0Ag-0.5Cu Pre-Heating : 150\pm10°C / 60 to 90seconds Solder Temperature : 240\pm5°C Immersion Time : 3\pm1 s</p>

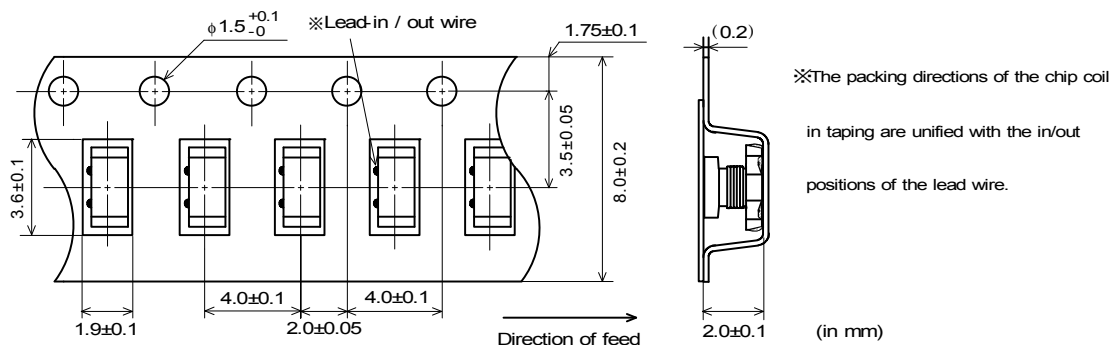
No.	Item	Specification	Test Method
7.5	Resistance to Soldering Heat	Appearance : No damage Inductance Change : within $\pm 5\%$	Flux: Ethanol solution of rosin, 25(wt)% (Immersed for 5s to 10s) Solder : Sn-3.0Ag-0.5Cu Pre-Heating: $150 \pm 10^\circ\text{C}$ / 60 to 90 seconds Solder Temperature: $270 \pm 5^\circ\text{C}$ Immersion Time: 10 ± 1 s Then measured after exposure in the room condition for 24 ± 2 hours.

8. Environmental Performance (It shall be soldered on the substrate.)

No.	Item	Specification	Test Method
8.1	Heat Resistance	Appearance : No damage Inductance Change : within $\pm 5\%$ Q Change : within $\pm 20\%$	Temperature : $85^\circ\text{C} \pm 2^\circ\text{C}$ Time : 1000 h (+48h, -0h) Then measured after exposure in the room condition for 24 ± 2 hours.
8.2	Cold Resistance		Temperature : $-40^\circ\text{C} \pm 2^\circ\text{C}$ Time : 1000 h (+48h, -0h) Then measured after exposure in the room condition for 24 ± 2 hours.
8.3	Humidity		Temperature : $40^\circ\text{C} \pm 2^\circ\text{C}$ Humidity : 90 % (RH) to 95 % (RH) Time : 1000 h (+48h, -0h) Then measured after exposure in the room condition for 24 ± 2 hours.
8.4	Temperature Cycle		1 cycle : 1 step : $-40^\circ\text{C} \pm 2^\circ\text{C}$ / 30 min \pm 3 min 2 step : Ordinary temp. / 10 min to 15 min 3 step : $+85^\circ\text{C} \pm 2^\circ\text{C}$ / 30 min \pm 3 min 4 step : Ordinary temp. / 10 min to 15 min Total of 10 cycles Then measured after exposure in the room condition for 24 ± 2 hours.

9. Specification of Packaging

9.1 Appearance and Dimensions of plastic tape



9.2 Specification of Taping

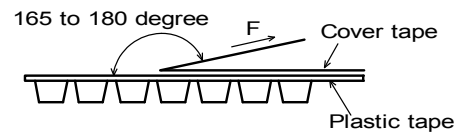
- (1) Packing quantity (standard quantity)
2,000 pcs / reel
- (2) Packing Method
Products shall be packed in the each embossed cavity of plastic tape and sealed by cover tape.
- (3) Sprocket hole
The sprocket holes are to the right as the tape is pulled toward the user.
- (4) Spliced point
Plastic tape and Cover tape has no spliced point.
- (5) Missing components number
Missing components number within 0.1 % of the number per reel or 1 pc., whichever is greater, and are not continuous. The specified quantity per reel is kept.

9.3 Pull Strength

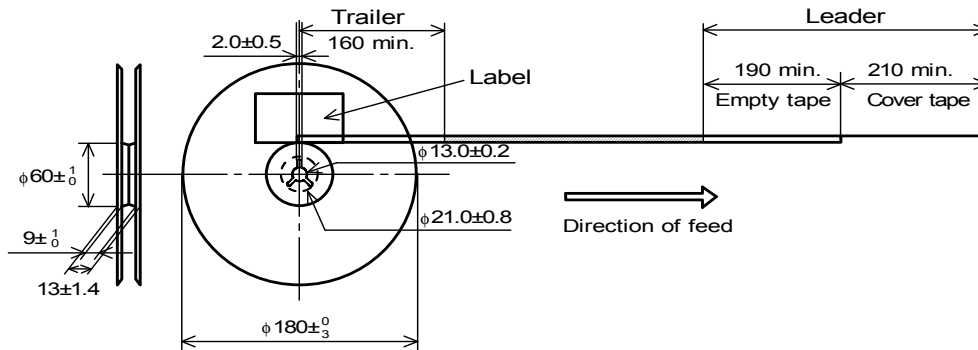
Plastic tape	10N min.
Cover tape	

9.4 Peeling off force of cover tape

Speed of Peeling off	300mm / min
Peeling off force	0.2N to 0.7N (minimum value is typical)

**9.5 Dimensions of Leader-tape, Trailer and Reel**

There shall be leader-tape (cover tape) and trailer-tape (empty tape) as follows.

**9.6 Marking for reel**

Customer part number, MURATA part number, Inspection number(*1), RoHS marking(*2), Quantity etc ...

*1) <Expression of Inspection No.>

□□ 0000 ×××
(1) (2) (3)

(1) Factory Code

(2) Date

First digit : Year / Last digit of year

Second digit : Month / Jan. to Sep. → 1 to 9, Oct. to Dec. → O, N, D

Third, Fourth digit : Day

(3) Serial No.

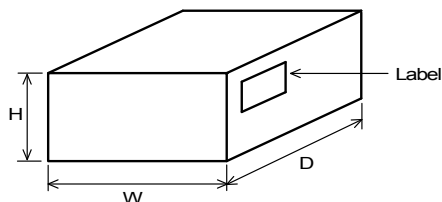
*2) « Expression of RoHS marking » ROHS – Y (△)
(1) (2)

(1) RoHS regulation conformity

(2) MURATA classification number

9.7 Marking for Outside package (corrugated paper box)

Customer name, Purchasing order number, Customer part number, MURATA part number, RoHS marking (*2), Quantity, etc ...

9.8. Specification of Outer Case

Outer Case Dimensions (mm)			Standard Reel Quantity in Outer Case (Reel)
W	D	H	
186	186	93	5

*Above Outer Case size is typical. It depends on a quantity of an order

10. ⚠ Caution**Limitation of Applications**

Please contact us before using our products for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property.

- | | |
|-----------------------------------|--|
| (1) Aircraft equipment | (6) Transportation equipment (vehicles, trains, ships, etc.) |
| (2) Aerospace equipment | (7) Traffic signal equipment |
| (3) Undersea equipment | (8) Disaster prevention / crime prevention equipment |
| (4) Power plant control equipment | (9) Data-processing equipment |
| (5) Medical equipment | (10) Applications of similar complexity and /or reliability requirements to the applications listed in the above |

11. Notice

This product is designed for solder mounting.

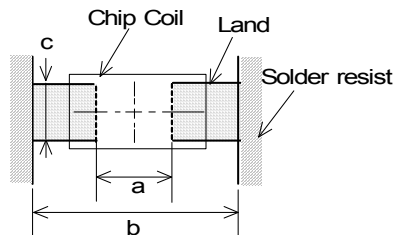
Please consult us in advance for applying other mounting method such as conductive adhesive.

11.1 Land pattern designing

Recommended land patterns for flow and reflow soldering are as follows:

It has been designed for Electric characteristics and solderability.

Please follow the recommended patterns. Otherwise, their performance which includes electrical performance or solderability may be affected, or result to "position shift" in soldering process.



a	1.0
b	4.5
c	1.5

(in mm)

11.2 Flux, Solder

Flux	<ul style="list-style-type: none"> • Use rosin-based flux. • Don't use highly acidic flux with halide content exceeding 0.2(wt)% (chlorine conversion value). • Don't use water-soluble flux.
Solder	<ul style="list-style-type: none"> • Use Sn-3.0Ag-0.5Cu solder • Standard thickness of solder paste : 200μm to 300μm

Other flux (except above) Please contact us for details, then use.

11.3 Flow soldering / Reflow soldering conditions

- Pre-heating should be in such a way that the temperature difference between solder and product surface is limited to 150°C max. Cooling into solvent after soldering also should be in such a way that the temperature difference is limited to 100°C max.

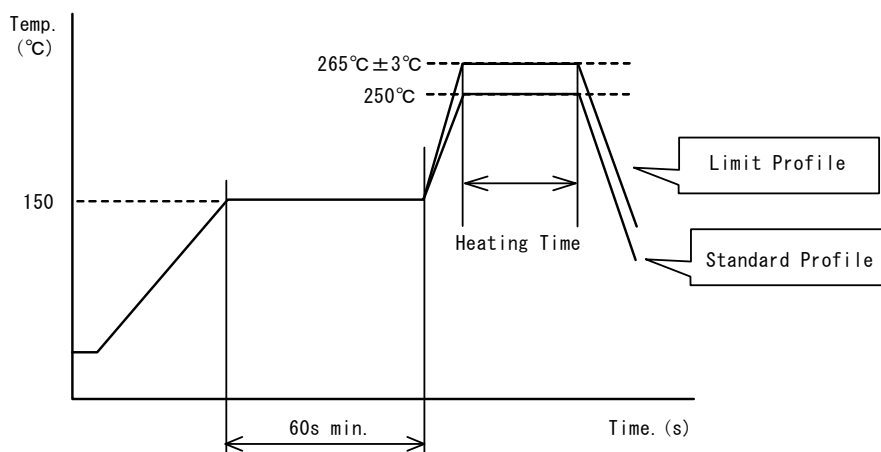
Insufficient pre-heating may cause cracks on the product, resulting in the deterioration of products quality.

- Standard soldering profile and the limit soldering profile is as follows.

The excessive limit soldering conditions may cause leaching of the electrode and / or resulting in the deterioration of product quality.

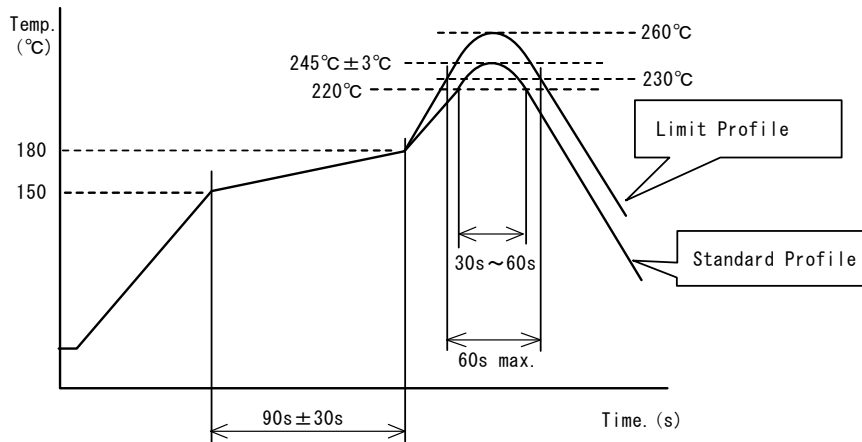
Soldering profile

(1)Flow soldering profile



	Standard Profile	Limit Profile
Pre-heating	150°C、60s min.	
Heating	250°C、4s~6s	265°C±3°C、5s
Cycle of flow	2 times	2 times

(2) Reflow soldering profile



	Standard Profile	Limit Profile
Pre-heating	150~180°C、90s±30s	
Heating	above 220°C、30s~60s	above 230°C、60s max.
Peak temperature	245±3°C	260°C, 10s
Cycle of reflow	2 times	2 times

11.4 Reworking with soldering iron.

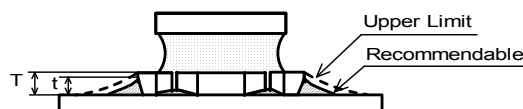
The following conditions must be strictly followed when using a soldering iron.

Pre-heating	150°C, 1 min
Tip temperature	350°C max.
Soldering iron output	80W max.
Tip diameter	φ 3mm max.
Soldering time	3(+1,-0)s
Times	2 times

Note : Do not directly touch the products with the tip of the soldering iron in order to prevent the crack on the products due to the thermal shock.

11.5 Solder Volume

- Solder shall be used not to be exceeded the upper limits as shown below.
- Accordingly increasing the solder volume, the mechanical stress to Chip is also increased. Exceeding solder volume may cause the failure of mechanical or electrical performance.



$$\frac{1}{3}T \leq t \leq T$$

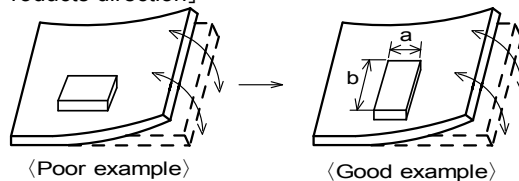
T: Lower flange thickness

11.6 Product's location

The following shall be considered when designing and laying out P.C.B.'s.

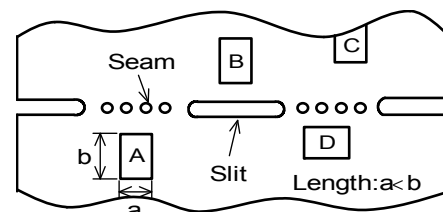
- (1) P.C.B. shall be designed so that products are not subject to the mechanical stress due to warping the board.

[Products direction]



Products shall be located in the sideways direction (Length: $a < b$) to the mechanical stress.

- (2) Products location on P.C.B. separation
Products (A,B,C,D) shall be located carefully so that products are not subject to the mechanical stress due to warping the board. Because they may be subjected the mechanical stress in order of $A > C > B \cong D$.



11.7 Cleaning Conditions

Products shall be cleaned on the following conditions.

- (1) Cleaning temperature shall be limited to 60°C max.(40°C max for alcohol type cleaner.)
- (2) Ultrasonic cleaning shall comply with the following conditions with avoiding the resonance phenomenon at the mounted products and P.C.B.
Power : 20 W / l max. Frequency : 28kHz to 40kHz Time : 5 min max.
- (3) Cleaner
 1. Alternative cleaner
 - Isopropyl alcohol (IPA)
 2. Aqueous agent
 - PINE ALPHA ST-100S
- (4) There shall be no residual flux and residual cleaner after cleaning.
In the case of using aqueous agent, products shall be dried completely after rinse with de-ionized water in order to remove the cleaner.
- (5) Other cleaning
Please contact us.

11.8 Resin coating

The inductance value may change due to high cure-stress of resin to be used for coating/molding products. An open circuit issue may occur by mechanical stress caused by the resin, amount/cured shape of resin, or operating condition etc. Some resin contains some impurities or chloride possible to generate chlorine by hydrolysis under some operating condition may cause corrosion of wire of coil, leading to open circuit. So, please pay your careful attention when you select resin in case of coating/molding the products with the resin. Prior to use the coating resin, please make sure no reliability issue is observed by evaluating products mounted on your board.

11.9 Caution for use

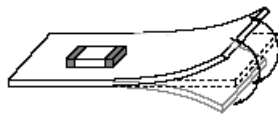
- Sharp material such as a pair of tweezers or other material such as bristles of cleaning brush, shall not be touched to the winding portion to prevent the breaking of wire.
- Mechanical shock should not be applied to the products mounted on the board to prevent the breaking of the core

11.10 Handling of a substrate

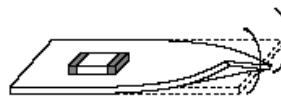
After mounting products on a substrate, do not apply any stress to the product caused by bending or twisting to the substrate when cropping the substrate, inserting and removing a connector from the substrate or tightening crew to the substrate.

Excessive mechanical stress may cause cracking in the product.

Bending



Twisting

**11.11 Storage and Handling Requirements**

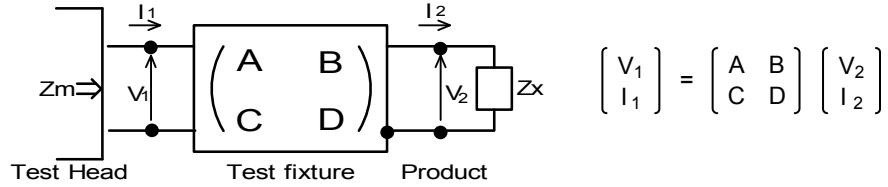
- (1) Storage period
 - Use the products within 12 months after delivered.
 - Solderability should be checked if this period is exceeded.
- (2) Storage conditions
 - Products should be stored in the warehouse on the following conditions.
Temperature : -10 °C to 40 °C
Humidity : 15 % to 85 % relative humidity No rapid change on temperature and humidity
The electrode of the products is coated with solder. Don't keep products in corrosive gases such as sulfur, chlorine gas or acid, or it may cause oxidization of electrode, resulting in poor solderability.
 - Products should not be stored on bulk packaging condition to prevent the chipping of the core and the breaking of winding wire caused by the collision between the products.
 - Products should be stored on the palette for the prevention of the influence from humidity, dust and so on.
 - Products should be stored in the warehouse without heat shock, vibration, direct sunlight and so on.
- (3) Handling Condition
Care should be taken when transporting or handling product to avoid excessive vibration or mechanical shock.

12. ⚠ Note

- (1) Please make sure that your product has been evaluated in view of your specifications with our product being mounted to your product.
- (2) You are requested not to use our product deviating from the reference specifications.
- (3) The contents of this reference specification are subject to change without advance notice. Please approve our product specifications or transact the approval sheet for product specifications before ordering

<Electrical Performance:Measuring Method of Inductance/Q>

(1) Residual elements and stray elements of test fixture can be described by F-parameter shown in following.



(2) The impedance of chip coil Z_x and measured value Z_m can be described by input/output current/voltage.

$$Z_m = \frac{V_1}{I_1}, \quad Z_x = \frac{V_2}{I_2}$$

(3) Thus, the relation between Z_x and Z_m is following;

$$Z_x = \alpha \frac{Z_m - \beta}{1 - Z_m \Gamma} \quad \text{where, } \alpha = D / A = 1$$

$$\beta = B / D = Z_{sm} - (1 - Y_{om} Z_{sm}) Z_{ss}$$

$$\Gamma = C / A = Y_{om}$$

$$\left[\begin{array}{l} Z_{sm} : \text{measured impedance of short chip} \\ Z_{ssa} : \text{residual impedance of short chip (0.771nH)} \\ Y_{om} : \text{measured admittance when opening the fixture} \end{array} \right]$$

(4) L_x shall be calculated with the following equation.

$$L_x = \frac{\text{Im}(Z_x)}{2\pi f}, \quad Q_x = \frac{\text{Im}(Z_x)}{\text{Re}(Z_x)} \quad \begin{array}{l} L_x : \text{Inductance of chip coil} \\ Q_x : Q \text{ of chip coil} \\ f : \text{Measuring frequency} \end{array}$$

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