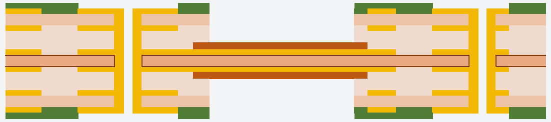
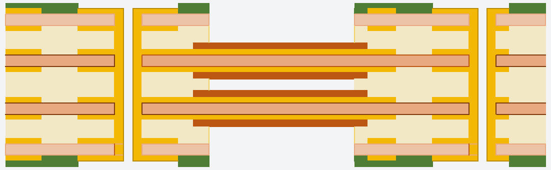
Rigid-Flex&Flex Design Rules

Construction/Stack-up Possibilities

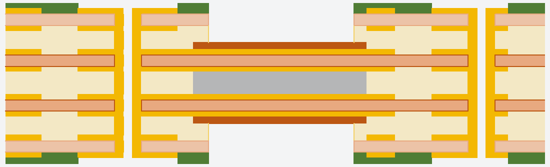
Standard rigid-flex (IPC-6013 type4)



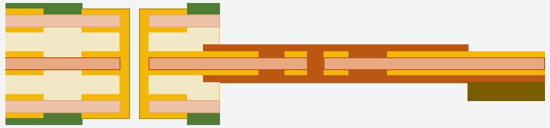
R+F on inner-layer



Multi-flex with airgap

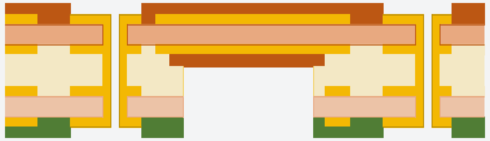


Multi-flex with bondply

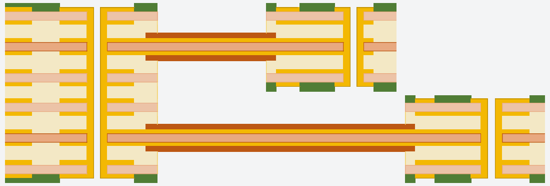


R+F with stiffener

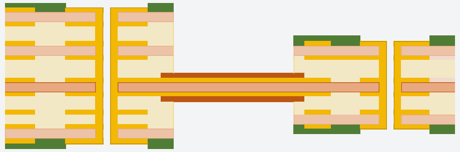
A-symmetrical rigid-flex (not recommended)



R+F on outer-layer



R+F with two rigid tails

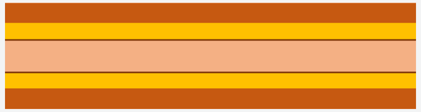


R+F with two thicknesses

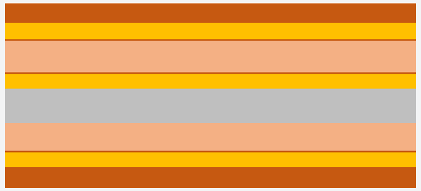
Construction/Stack-up Possibilities

Standard flex

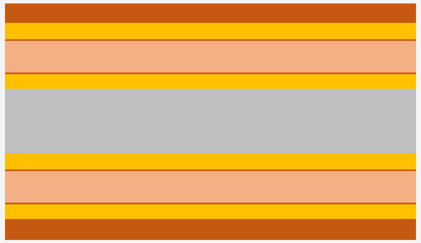
Flex 1 layer with cover-layer
(IPC-6013 type 1)



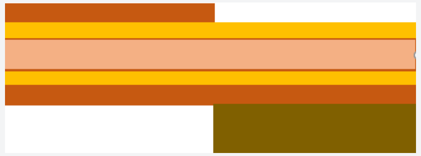
Flex 2 layer with cover-layer
(IPC-6013 type 2)



Flex 3 layer with cover-layer
(IPC-6013 type 3)



Flex 4 layer with cover-layer
(IPC-6013 type 3)



Stiffener

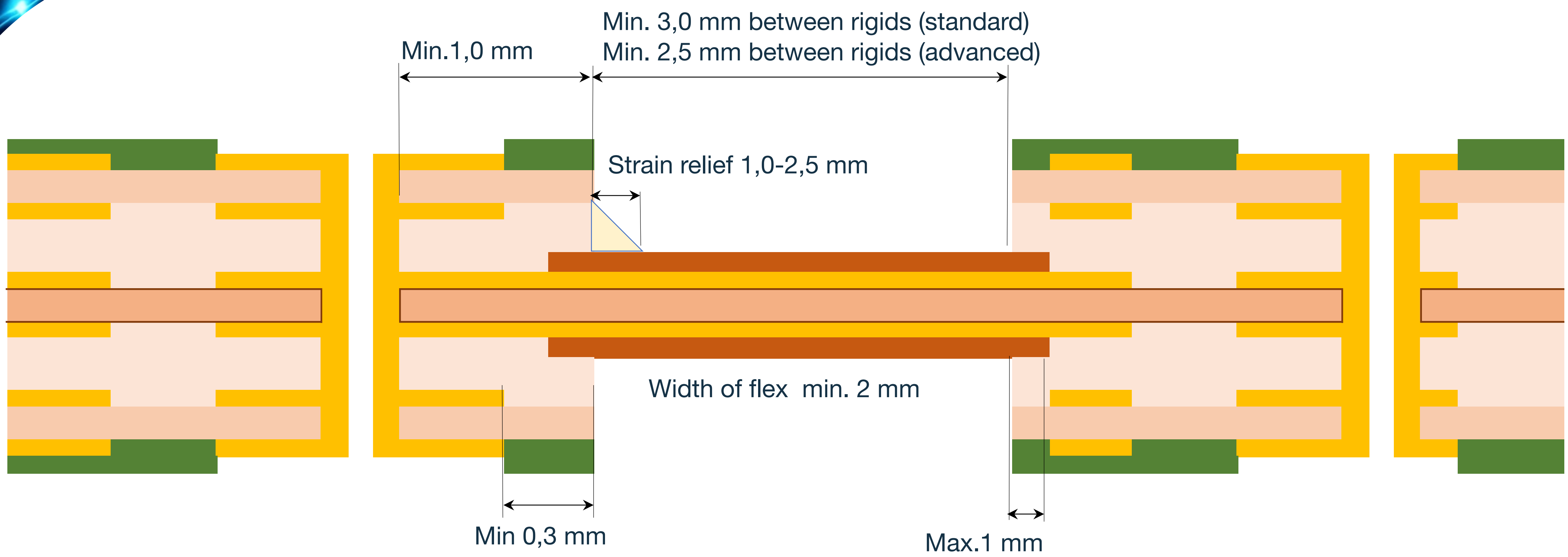
Materials

Bare material	Brand	Remark
Rigid (CCL)	ITEQ, ShengYi, Ventec, EMC, Panasonic, Isola, Rogers, Arlon, Nelco	IPC4101 (Tg> 150C)
Prepreg	ITEQ, ShengYi, Ventec, EMC, Panasonic, Isola	IPC4101 (Tg> 150C)
No-flow/low-flow	Ventec, Arlon, Isola, EMC, Doosan	IPC4101 (Tg> 150C)
PI Flex (FCCL)	Dupont, Panasonic, Thinflex, ShengYi, Doosan, Taiflex	IPC-4204 12µ/25µ/50µ/75µ/100µ/125µ/150µ
Cover-layer	Dupont, ShengYi, Doosan, Taiflex	IPC-4203 25µ/37,5µ/50µ/60µ/75µ/100µ
Bondply/Adhesive	Dupont, ShengYi, Doosan, Taiflex	IPC-4203 25µ/50µ/75µ/100µ/125µ
Flexible solder mask	Taiyo, Sun chemicals, Peters	IPC840
Stiffener	Polyimid, FR-4, Aluminium, Stainless steel, copper	Used as reinforecment for connectors or solder areas. Thicknesses can vary from 100µ to 1,6 mm
Double sided adhesive	Tesa, 3M	

Design Rules Rigid-Flex

Design rule	Value
Dimension	420*650mm (800 x 600 mm advanced)
No. layers	24
No. Flex layers	12
Thickness	0,5 – 6,0 mm
Finish	ENIG, ENEPIG
Aspect ratio	15:1
Smallest holes	0,2 mm
HDI	3+N+3
Outline tolerance	+/- 100µ

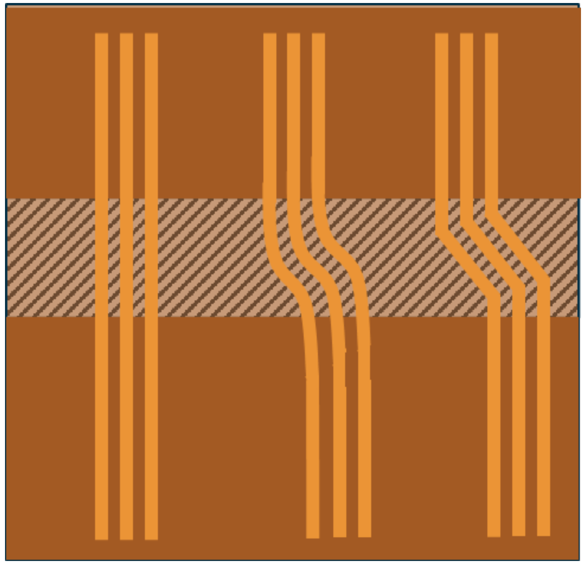
Design Rules Rigid-Flex



FINELINE
DEFINING EXCELLENCE

Design Rules Rigid-Flex

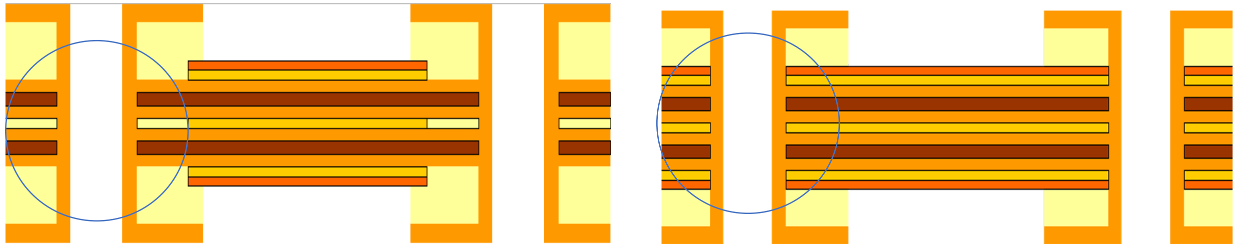
Flex zone



OK Accepted NOK

Bikini construction

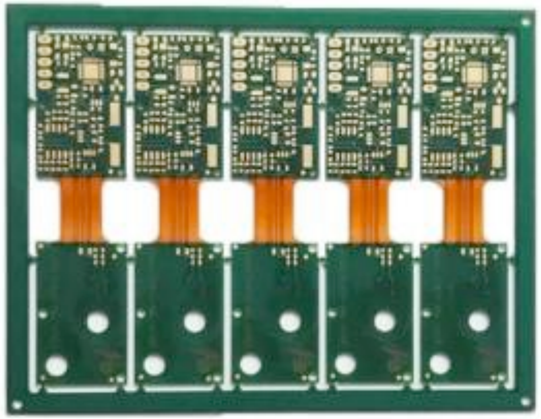
No adhesive in PTH Adhesive in PTH

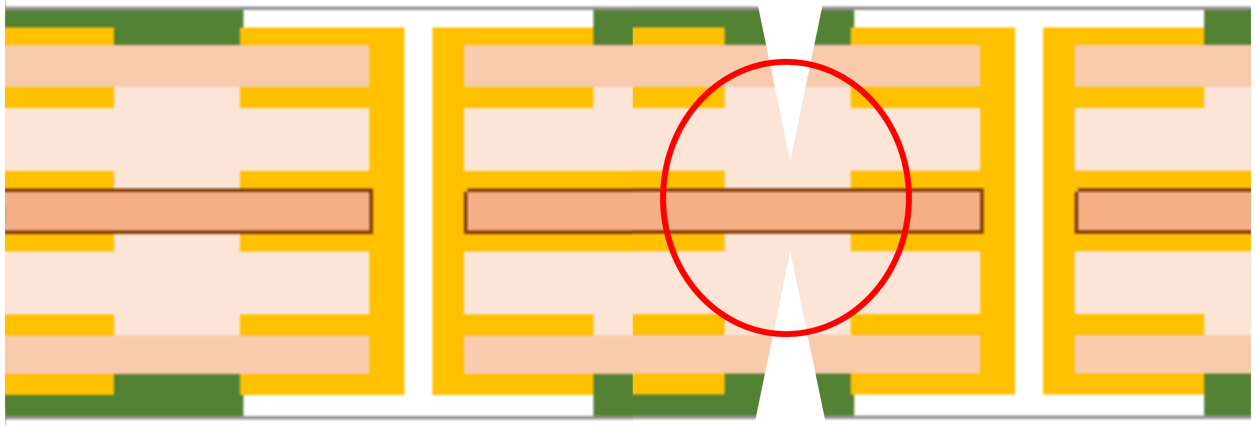


OK NOK

Design Rules Rigid-Flex

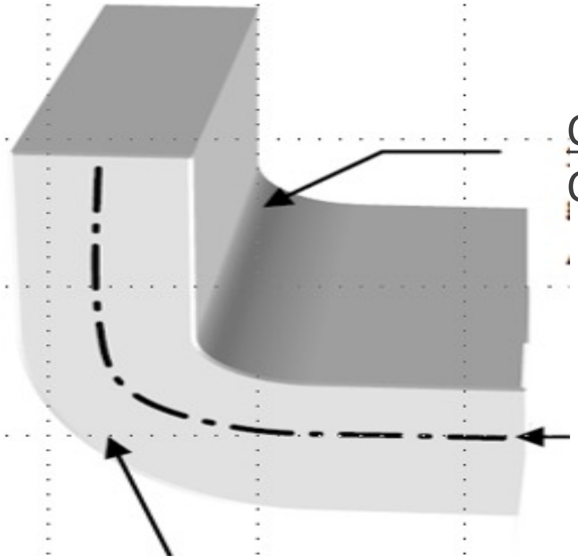
- Always put Rigid-Flex in a frame for assembly
- Routing is preferred, scoring is not recommended (flex will not break)

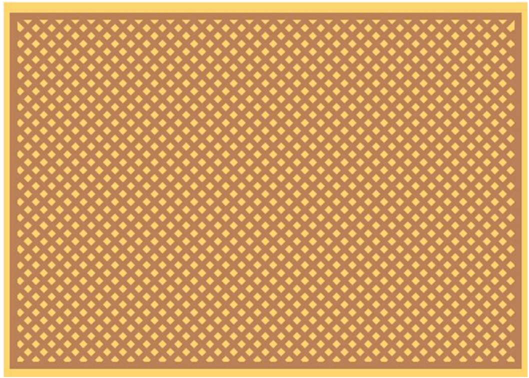




Design Rules Flex

- Bending radius according IPC-2223 5.2.3.3
  - Symmetrical construction
  - Adhesive & adhesiveless constructions
  - RA and ED copper
- Cross hatch will improve the flexibility
  - Better for release of moisture
- Rule of thumb
  - **10x** the thickness of the flex for static applications
  - **50-100x** the thickness of the flex for dynamic applications
  - You may fold the flex but then it must be fixed





Cross hatch

Design Rules Flex

Design rule	Value	Remark
Dimension	570 x 420 mm 550 x 1600 mm 250 x 35000 mm	Up to 8 layers Up to 2 layers 1 layer
No.of layers	8	
Min. Track/gap 12µ Cu **Min. Track/gap 18µ Cu** **Min. Track/gap 35µ Cu**	50µ 75µ 100µ	
Min. Hole size (laser) **Min. Hole size (Mechanical)**	100µ 200µ	
Min. Annularing (laser) **Min. Hole size (Mechanical)**	100µ 125µ	
Finish	ENIG, ENEPIG, I Ag, I Sn, OSP	
Outline tolerance (laser)	+/- 50µ	

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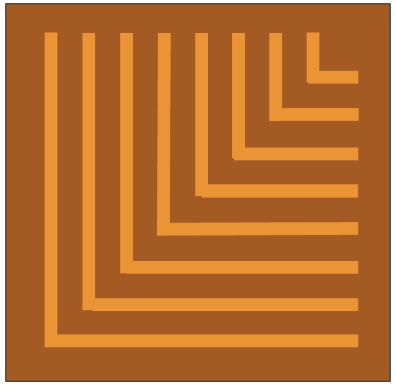
DEFINING EXCELLENCE

Design Rules Flex

OK

Only for static application



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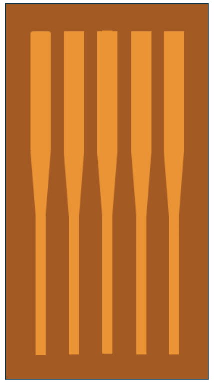

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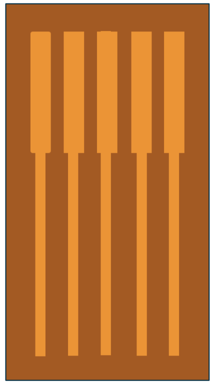

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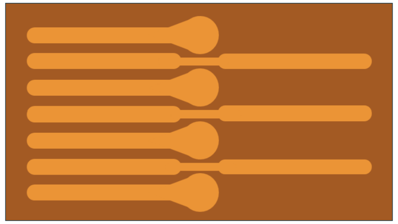

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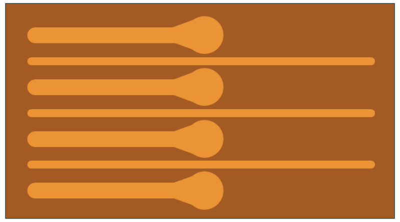

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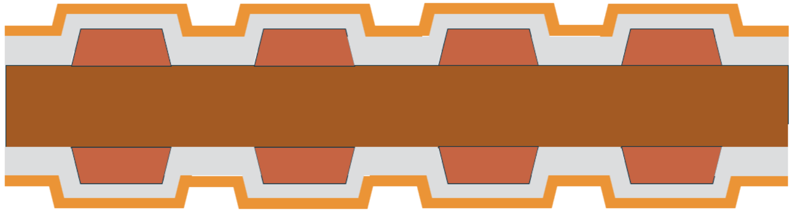

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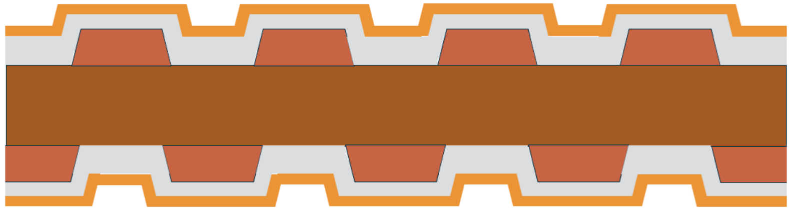
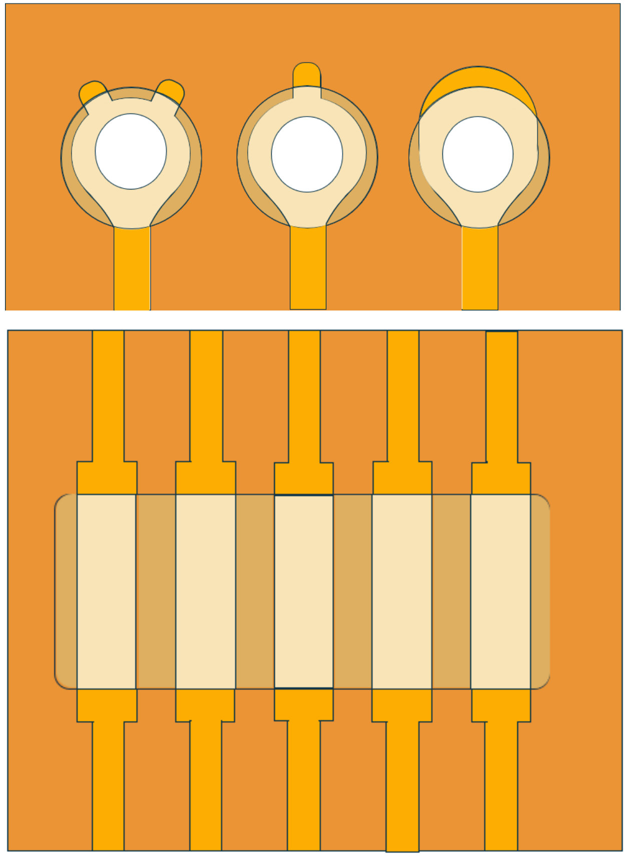


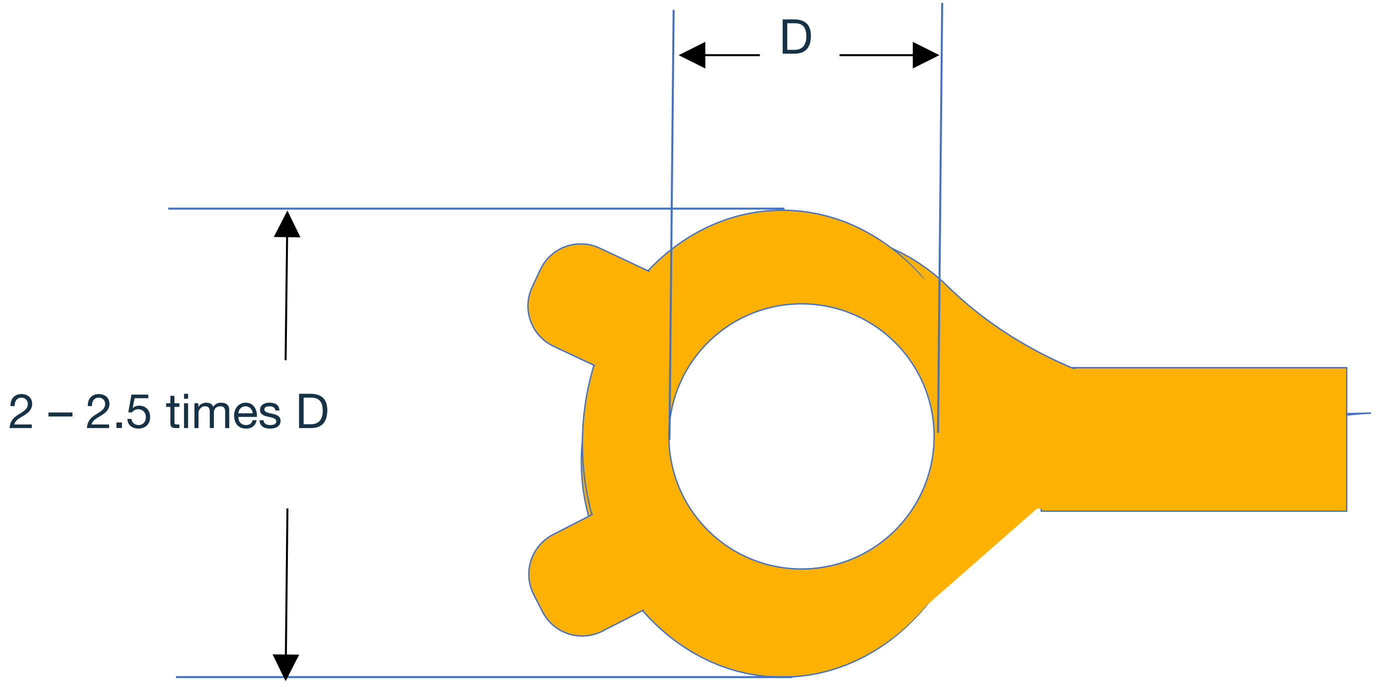
OK

Design Rules Flex

Coverlay opening



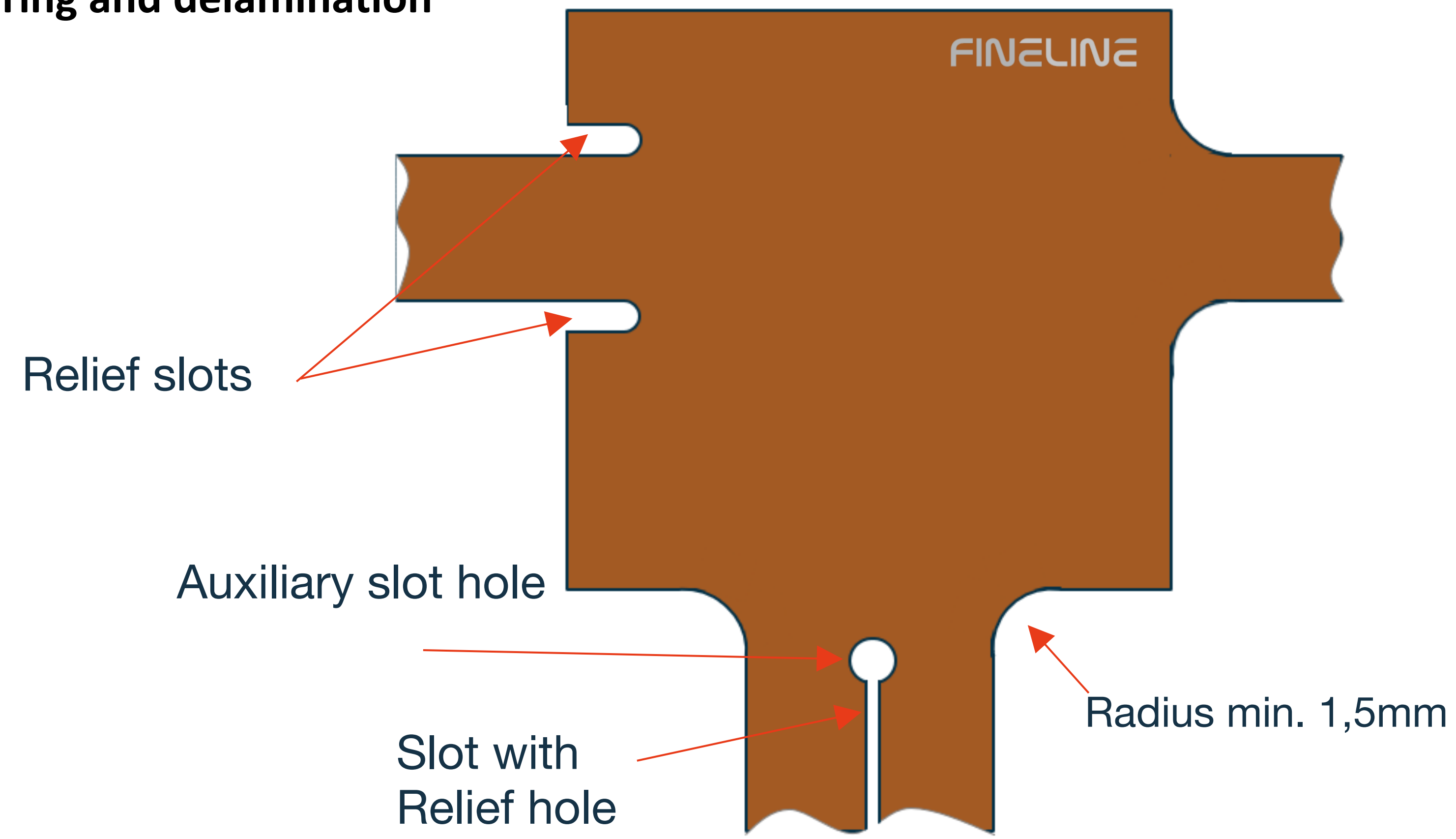
Coverlay opening pad =300um



Pads should be made 2-2.5 times the hole diameter.

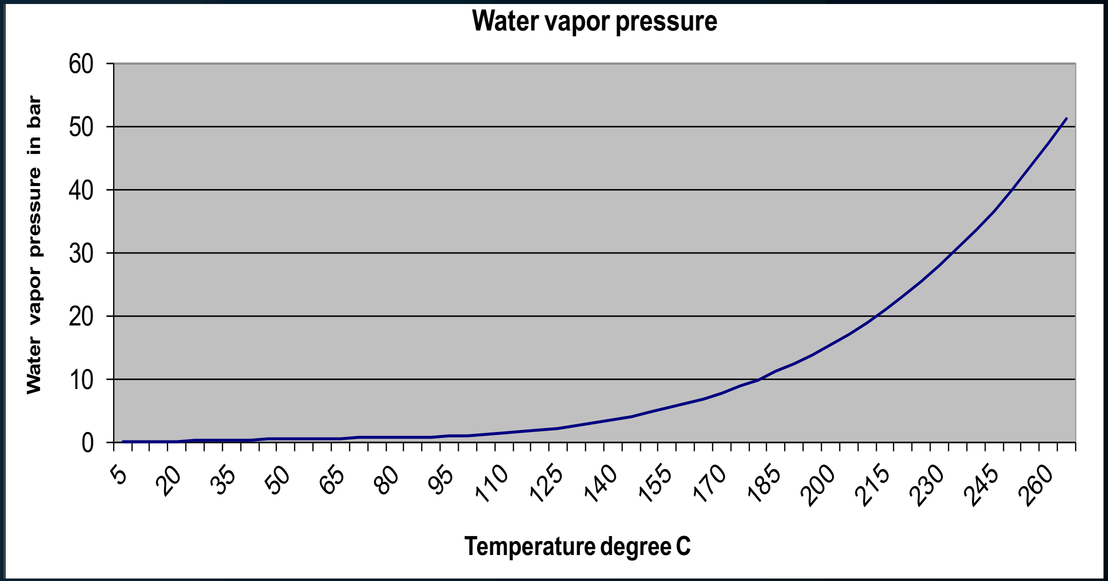
Design Rules Flex

Preventing tearing and delamination

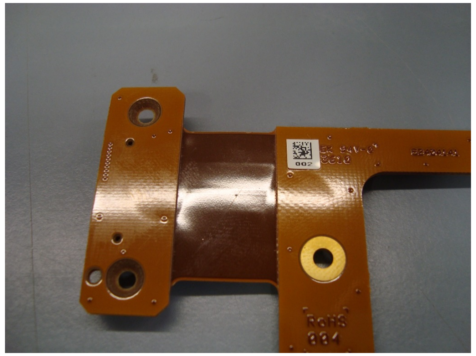


Handling

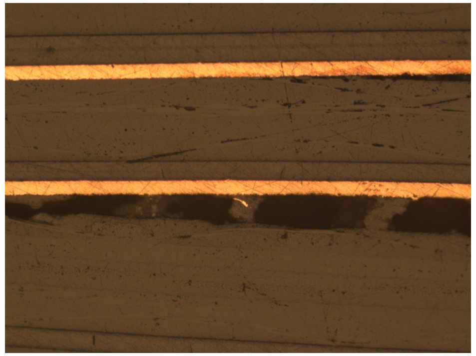
- Drying for assembly is essential
- If not dried properly
  - Delamination can occur
  - Thermal crack can occur
- Drying should be part of the assembly process
  - **12h@105C** is recommended for Rigid-Flex
  - **4h@105C** is recommended for Flex



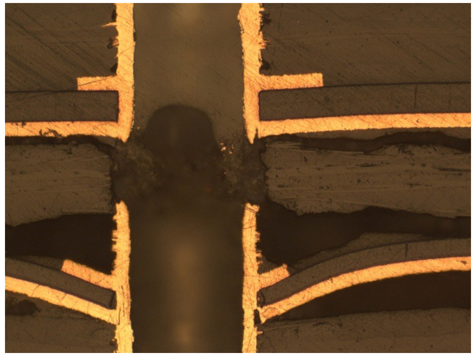
Delamination



Delamination



Delamination



Thermal crack

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