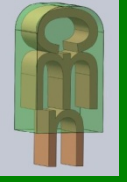


Compliant pin design

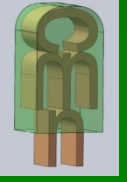
A, Tool requirements:

✓Tools shall be used and inspected according to the instructions and dimensions provided by the manufacturer.

✓The tools shall be capable of making uniformly reliable connections during their useful life.

✓The tools shall be so designed that they do not damage the press-in termination or the printed board when correctly operated.

✓Tools are evaluated by testing press-in connections made with these tools.



Compliant pin design

B, pin requirements:

a, Material/finish requirements---mechanical and electic function

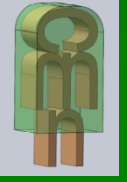
The choice of material will depend upon the size and function of the part but should equally be suited to the requirements of a good, stable electrical connection.

All materials are subject to stress relaxation depending on time, temperature and stress. The termination material and design should be such that the force maintaining the connection will not decrease with time to a degree where the connection suffers an unacceptable increase in resistance.

The surface finish of the press-in zone, and its compatibility with the finish of the plated-through hole in the printed board shall be specified

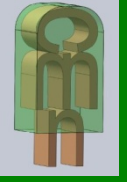
b, Dimensions of the press-in zone

The performance of a press-in connection depends on the dimensions of the specially shaped press-in zone and the materials used for the press-in termination together with the dimensions and materials of the plated-through hole in the printed board.



Compliant pin design

c, design features
-For the shape of the press-in zone, a wide variety of designs can be used.
-The press-in termination shall be so designed that a press-in connection is achieved by inserting the press-in zone to a predetermined depth in a specified plated-through hole in the board.
-The press-in terminations and their press-in zones shall be so designed and manufactured such that damage to the plated-through hole in the printed board is avoided
-Press-in terminations shall have insert features, for example a shoulder or suitable surface, to facilitate the insertion operation.
-All surfaces of the press-in termination which come into contact with the plated-through hole are made to minimize damage to the metal plating of the plated-through hole and to ensure that a good contact function is established;
- The press-in zones are provided with a lead-in



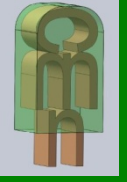
Compliant pin design

C,PCB requirements:
Printed boards according to IEC 60326-3, IEC 60326-5 and IEC 62326-4 or to a specification given by the manufacturer shall be used.
The manufacturer shall define the type(s) of printed board for which the press-in zone is designed to . Essential parameters are:
- diameter of drilled hole and finished hole;
- true position tolerance of hole pattern of printed board;
- plating thickness;
- characteristics of the plating material(s) (for example ductility, adhesion);
- thickness of the printed board;
- number of layers in a multilayer board;
- characteristics of the base material of the printed board.

a, material
Printed boards shall be made of base material according to the following relevant standards:
a) for double sided printed boards:
- IEC 60249-2-4 - Type 60249-2-4-IEC-EP-GC-Cu
- IEC 60249-2-5 - Type 60249-2-5-IEC-EP-GC-Cu

b) for multilayer printed boards:
- IEC 60249-2-11 - Type 60249-2-11-IEC-EP-GC-Cu
- IEC 60249-2-12 - Type 60249-2-12-IEC-EP-GC-Cu

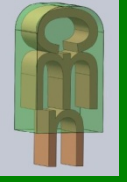
C) other printed circuit board material according to the specification given by the manufacturer.
b, Thickness of printed boards
The manufacturer shall specify for which range of board thicknesses the press-in zone is designed.
c, PTH plating
The thickness of the plating of the plated-through hole shall be: copper ≥ 25 μm.



Compliant pin design

d, PTH dimensions

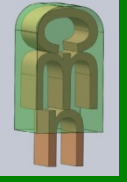
Nominal hole diameter	Diameter of the finished plated-through hole	Diameter of the hole prior to plating
0,50	0,50 ± 0,05	0,60 ± 0,01
0,55	0,55 ± 0,05	0,64 ± 0,01
0,60	0,60 ± 0,05	0,70 ± 0,02
0,65	$0{,}65\ ^{+0{,}07}_{-0{,}04}$	$0{,}80\ ^{+0}_{-0{,}03}$
0,70	$0{,}70\ ^{+0{,}07}_{-0{,}05}$	$0{,}80\ ^{+0{,}03}_{-0{,}02}$
0,75	$0{,}75\ ^{+0{,}05}_{-0{,}07}$	$0{,}85\ ^{+0{,}01}_{-0{,}04}$
0,80	$0{,}80\ ^{+0{,}09}_{-0{,}03}$	0,90 ±0,025
0,85	$0{,}85\ ^{+0{,}10}_{-0{,}05}$	$1{,}00\ ^{+0{,}01}_{-0{,}04}$
0,90	0,90 ± 0,07	1,00 ± 0,025
1	$1{,}00\ ^{+0{,}09}_{-0{,}06}$	1,15 ± 0,025
1,45	$1{,}45\ ^{+0{,}09}_{-0{,}06}$	1,60 ± 0,025
1,60	$1{,}60\ ^{+0{,}09}_{-0{,}06}$	1,75 ± 0,025



Compliant pin design

D, compliant connection

a) The combination of press-in termination, printed board and termination insertion tool shall be compatible and specified by the manufacturer.
b) The press-in termination shall be correctly mounted in the plated-through hole of the printed board as specified in the specification of the manufacturer of the press-in zone.
c) The press-in operation may result in deformation of the plated-through hole (visible by microsectioning).
d) The press-in termination shall not be damaged (e.g. cracked or bent).
e) There shall be no deformation of the printed conductor and/or the plating of the plated-through hole caused by the termination insertion tool or device.
f) There shall be no lands fractured or lifted.
g) There shall be no delamination, blistering or cracking of layers.
h) After the press-in operation, no detrimental plating particle chips shall be visible.
i) At the opposite side of the press-in direction, no plating of the plated-through hole shall be loosened.



Compliant pin design

E, qualification test requirements

There are two test schedules which shall be applied according to the following conditions.

a) Press-in connections is intended to be applied on individual press-in terminations without component housing.

b) Press-in connections is intended to be applied on complete components consisting of multiple press-in terminations mounted in a component housing.

Gruop A

Test phase	Test		Measurement to be performed		Requirement
	Title	Subclause	Title	Test No. of IEC 60512	Subclause
AP1	Mounting	5.3.2.1.1	Press-in force		5.2.2.2
AP2 if applicable	Replacement	5.2.2.6			
AP3			Visual examination (and evaluation of tools)	1a	4.3, 4.4, 4.5, 4.6 and 4.2
AP4	Microsectioning	5.2.2.5			
AP4.1 Three specimens	Transverse sectioning	5.2.2.5.1			5.2.2.5.1
AP4.2 Three specimens	Longitudinal sectioning	5.2.2.5.2			5.2.2.5.2

Compliant pin design

Gruop B

Test phase	Test		Measurement to be performed		Requirement
	Title	Subclause	Title	Test No. of IEC 60512	Subclause
BP1	Mounting	5.3.2.1.2	Press-in force		5.2.2.2
BP2 if applicable	Bending [a]	5.2.2.1			
BP3			Push-out force		5.2.2.3
BP4 if applicable	Replacement	5.2.2.6			
BP5 if applicable		5.2.2.3	Push-out force		5.2.2.3
[a] This test shall be done on the seven sets of parts with holes in range b.					

Gruop C

Test phase	Test		Measurement to be performed		Requirement
	Title	Subclause	Title	Test No. of IEC 60512	Subclause
CP1			Contact resistance – millivolt level method	2a	5.2.3.1
CP2	Rapid change of temperature	5.2.4.1		11d	
CP3	Climatic sequence	5.2.4.2		11a	
CP4	Dry heat	5.2.4.3		11i	
CP5	Flowing mixed gas corrosion test	5.2.4.4		11g	
CP6			Contact resistance – millivolt level method	2a	5.2.3.1

Compliant pin design

Group D

Test phase	Test		Measurement to be performed		Requirement
	Title	Subclause	Title	Test No. of IEC 60512	Subclause
DP1			Contact resistance – millivolt level method	2a	*
DP2	Vibration	5.2.2.4	Contact disturbance	6d and 2e	
DP3	Rapid change of temperature	5.2.4.1		11d	
DP4	Dry heat	5.2.4.3		11i	
DP5			Contact resistance – millivolt level method	2a	*
DP6 Eight specimens	Microsectioning	5.2.2.5			
DP6.1 Four specimens	Transverse sectioning	5.2.2.5.1			5.2.2.5.1
DP6.2 Four specimens	Longitudinal sectioning	5.2.2.5.2			5.2.2.5.2

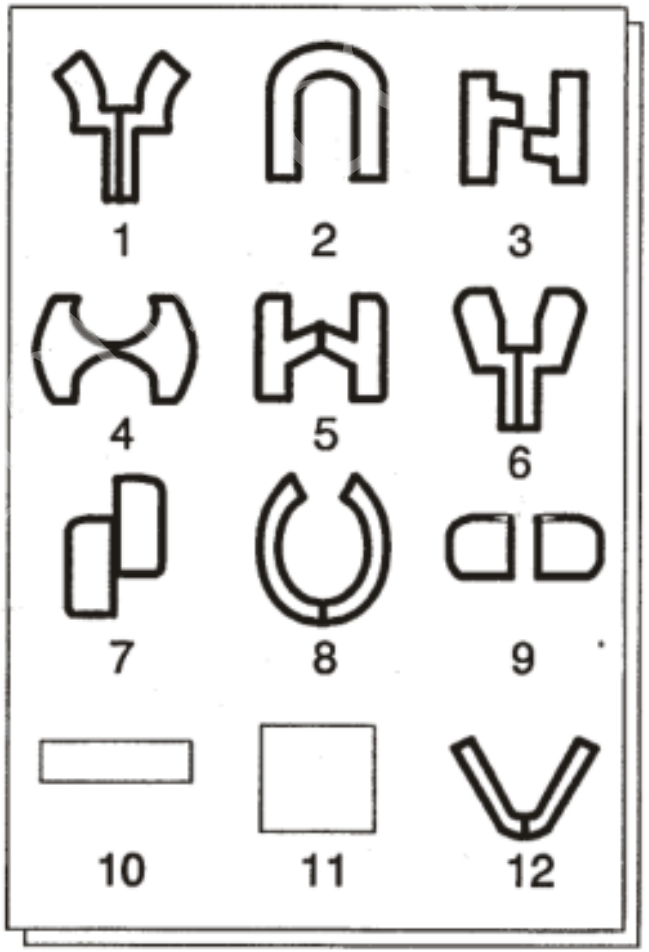
* According to the component specification

Compliant pin design

F, Compliant pin design

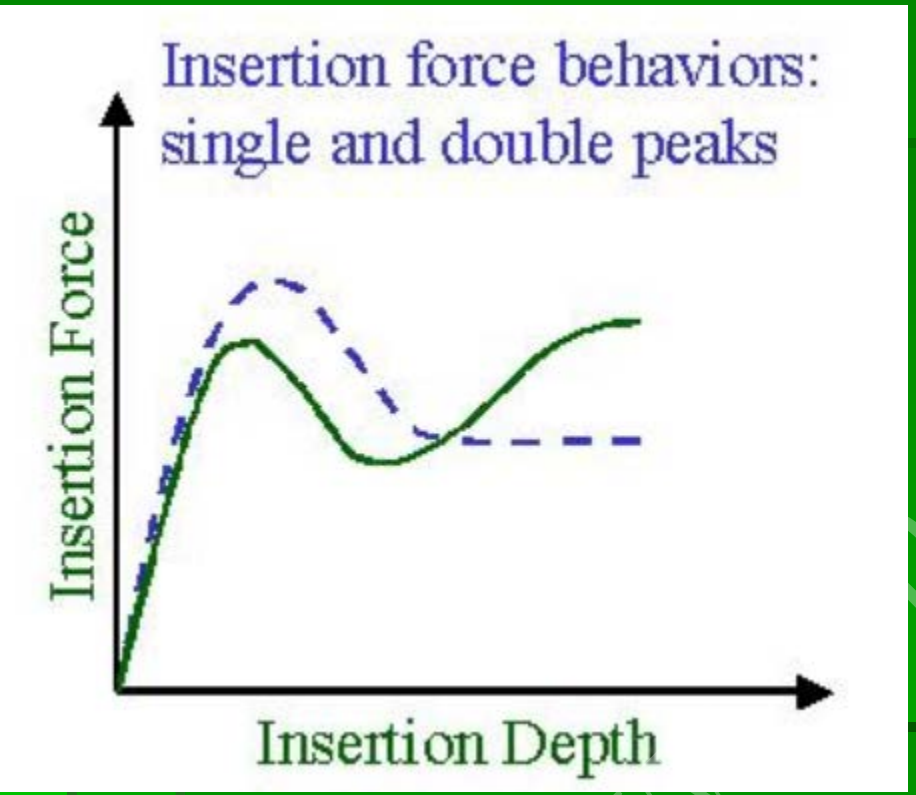
a, compliant pin type

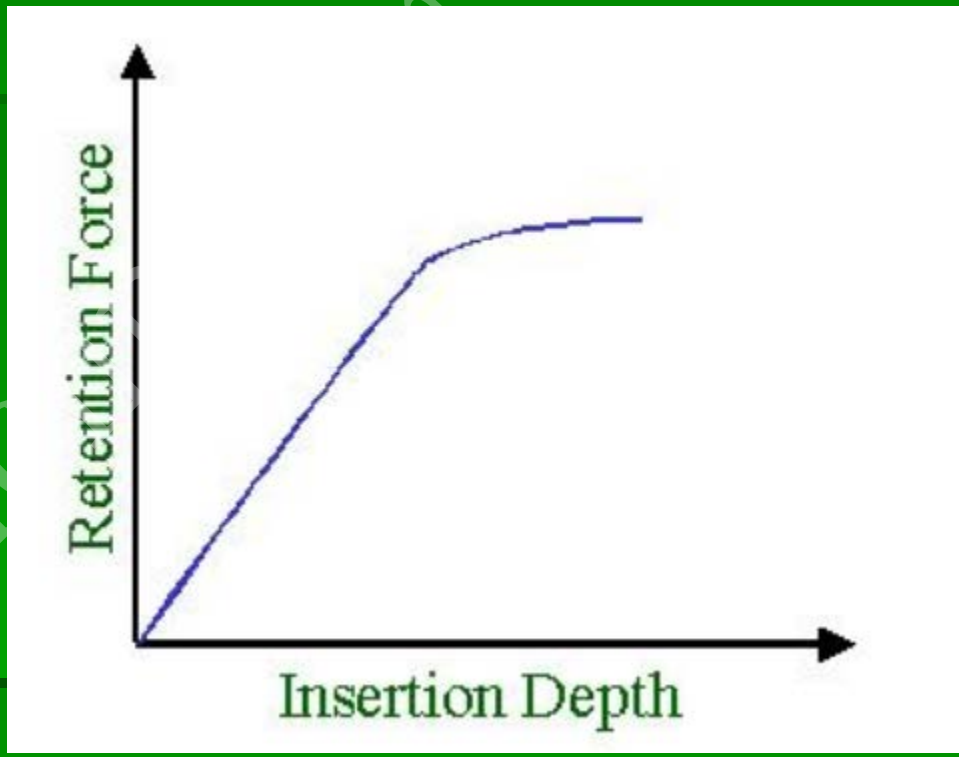
1. Burndy
2.
3. Elco
4. DuPont (Bow Tie)
5. JAE (Sigma)
6. Burndy
7. AMP (Action Pin)
8. Winchester ("C")
9. Teradyne (Eye of Needle)
10. Rigid
11. Rigid
12. Fujitsu



Compliant pin design

b,Insertion force and retention force





Factors affecting insertion and retention force:

•The PTH diameter variation has the largest impact on the peak insertion force. Smaller holes have greater interference with the pins and lead to higher insertion forces.

• Since the dominant deformation behavior of the compliant pin is plasticity, the yield stress (not elastic modulus) is the material property that impacts insertion and retention forces.

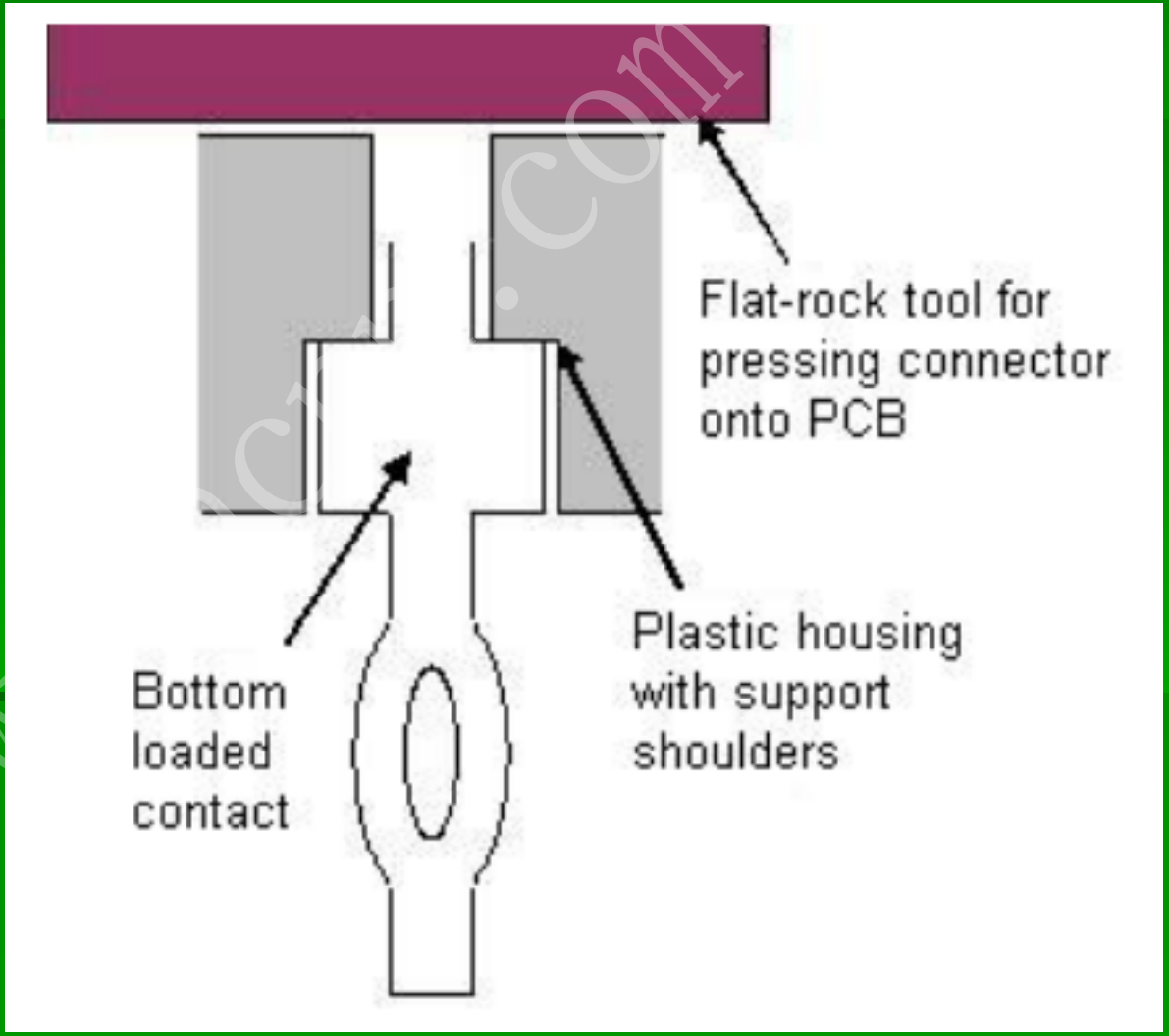
•The surface interaction between the compliant pin and PTH dictates the effective coefficient of friction.

•Since each compliant pin geometry is unique, they have different features to be optimized to provide the required forces.

Compliant pin design

c, insertion features

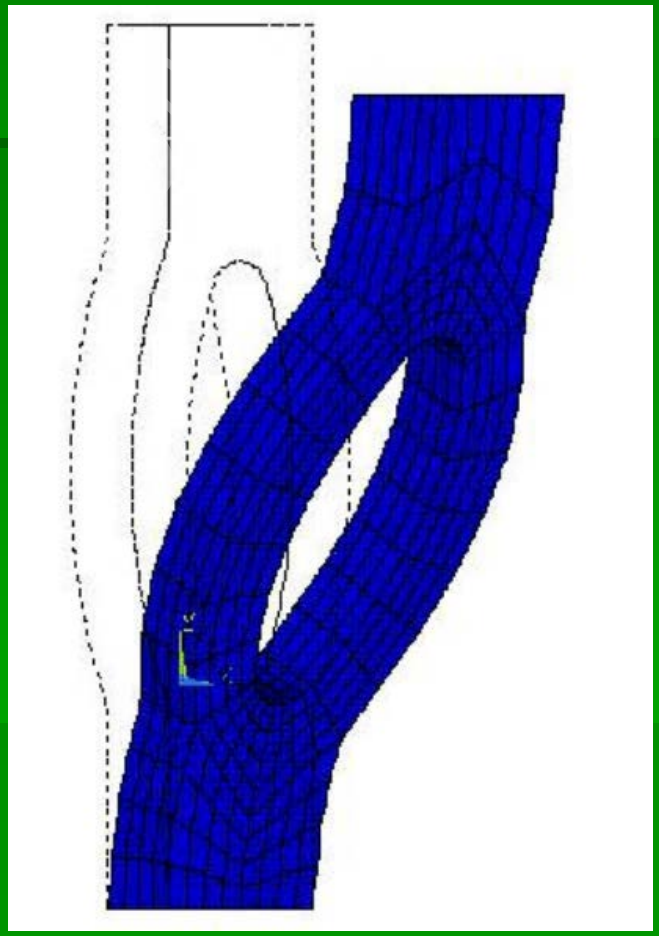
Accommodating the insertion forces of the pins puts requirements on the robustness of the housing. The housing is what transfers the compressive force applied to the top of the connector to the support features of the metal contact. Adequate mechanical strength needs to be designed into the housing and support features to deliver the insertion force.



Compliant pin design

d, buckling force

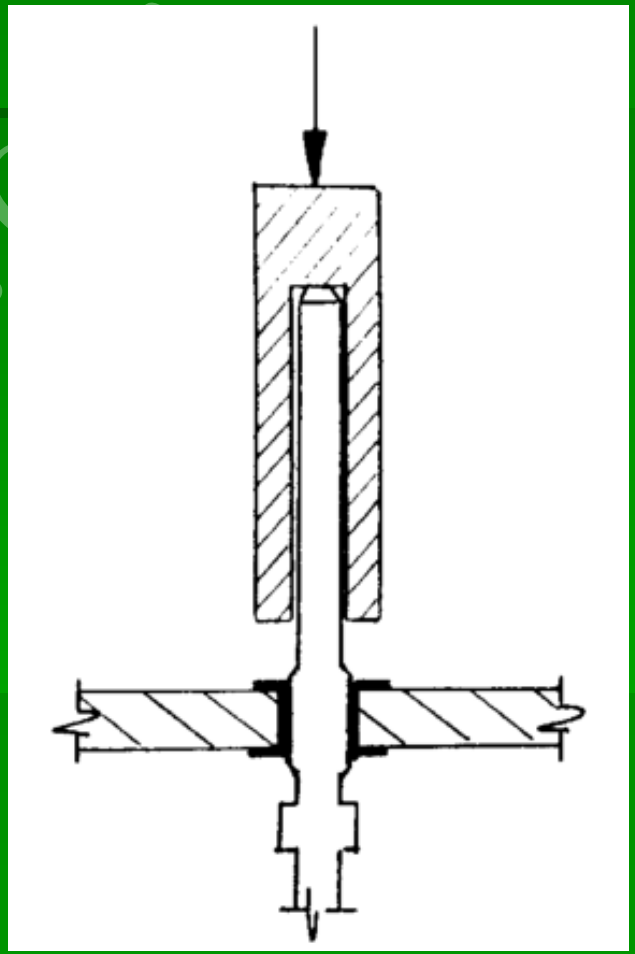
When a compliant pin is initially placed on a PCB with the tips of the pins resting at the entrance to the PTH, it can be viewed as a column. When the insertion force is applied, there are two modes of deformation, insertion or buckling. The pin will deform in the mode that has the lowest force requirement. It is important for the column buckling force of the compliant pin to be larger than the highest expected insertion force to ensure pin insertion.



Compliant pin design

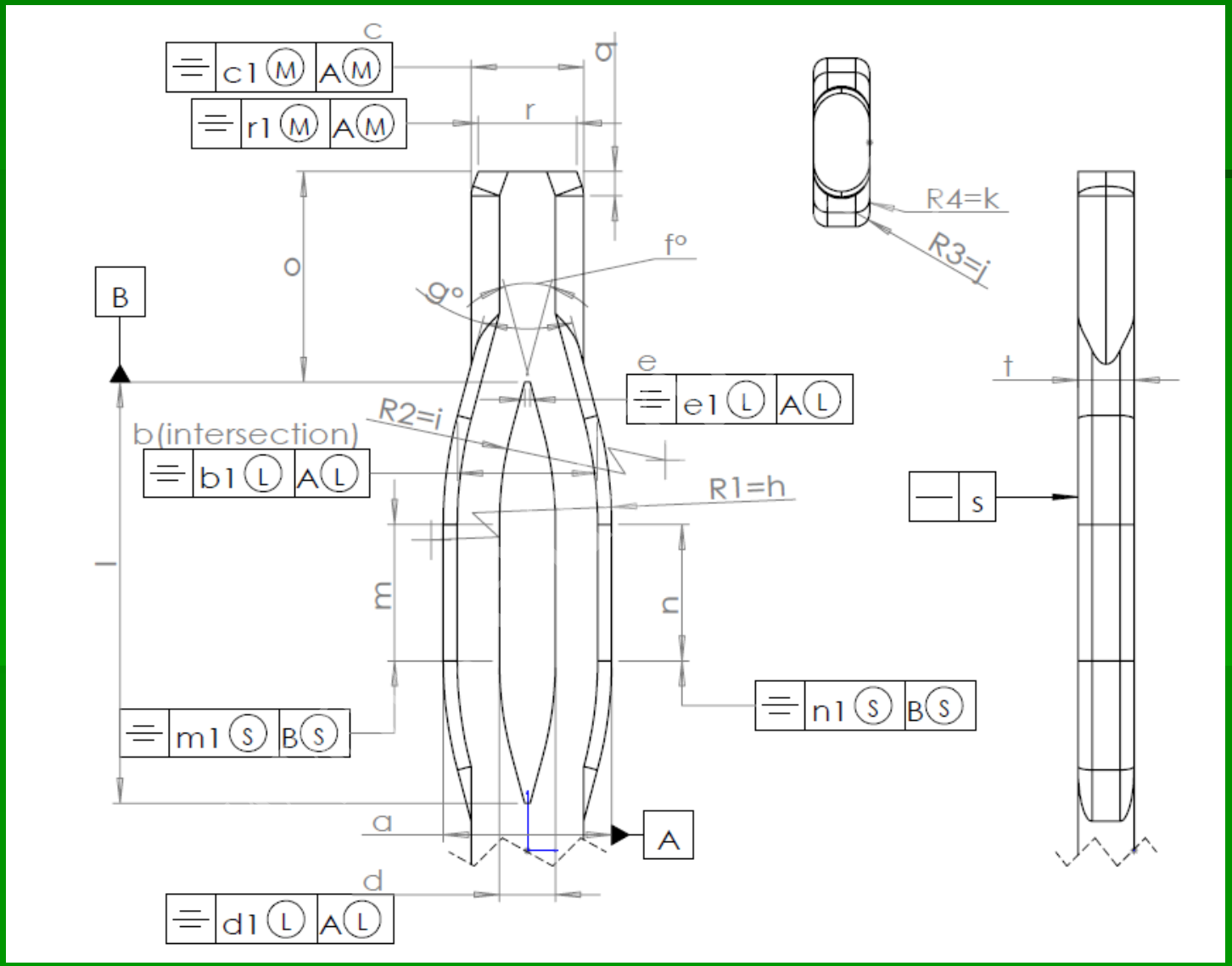
e, pin removal

In many applications, connectors with compliant pins are required to be removable from the PCB without damaging the PTH or other components on the PCB. This requires a repair strategy. If there are only a few compliant pins on the connector, then the connector may be removable in a single piece. However, if there are hundreds of press-fit pins, the cumulative retention force is very large and the connector cannot be removed in one piece. Available space on the PCB to place tools or support structures can dictate which repair strategy is best. A popular strategy is to pull the housing off the contacts and remove the pins individually. This requires the contacts to be bottom-loaded into the housing.



Compliant pin design

f, Design case



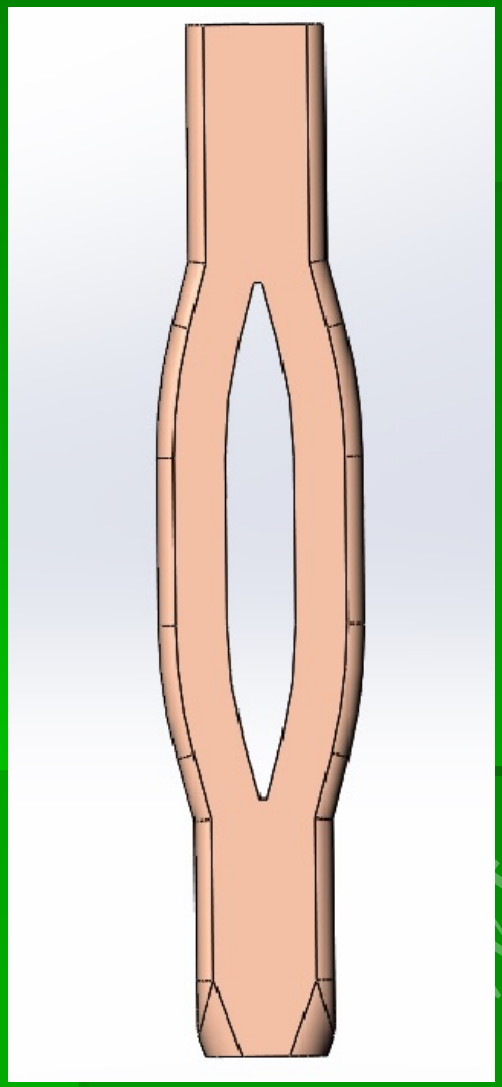
Compliant pin design

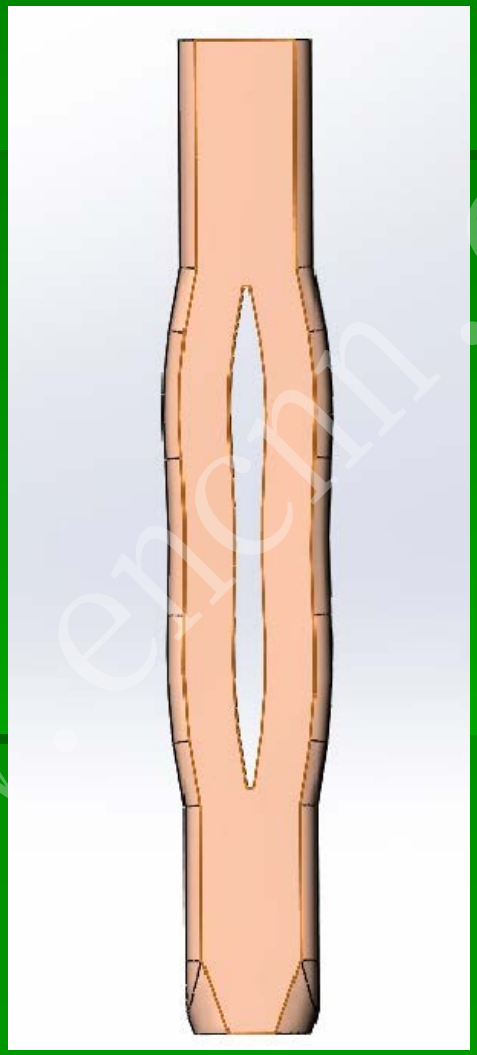
f, Design case

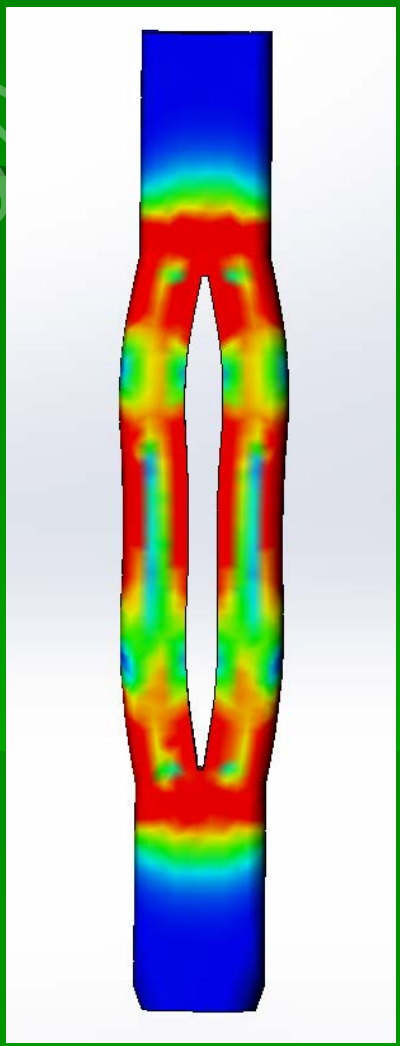
hole diameter	pcb thicknesss	a+/-	b+/-	b1	c+/-	c1	d+/-	d1	e+/-	e1	f+/-	g+/-	h+/-	i+/-	j+/-	k+/-	l+/-	m+/-	m1	n+/-	n1	o+/-	p+/-	q+/-	r+/-	r1	s	t+/-
0.55																											
0.60																											
0.65																											
0.70																											
0.75																											
0.80																											
0.85																											
0.90																											
1																											
1.45																											
1.60																											

Compliant pin design

f, Design case

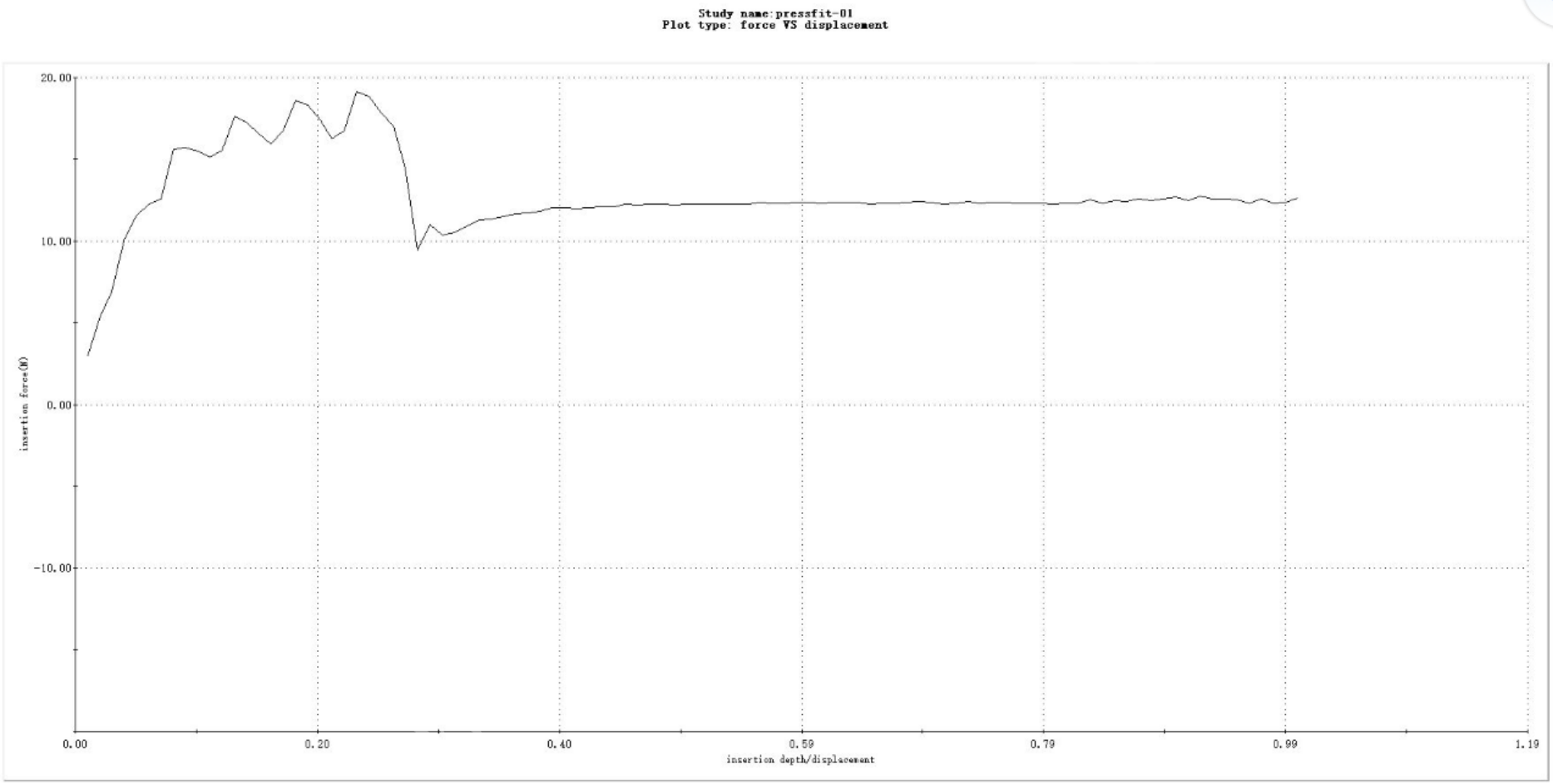






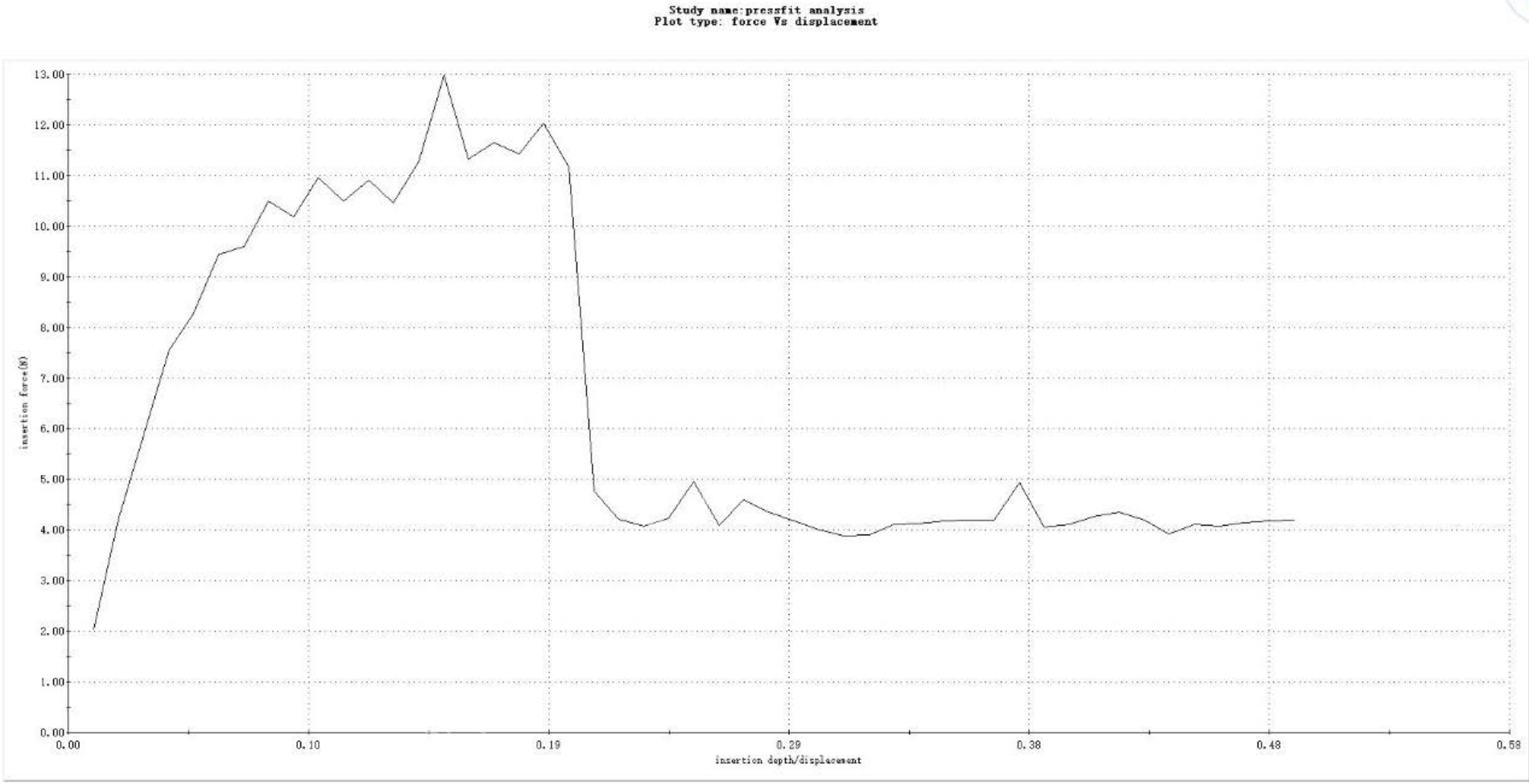
Compliant pin design

f, Design case---insertion force simulation-1



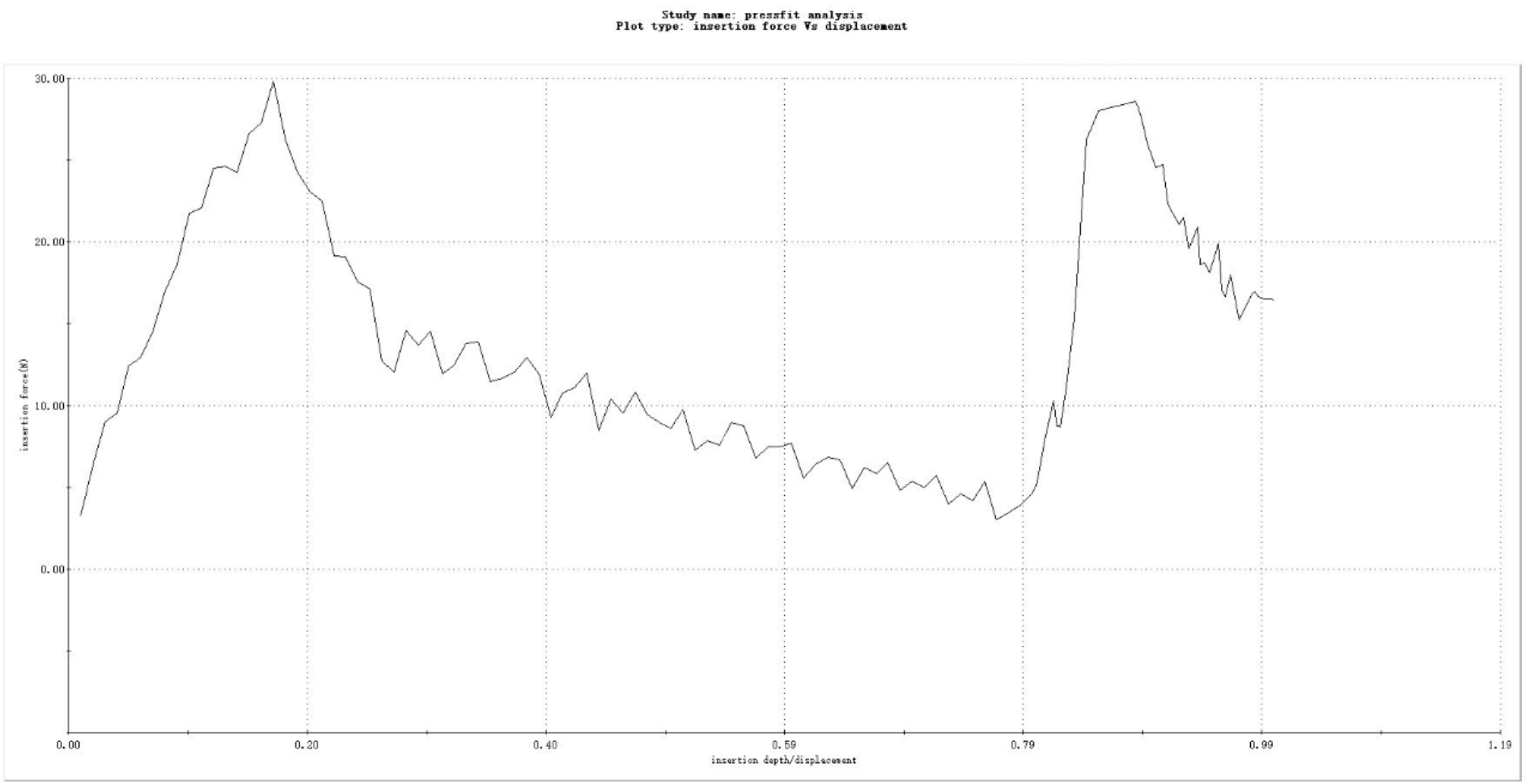
Compliant pin design

f, Design case---insertion force simulation-2



Compliant pin design

f, Design case---insertion force simulation-3



Compliant pin design

f, Design case---insertion force simulation-4