

1 机械性能及加工规范 Mechanical property and specification

1.1 未注公差标准采用: no marked tolerance standard adopted

默认未注公差, 受折弯或冲压成型影响的尺寸建议按照 GB/T 15055-m 执行, 未注形位公差按照 GB/T 13916-2013-m 执行, 孔间距和加工尺寸按照 GB/T 1804-c 执行。

Affected by bending or stamping molding, default no marked tolerance is according to GB/T15055-m, the other is based on GB/T 1804-c, the purchaser also can adapt their own no marked tolerance ,but it's not above GB/T 1804-c.

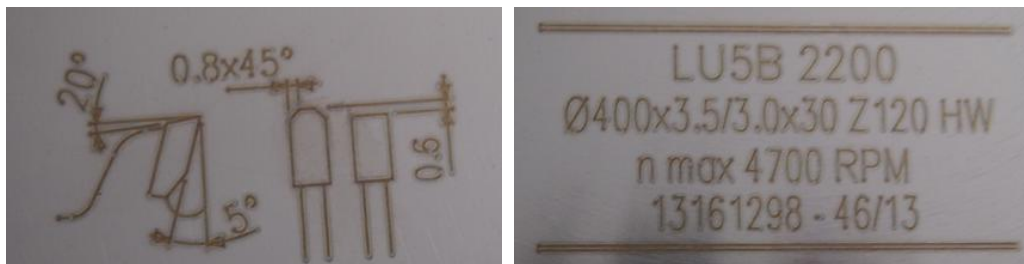
1.2 裁切加工方式 Cutting method

1.2.1 锯切 Cutting

可参照铝型材切断工艺, 圆锯推荐采用梯平齿锯片, 以保证断面锯切质量, 避免端头粘铝现象。在使用高速锯时, 最好使用乳化液或皂化液冷却锯片, 因为铝的加工过程中容易出现粘锯现象, 影响端面质量。

Technology of cutting process for AL section bar can be as reference. The TCG blade is recommended for circular saw to avoid Al-adhesion at the end. When high-speed saw is applied, the emulsion or saponification liquid shall be used to cool the blade, as the property of AL is sticky and AL melting point is low, which could make inferior quality on end-face.

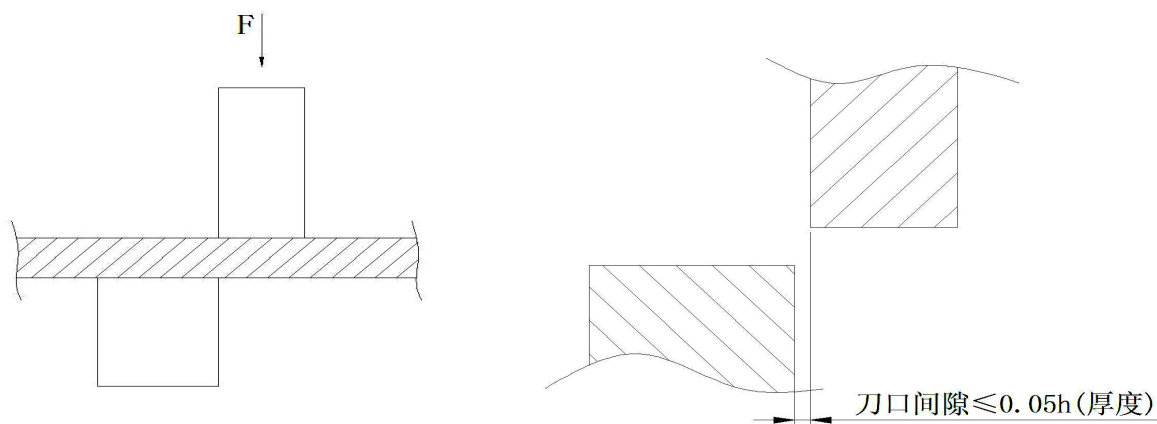
推荐梯平齿锯片参数如下: recommended ladder flat tooth saw blade parameters are as follows:



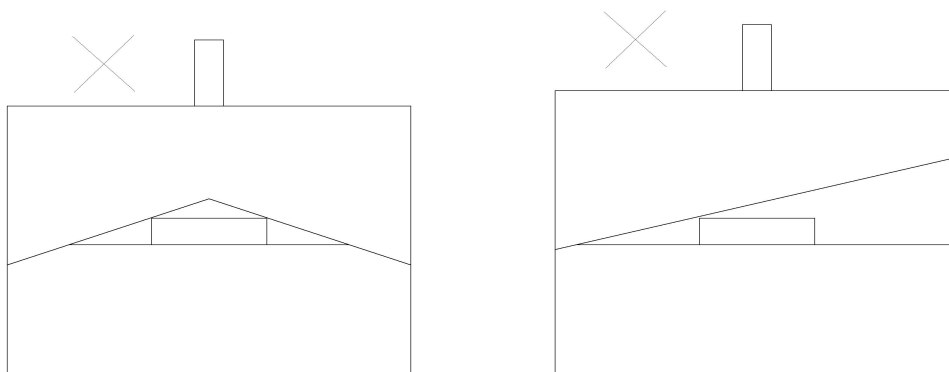
1.2.2 冲切 Die Cutting

1.2.2.1.1 在冲切加工中要调整好模具间隙，刀刃间隙应不大于 $0.05h$ （厚度） mm，刀刃要锋利，否则容易对铜铝结合层造成损伤。间隙配合如下图所示：

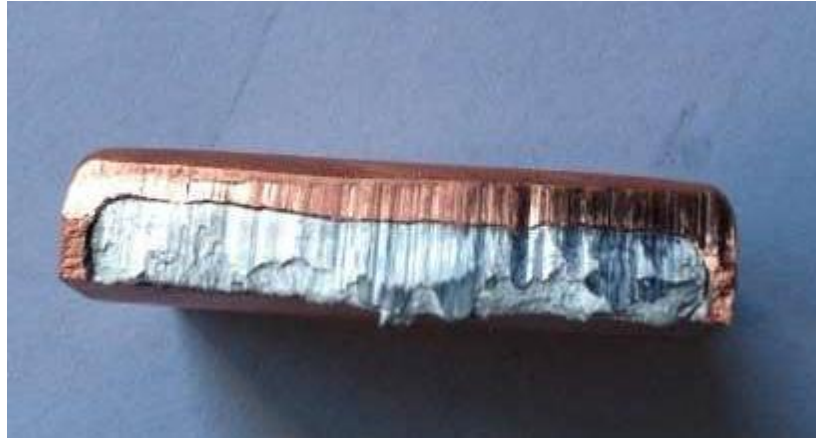
Check and adjust the gap of die, its blade clearance should be less than $0.05h$ (thickness) mm, keep sharp edge, otherwise the bonding layer of Cu and Al could be damaged. Clearance fit showed as below:



1.2.2.2 不允许使用的冲切方式如下 Prohibited as showed



1.2.2.3 当冲切加工模具间隙过大或者刀刃钝化，冲切的结果如下图所示：（图示并不是铜铝复合排分层，而是由于冲切模具间隙过大导致的） when the clearance between die cutting is too large or the blade is passivation, its result is as follow (showed in the picture is not layered between Cu and Al, but due to die cutting clearance is too large).



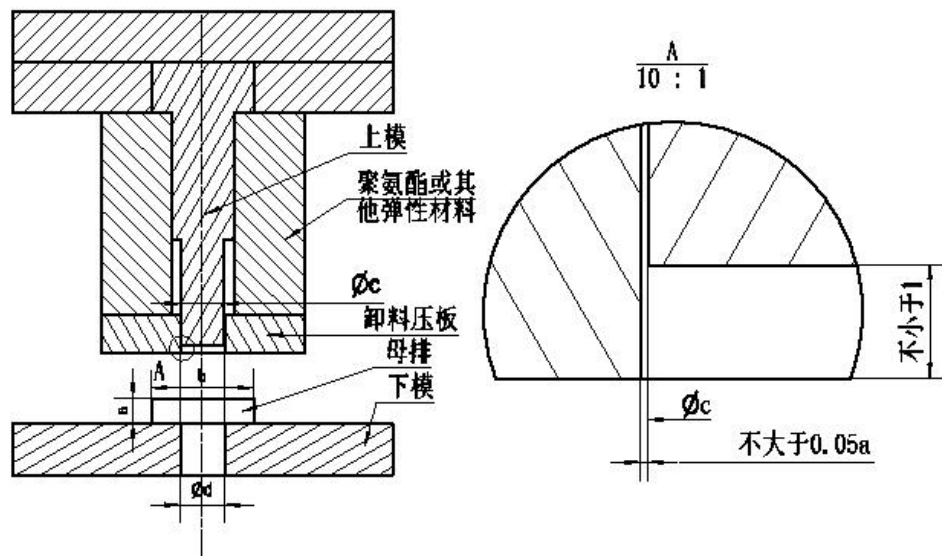
1.3 孔加工方式 Hole machining method

1.3.1 冲孔 Punching

冲孔模具间隙应满足凸模和凹模的单边间隙不大于 $0.05h$ （厚度）mm，避免间隙过大对铜铝结合层造成破坏，请参考下图：

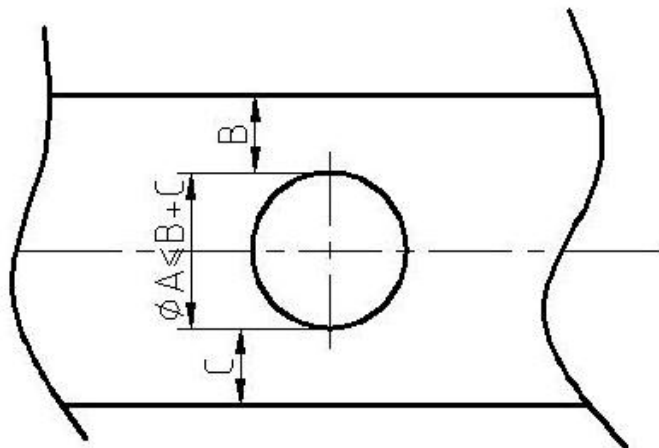
In punching unit, die gap shall be adjusted according to the requirements of CCA busbar, the unilateral clearance of convex and concave die should be not more than 0.05mm, the stripping device for die with tightening mechanism is necessary, especially for multiple-hole and U-shaped hole machining, if the gap is too large, it could damage the bonding layer between Cu and AL when punching.

In station busbar processing machine, not only to adjust the die gap, but also to keep coaxiality of convex and concave die when in close running in case partial axis thrust occurs. Picture is as follow:



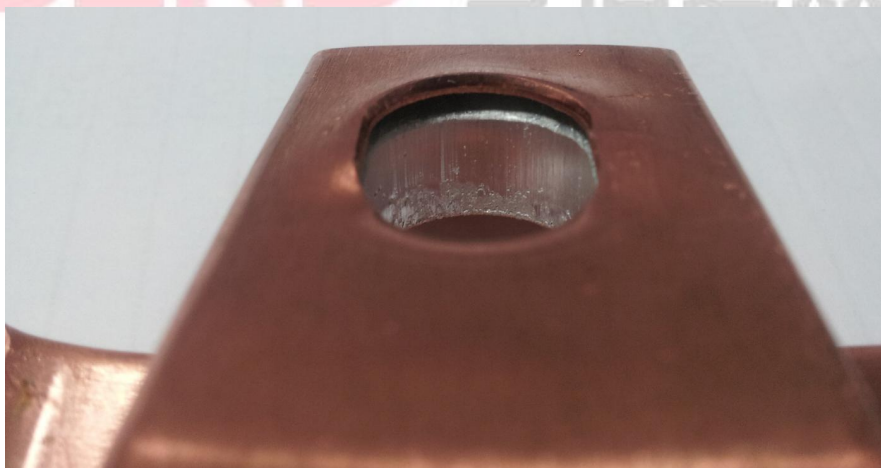
1.3.1.1 冲头直径 A 选择应满足 $\Phi A \leq B + C$, 冲头要有卸料压板详细如下图所示

Punch diameter should be $\Phi A \leq B + C$, it must have die pressure plate, as shown below in detail:



4.3.1.3 模具上模必须要有卸料压板，否则脱料时会对上表面结合层造成破坏，如下图：

if there isn't discharge pressure plate on the punch head, it will damage the surface layer as follow.



1.3.2 钻孔 Drilling

铜铝复合排钻孔时，需确保钻头锋利，钻头接近底面铜层时，应适当放慢进给速度，避免挤压力过大，在孔周围形成毛刺甚至破坏铜铝结合层，另需注意下面应装有垫板，避免悬空对铜铝结合层造成破坏。

a) 推荐钻头锥度 135° - 140° ;

b) 钻孔时开启切削液。

When drilling, keep the speed of sharp bit to forward, when near the bottom layer of copper, the drilling speed should be lower in case that the excessive operating pressure will result in burrs around the hole and even damage the bonding layer of CCA bimetal. A underlay pad should be used and no space is allowed:

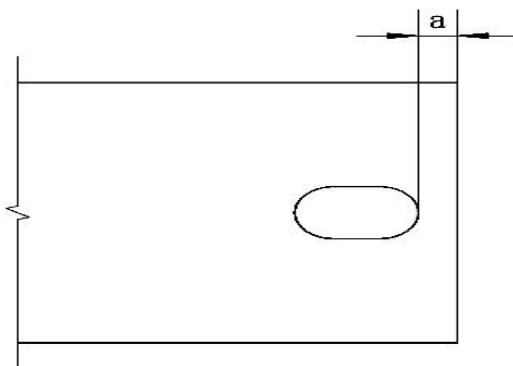
Recommended:

a) Bit taper 135° — 140° ;

b) Cutting fluid should be applied when drilling.

4.3.3 冲孔位置距离端面太近会造成端面材料凸起，设计时应保证 $a \geq$ 厚度；如果是涨铆螺母底孔，应保证 $a \geq$ 厚度+5mm，否则在涨铆时容易造成已电镀的端面电镀层破裂，请参考下图：

Punching position shouldn't be close to the head face, otherwise, the material will be raised, when designed, the distance "a" should be more than thickness; if it's a bottom hole by riveting nut, the distance "a" should be more than thickness+5mm, otherwise, the electroplating layer will be bursted after riveting nuts.



1.4 弯曲 Bending

1.4.1 立弯(厚度方向)折弯半径 90° 尺寸应参考下表规定。

B -side (thickness direction) with bending radius refer to table when bending angle 90°

铜铝复合排折弯半径

单位：mm

Bending radius of CCA busbar

units:mm

标称尺寸 nomal dimensiona	推荐折弯半径 Recommend bending radiusmm
h≤5	h
h=6	6、8、10
h=8	8、10、15
h=10	10、12、15
h=12	15、20

4.4.1.1 折弯半径不符合标准时容易出现铜层分裂、褶皱等问题，如下图

If bending radius doesn't conform to standard ,it's easy to have copper layer division and fold as follows.



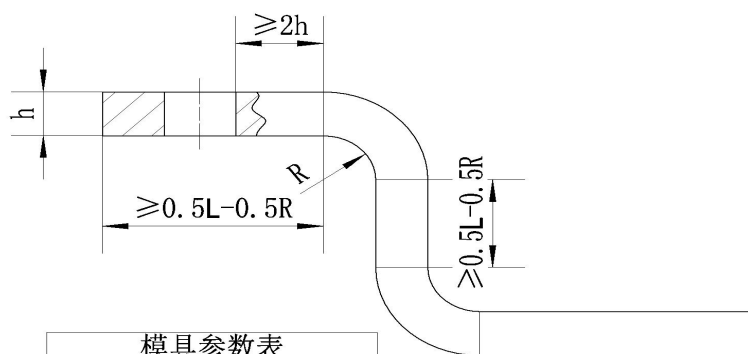
1.4.2 平弯（宽度方向）折弯半径 R 值应 2 倍以上 b 值（随 b 值增大倍数也增大），由于侧弯尺寸公差相对较大(参照 GBT15055-m 表中厚度值相应替换为宽度，公差值按相应倍数放大)，由于实际应用极少，不推荐采用，如需采用侧折弯尽量与加工单位协商使用现有模具。

Side bending radius R should be 2 times above than b (Multiples increases with the b increases), because of lateral bending dimension tolerance is a little large(reference GB/T15055-m), it's used very small in actual application and not recommended, if it needs to be used, you could contact with supplier using the existing die.

1.4.3 折弯设计注意事项（孔拉伸） **Notes for Bending Design (elongated hole)**

4.4.3.1 由于折弯工艺限制，在设计过程中应保证折弯两侧直线段的尺寸 $\geq 0.5L-0.5R$ （特殊情况可协商定做模具），孔边距折弯切线距离应 $\geq 2h$ ，避免距离过近产生的孔拉伸问题。（孔拉伤问题可以折弯后再加工孔进行避免，但加工成本会增加，所以应尽量避免。）参见下图：

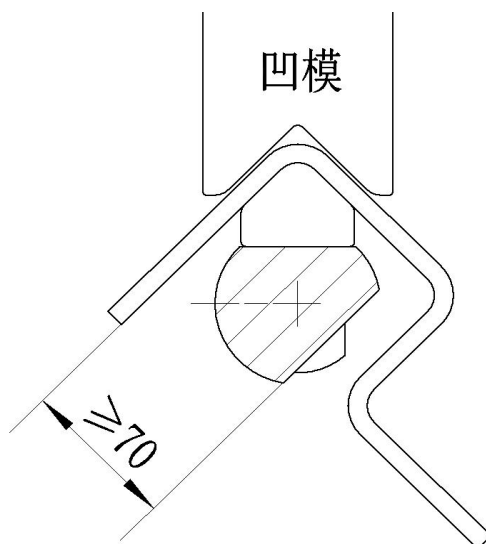
The linear distance should be more than $0.5L-0.5R$ (negotiable under special condition) between two bends if there are two bends above in the design. To avoid damaging elongated hole, it could be made after bending as an option though the processing cost will be increased.



排厚	L
≤6	60
8	85
10	95
12	120

1)满足常规折弯的加工尺寸以及防止孔的变形 Meet the conventional bending processing size and prevents deformation of the hole.

4.4.3.2 特殊工件折弯应考虑模具干涉问题。参见下图:



2)注意模具干涉，特殊情况尺寸限制可根据客户要求定做。Pay attention to the interference in the mould, the size of the special circumstances limit can be customized according to customer's requirements.

注：以上干涉参考数据适用于 GJCNC-BB-30-2.0 机型。

Note:above interference parameters use to GJCNC-BB-30-2.0 machine type.

4.4.4 折弯加工工艺注意事项: attention about bending processing

1)相同厚度的复合排尽量保证折弯半径相同,凸模半径凹模跨度尺寸不变,否则容易造成折弯系数不稳定,从而导致折弯误差变大;

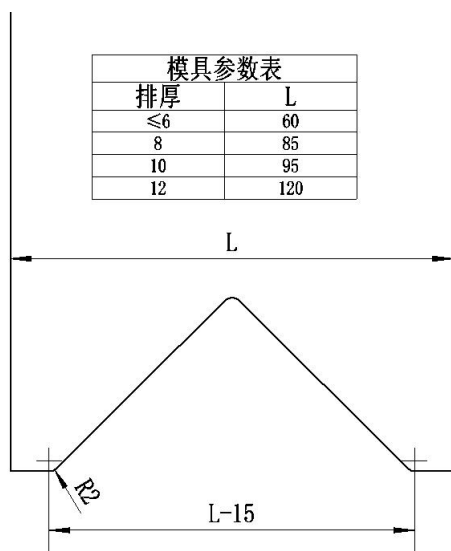
2)遵循复合排厚度越大凹模跨度越大的折弯规律,折弯半径越大凹模跨度 L 越大的原则,否则容易造成压痕过大过深;但凹模跨度过大则易造成折弯形状不理想,以及折弯尺寸波动大(参考下表推荐模具);

3)推荐采用固定的折弯模具应对固定排厚的折弯,有利于保证折弯尺寸的稳定性。

1) The same thickness CCA busbar should have the same bending radius, keep the punch die radius and die span remain the same, otherwise, the bending coefficient will not be stable and cause to bending error too big.

2) Follow the law about the more thickness of CCA busbar, the greater of die span; the more bending radius, the greater die span L vaule. Otherwise, it's easy to cause indentation deeper; but if die span is much more, it's also easy to cause bending not ideal and as well as bending dimension.(reference die requirements as follow)

3) Recommended fixed bending die to bend fixed thickness of CCA busbar, it's benifit to keep stable of bending dimension.



1.5 压铆 Riveting

铜铝复合排的铜层厚度完全满足压铆螺母的安装要求，安装后母排表面无变形，孔内无残屑，安装前应去除孔表面毛刺，不允许倒角，以确保压铆强度，（压铆螺母的安装强度判定标准，以用螺栓反复拆装 10 次，压铆螺母无松动、母排外观无变化为合格，具体检测力矩参照表 5）。

The thickness of copper layer of CCA busbar can meet the installing requirements of riveting nut, it should be no surface distortion and no aluminum powder residue inside, pre- treatment of deburring is necessary before installation, but chamfering is not allowed, to guarantee the riveting intensity. (Installation strength criteria of riveting nut : disassemble and assemble repeatedly 10 times with bolt , no loose rivet nuts ,no surface changes in busbar , Riveting torque see Table 5).

表 5 铜铝复合排压铆螺母检测力矩值

单位：N.m

Table5: riveting nut test torque value of CCA busbar

units: N·m

压铆螺母规格	紧固力矩
S-M5-2-ZI	3
S-M6-2-ZI	8
S-M8-2-ZI	18
S-M10-2-ZI	30
S-M12-2-ZI	50