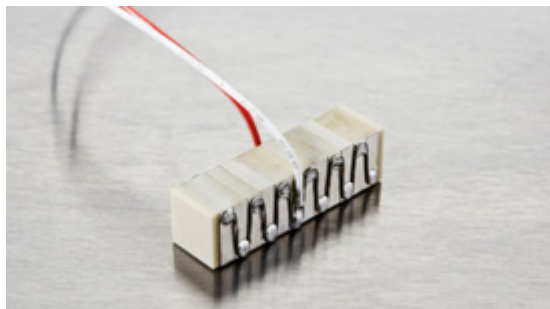


# NAC2013-Hxx



Noliac plate stack actuator NAC2013-Hxx (height in mm – Hxx) is based on the multilayer actuator NAC2013 and can be stacked to match your requirements. The standard range of NAC2013-Hxx is produced in a height between 4-50 mm. The plate stack provides a stroke up to 79.2  $\mu\text{m}$  and blocking force up to 1050 N depending on the height of the stack.

## SPECIFICATIONS

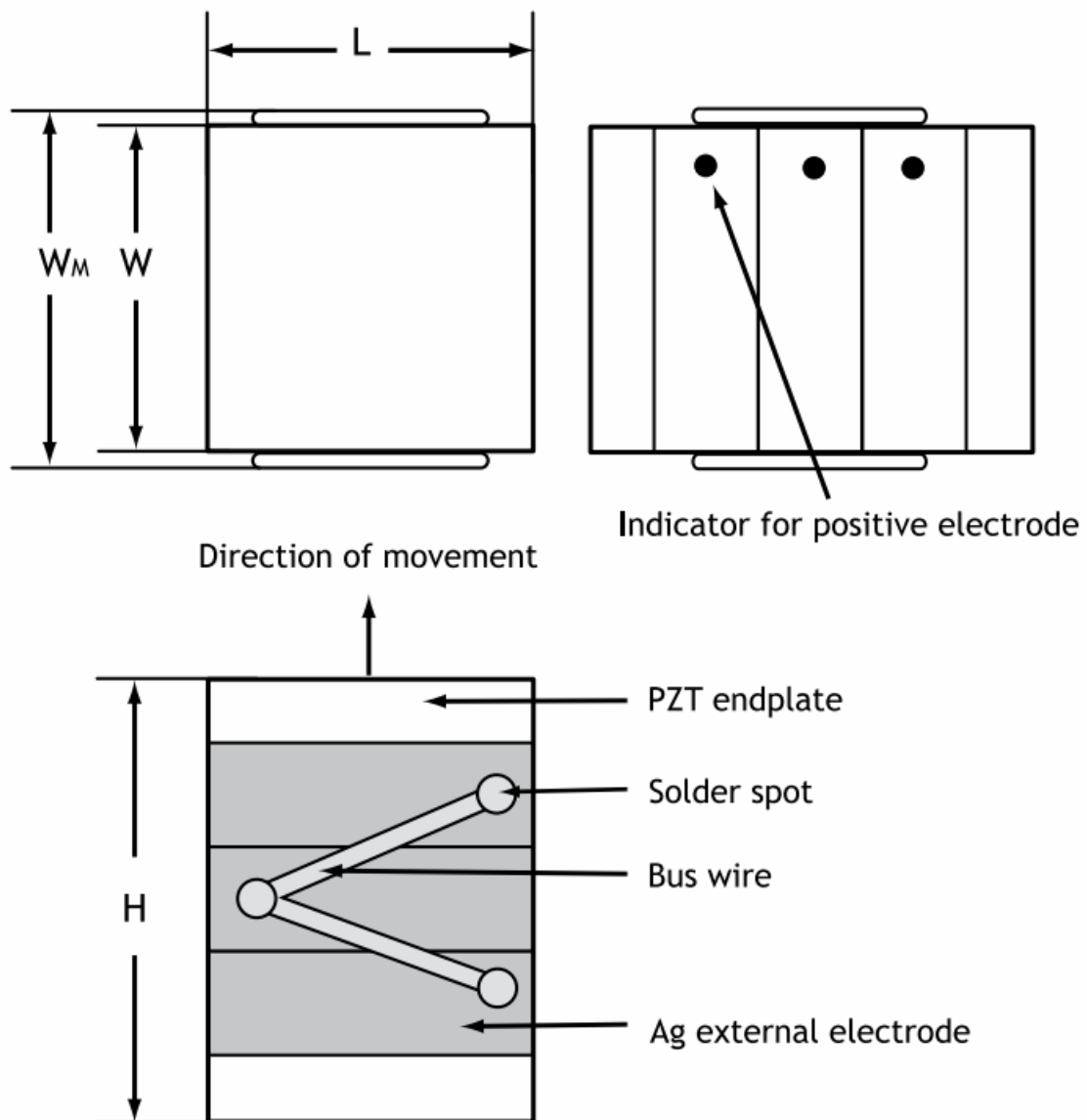
Attributes	Value	Tolerance
Length / outer diameter	5 mm	+0.30/-0.10 mm
Width / inner diameter	5 mm	+0.30/-0.10 mm
Max width / outer diameter max	6.8 mm	
Height	4 — 50 mm	+/-0.2 mm or 1% (whichever is largest)
Operating voltage, max.	150 V	
Free stroke, max.	3.3 — 79.2 $\mu\text{m}$	+/- 15%
Blocking force, max.	1050 N	+/-20%
Capacitance	180-4330 nF	+/- 15%
Stiffness	318-13 N/ $\mu\text{m}$	+/-20%
Maximum operating temperature	150 °C	
Material	NCE51F	
Unloaded resonance frequency	>248 k - 22 k Hz	
Electrodes	Screen-printed Ag and soldered bus wire (option: glued connections)	
Remarks	-	

## Stack options

Height	Stroke	Capacitance
4 mm	3.3 $\mu\text{m}$	180 nF
6 mm	6.6 $\mu\text{m}$	360 nF
8 mm	9.9 $\mu\text{m}$	540 nF

10 mm	13.2 $\mu\text{m}$	720 nF
12 mm	16.5 $\mu\text{m}$	900 nF
14 mm	19.8 $\mu\text{m}$	1080 nF
16 mm	23.1 $\mu\text{m}$	1260 nF
18 mm	26.4 $\mu\text{m}$	1440 nF
20 mm	29.7 $\mu\text{m}$	1620 nF
22 mm	33 $\mu\text{m}$	1810 nF
24 mm	36.3 $\mu\text{m}$	1990 nF
26 mm	39.6 $\mu\text{m}$	2170 nF
28 mm	42.9 $\mu\text{m}$	2350 nF
30 mm	46.2 $\mu\text{m}$	2530 nF
32 mm	49.5 $\mu\text{m}$	2710 nF
34 mm	52.8 $\mu\text{m}$	2890 nF
36 mm	56.1 $\mu\text{m}$	3070 nF
38 mm	59.4 $\mu\text{m}$	3250 nF
40 mm	62.7 $\mu\text{m}$	3430 nF
42 mm	66 $\mu\text{m}$	3610 nF
44 mm	69.3 $\mu\text{m}$	3790 nF
46 mm	72.6 $\mu\text{m}$	3970 nF
48 mm	75.9 $\mu\text{m}$	4150 nF
50 mm	79.2 $\mu\text{m}$	4330 nF

## DRAWINGS



### Mounting

The actuators are usually grinded on top and bottom surfaces (perpendicular to the direction of expansion) in order to obtain flat and parallel surfaces for mounting. The actuators may be mounted either by mechanical clamping or gluing.

Avoiding short circuit can either be achieved by:

- Adding Kapton foil on the metallic surfaces.
- Having inactive ceramic plates between the actuator and the metal plate.

Stacked actuators are manufactured with top and bottom insulating ceramic end-plates.

If glued, it is important to ensure a very thin glue line between the actuator and the substrate. It is recommended that a pressure, e.g. 2-5 MPa, is applied during the curing process.

To avoid significant loss of performance, the mounting of the actuators should avoid mechanical clamping and/or gluing on the sides of the actuator.

During manufacturing or handling, minor chips on the end-plates can appear. Minor chips cannot be avoided, but such chips do not affect performance.

### Electrical connection

#### External electrodes

The external electrodes are screen printed silver as standard. Other materials, e.g. gold or silver/palladium are available on request. The positive electrode is indicated by a black spot.

Electrical connection to the external electrodes can be achieved by mechanical contacts, soldering, gluing with electrically conductive glues or wire bonding.

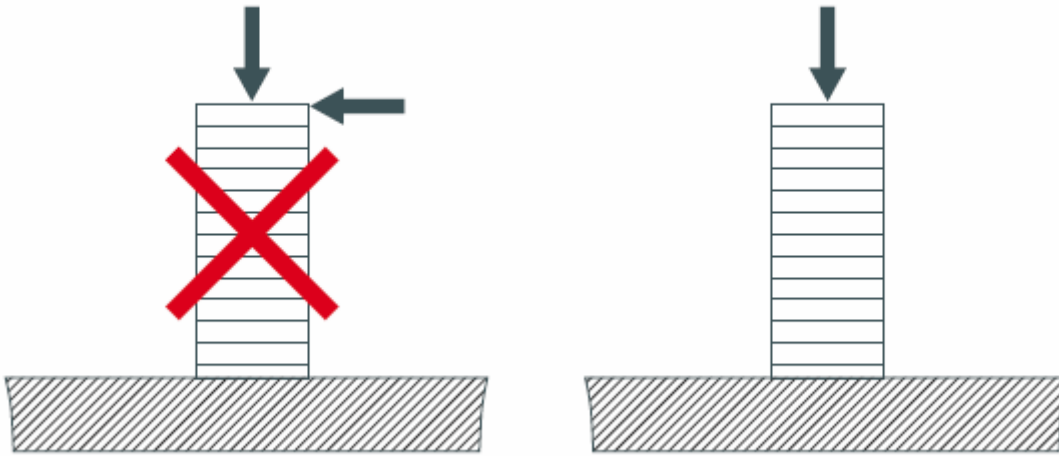
#### Mechanical connections

Mechanical connections can be arranged by e.g. copper springs contacted to the external electrodes. It is recommended to use external electrodes of gold in order to eliminate oxidation of the electrodes.

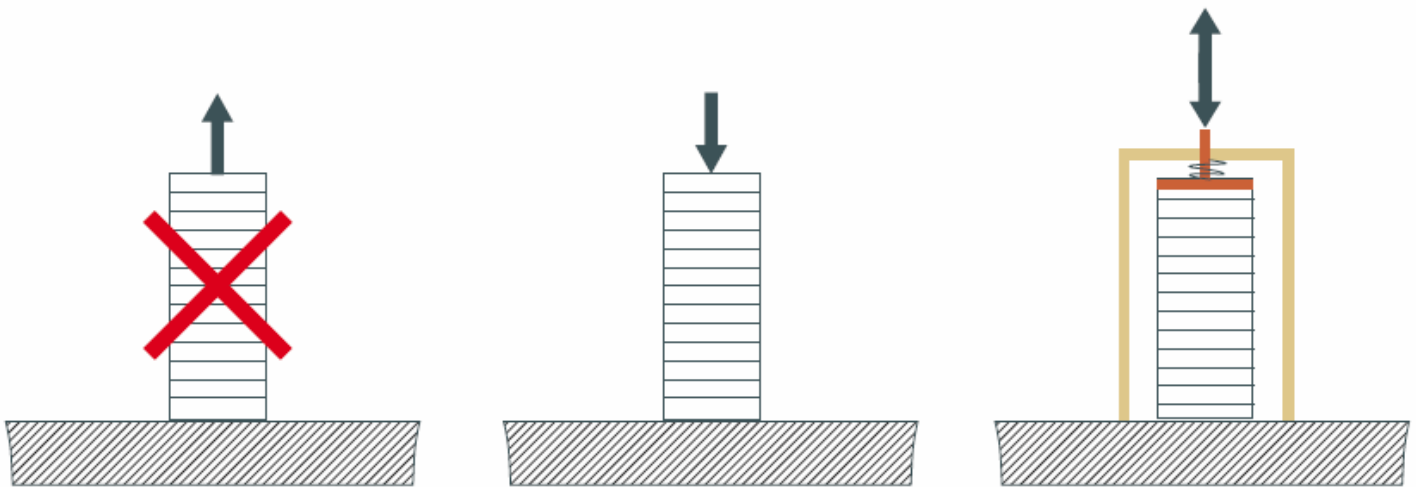
#### Soldering

Soldering electrical wires to the screen-printed silver electrode makes an excellent and time-stable connection. In order to avoid challenges with wetting the solder on the silver surface, always clean the external electrodes with a glass brush or steel wool.

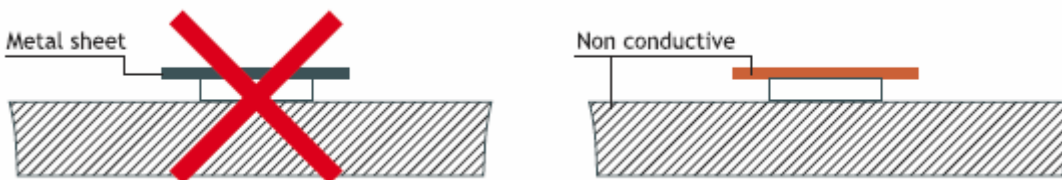
The actuators may only be stressed axially. Tilting and shearing forces must be avoided.



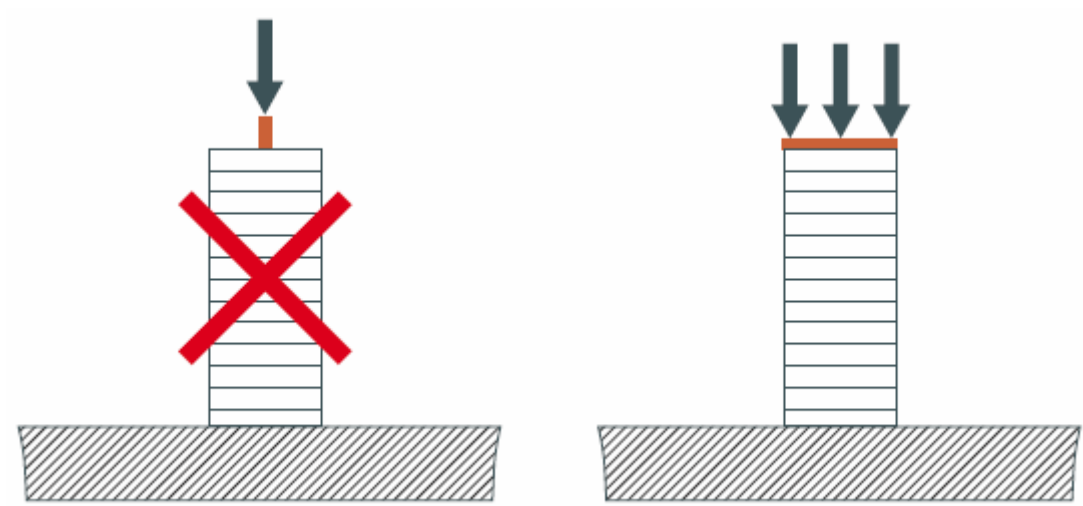
The actuators without preload are sensitive to pulling forces. It is recommended to apply a pre-load in order to optimize the performances of the actuators.



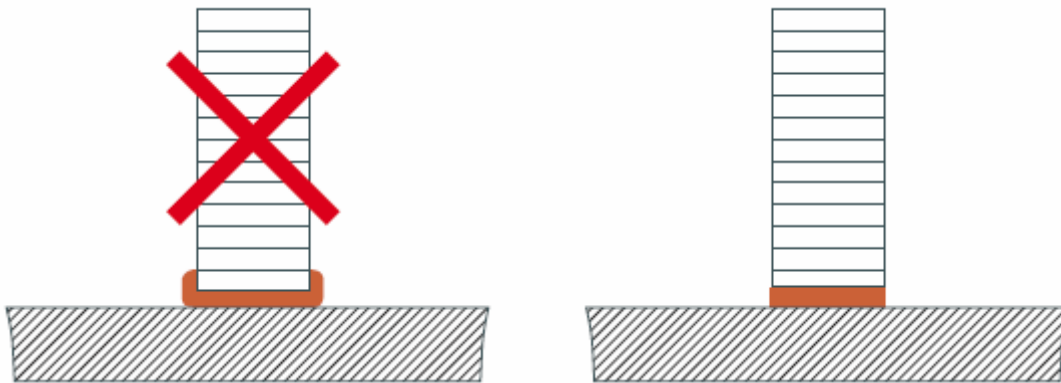
For linear actuators it is recommended not to use a metal plate on top and bottom in order to avoid short circuit.



The force must be applied on the full surface of the actuator in order to assure a good load distribution.



Epoxy glues are well suited for gluing piezoceramics.



## WIRES

When you order actuators from Noliac, you can have wires fitted to save time and money. However, you should consider these parameters, when you select a wire for connection:

- Operation voltage
- Intensity of current
- Operating temperature
- Environment for example vacuum

### We recommend Teflon wires

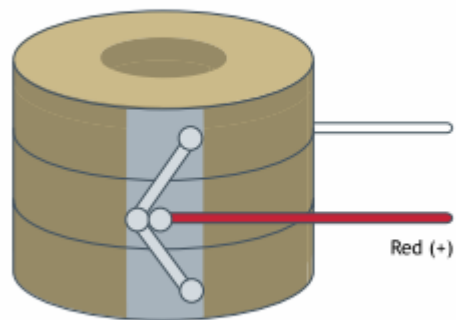
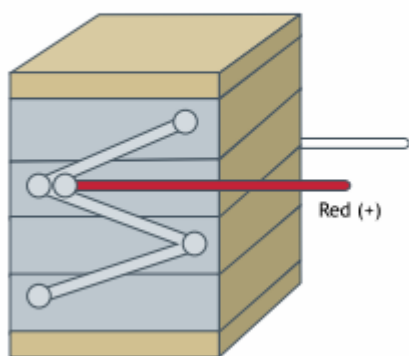
Teflon wires can stand temperatures above 200 °C, whereas PVC wires only resist temperatures up to 80 °C. In tough operating conditions or in vacuum, it is recommended always to use Teflon isolated wire to guarantee the proper performance of PZT-elements.

### Wire thickness (AWG)

The wire thickness (AWG) is determined by the current that has to be transmitted to and from the PZT-element. The required current is determined by the capacitance of the PZT-element, the maximum driving frequency and the maximum voltage  $U_p$ .

	Option A01	Option A02	Option C
Type	28 AWG Teflon	28 AWG Teflon	Custom
Length	200 +/- 10mm	200 +/- 10mm	To be defined
Position	Middle of the actuator	Middle of the actuator	To be defined
Direction	Perpendicular to the height	Toward top	To be defined

## Type A01



## Type A02

