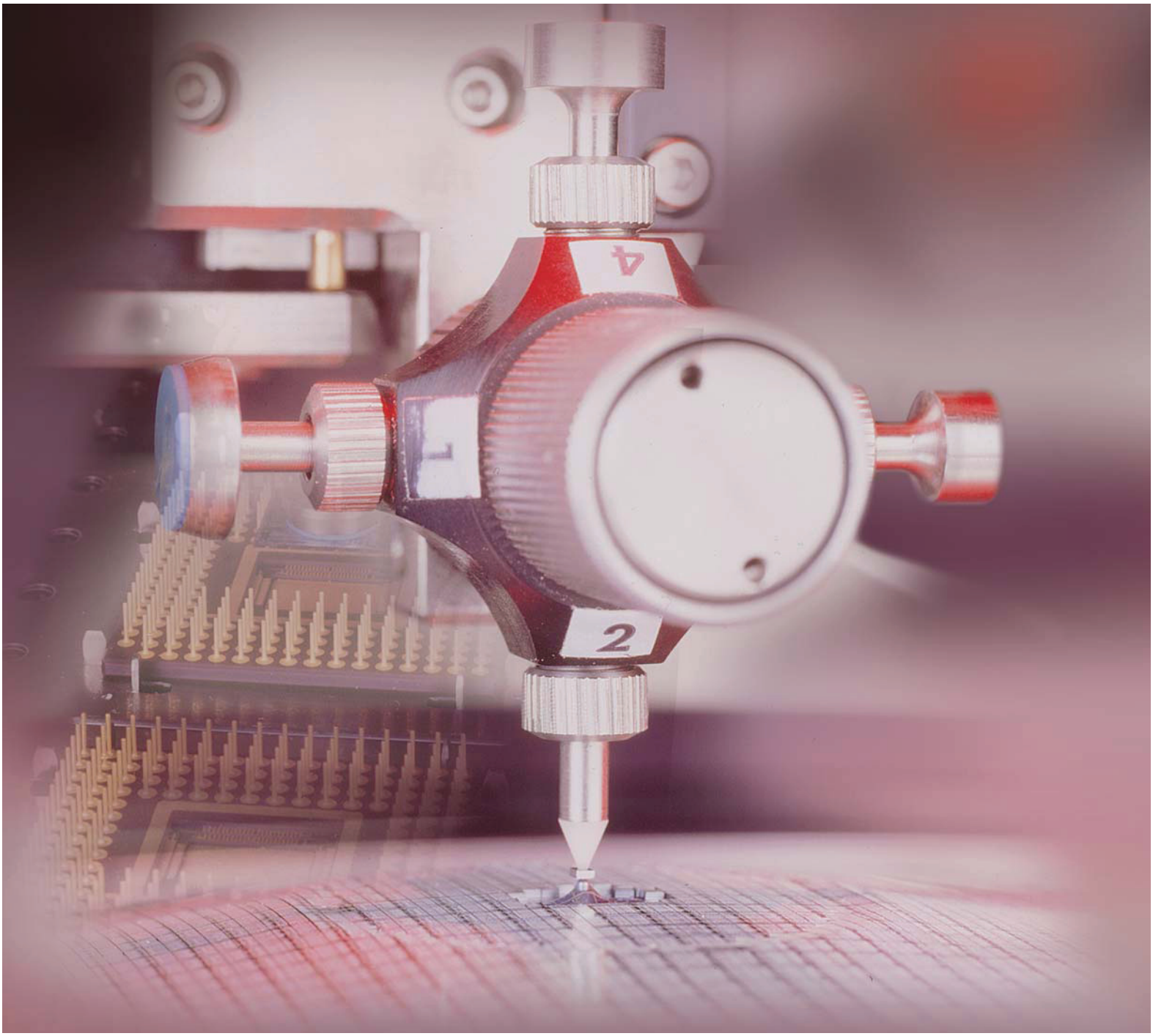
Die Bonding Tools Catalog



Micro Point Pro

Micro-Point Pro

Micro-Point Pro Ltd. is a leading customized solutions provider for the semiconductors and other micro-electronic devices assembly industry, with the strong foundation of Kulicke & Soffa Bonding Tools (Micro-Swiss). Micro Point Pro applies over 40 years of experience and expertise in the design and manufacturing of micro tools such as: Wire Bonding Wedges, Die Attach tools, Pick & Place tools, Nozzles and other customized tools for a broad range of applications, providing end-to-end solutions to a wide array of clients who are all market leaders in their respective fields. Our product offerings vary from standard designs to special solutions which address different packaging challenges and application conditions. Micro Point Pro is also a leading provider of customized solutions for Four Point Resistivity Probe Heads.

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INTRODUCTION

The die attach process takes place prior to wire bonding. The selected die is placed in a package and mechanically connected using either eutectic or adhesive die attach methods. Selecting the appropriate die bonding tools is an important decision that should be made during packaging process development and is in many cases the key to success in finding a robust, reliable and reproducible die attach process.

It is critical that the person selecting the die attach tool is knowledgeable in the particular area of IC assembly operation. This section of the catalog aims to provide a brief introduction to the die attach process and to provide necessary information for selecting the right die attach tool.

ADHESIVE DIE ATTACH

In the adhesive die attach process, an adhesive, such as epoxy, polyamide, or silver glass, is placed in the die placement area by a stamping tool or dispensing system. The die is then transferred by a die attach tool and placed under controlled pressure for the time necessary to achieve the appropriate bond.

Conductive Epoxy:

Main Features:

- ❒ Most economical process.
- ❒ Medium compressive thermal stresses in the die due to thermal expansion mismatch.
- ❒ High occurrence of voids.
- ❒ Low modules of elasticity.
- ❒ Poor thermal stability with medium heat dissipation.
- ❒ Does not need special die backside preparation.

Common Applications:

- Plastic
- IC Packages
- Hybrids
- PGA
- PDiP

In most cases, the pick up tool face should be smaller than the die to ensure that surplus of the adhesive paste does not come in contact with the tool face. In cases where the die is thick enough to ensure that no paste touches the tool, the tool face dimensions can be larger than the die's.

Silver Glass Pastes:

Main Features:

- ❒ Medium cost process.
- ❒ Low to Medium compressive thermal stresses in the die due to thermal expansion mismatch.
- ❒ No occurrence of voids.
- ❒ Low modules of elasticity.
- ❒ High thermal stability with high heat dissipation.
- ❒ Does not need special backside die preparation.

Common Applications:

- Ceramic Packages.
- LSI / VLSI die attach in cerdips & side braze.
- Lower expansion metal packages.
- Pin Grid Array chip carrier.
- Hermetic hybrid packages.

The bonding of silver-leaded glass is chemical in nature and is obtained by reaction of the glass in the paste with the die backside and the substrate. After die placement, the silver glass adhesive is dried and then heated to 430°C to burn out the remaining organic components and is left with molten glass to wet the back of the die and package.

HIGH TEMP DIE ATTACH

Eutectic Die Attach

This is the most stable die bonding process and it offers excellent thermal conductivity. The bonding process is usually applicable to dies smaller than 400mil. Since in most cases scrubbing is needed a Die Collet is required, since only a Die Collet has sufficient grip on the die and permits scrubbing. The bonding tool should also be able to sustain high temperatures.

Main Process Features:

- ❒ High temperature process (up to 400°C approximately).
- ❒ Very reliable die bonding process.
- ❒ High Modulus of Elasticity.
- ❒ High Thermal Dissipation.
- ❒ High cost process.
- ❒ Main disadvantage is the likelihood of die cracking due to die stresses generated from thermal mismatch between the die, the gold preform and package.

Common Applications:

- ❒ Power devices.
- ❒ Military applications.
- ❒ Very high reliability demands.

The combined high temperature and scrubbing operation requires a tool that on one hand will have sufficient grip on the die and on the other hand will have high temperature endurance, hence, a Die Collet is compatible with the application.

FLIP CHIP

There are several different Flip Chip processes, which consist of many different types of die attach methods such as C4.
The fundamental properties required from Flip Chip processes are accuracy and conductivity.

Main Process Features:

- ❒ Very reliable die bonding process.
- ❒ High Modulus of Elasticity.
- ❒ High cost process.
- ❒ High Planarity requirements.
- ❒ High Placement Accuracy.
- ❒ Low Surface Area.
- ❒ High Vacuum Area.
- ❒ Compliance with process continuity.

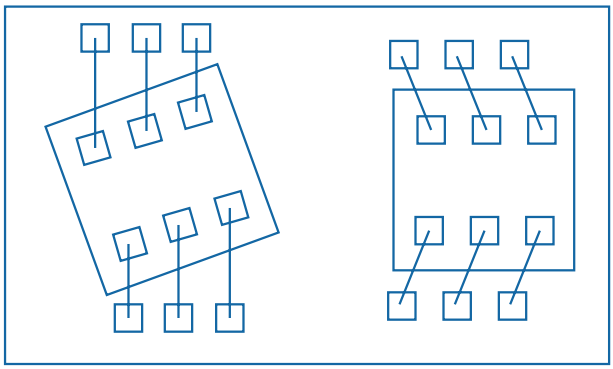
The combined process of high precision and high positioning accuracy forces the die attach tool to have high perpendicularity.
Die Collet is more compatible with this application than a Pick Up tool.

DIE COLLETS vs. FLAT FACE PICK UP TOOLS

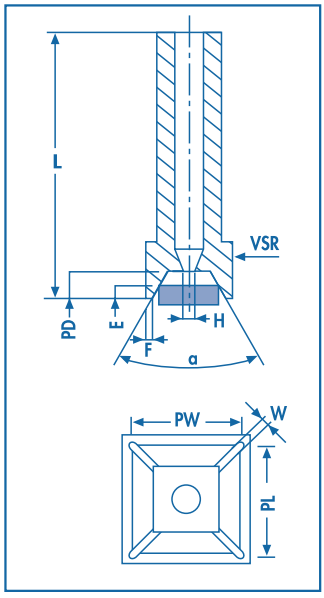
The decision whether to use a Die Collet or a Pick Up tool is crucial to the success of the die bonding process. The following is a short summary of the main guidelines to consider when a tool selection is required:

Die Collet:

- When positioning accuracy of the die is critical (die position is precisely defined and not affected by picking positioning errors or die shifts during bonding).
- Fine Pitch applications where any error in the die placement reduces the actual pitch between wires.

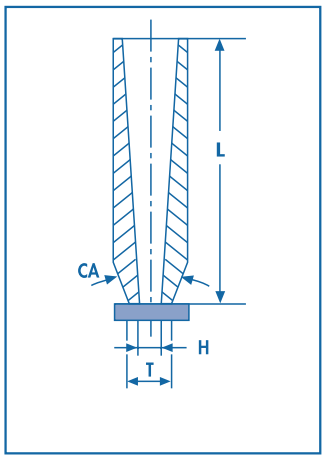


- When minimum contact with the die is required, i.e. no contact between the die's face and the attachment tool.
- When a strong grip is required, especially in the eutectic die bonding where scrubbing is necessary.



Flat Face Pick Up tool:

- When chipping prevention is essential.
- In adhesive die attach processes, in which minimum die grip is not a fundamental process constraint.
- In processes where a full contact between the Die and the tool is allowed.



PYRAMIDAL DIE COLLET DESIGN CONSIDERATIONS

The internal dimensions of the inverted pyramid ensure that part of the die thickness will be engaged within the Die Collet pocket for secure placement of the die while the other part will protrude out of the collet for optimum clearance for Eutectic (preform) or Epoxy attachment. All Die Collets are designed according to the picking method, which ensures that the tool tip does not come in contact with the die surface.

Micro-Swiss Die Collets are made for use in all types of die bonding machines.

When deciding on a Die Collet the following elements should be considered:

1. Die Engagement:

- The usual die engagement for a die with less then 10 mil of inch thickness is equal to half of the die thickness.
- For thicker dies, the die engagement is 5 mil of an inch.
- Die engagement can be modified for special applications.

2. Pocket Angle:

The pocket angle affects both the die placement accuracy and the magnitude of the forces exerted by the collet on the die edges.

Micro-Swiss standard pocket angle is 90°.

Higher pocket angles are optional and are recommended when the reduction of the exerted forces is needed. On the other hand, they reduce the positioning accuracy of the die.

3. Corner relief:

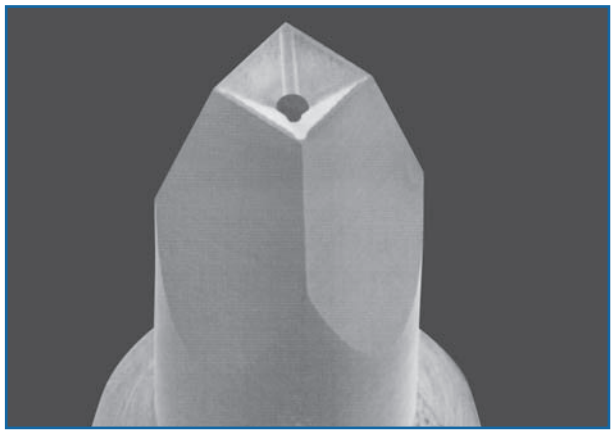
The inverted pyramid cavity in Micro-Swiss Die Collets is obtained by very precise Electro Discharge Machining. The resulting corners of the inverted pyramid have a very small radius.

In situations where corner chipping is a critical factor, **I**nternal **C**orner **R**elief (ICR) or **E**xternal **C**orner **R**elief (ECR) should be used.

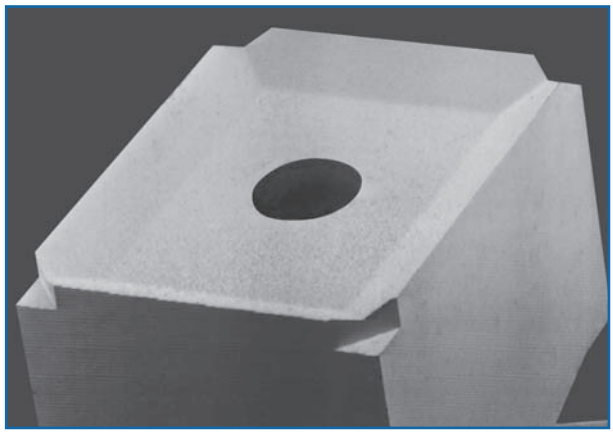
ICR is recommended for die smaller than 100 mil.

ECR is recommended for die greater than 100 mil.

In some cases very small dies (i.e. those less than 20 mil) require no corner relief.



Die Collet with ICR

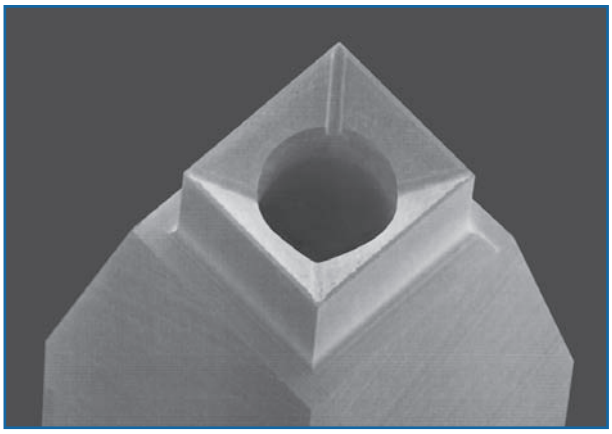


Die Collet with ECR

4. Vertical Relief:

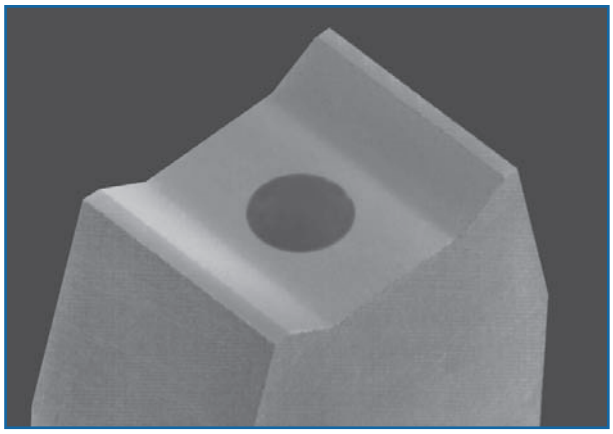
Vertical Relief is used in cases where there is a small clearance between the die and the components or next die which may be placed around it. The standard vertical relief height is .0150".

Higher Vertical Relief is optional.



5. Open Pocket:

When the clearance between the die and other objects at the bonding site is limited, an open pocket Die Collet can be used. When using an open pocket Die Collet the clearance between the die and the neighboring items on the substrate can be almost nil on two sides of the die. The main disadvantage of open Die Collets is that during the bonding process the die may move in the direction of the open collets. Therefore, whenever possible, Vertical Relief would be preferable.



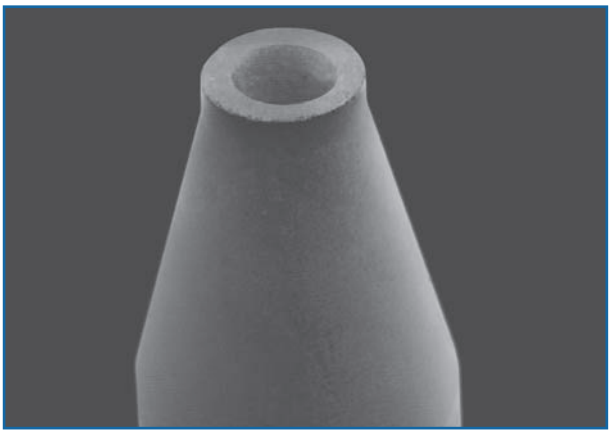
FLAT FACE PICK UP TOOLS DESIGN CONSIDERATIONS

1. Tip Dimension Considerations:

In general (mostly in epoxy bonding) the tool's size must be smaller than the die size.

In cases where the tool tip dimensions exceeds the die dimensions, glue surplus might come in contact with the tool face during the die bonding operation. Thus the "next" die attachment is preformed with a contaminated tool, and damage could be caused to the die.

Tool Tip dimensions (80% of the die size) are recommended to be large enough so a concentration of loads on a small die area is prevented and the die is not damaged.



2. Vacuum Hole Considerations:

The diameter of the vacuum hole should be big enough to generate a vacuum lifting force.

On the other hand, if the vacuum hole is too large, not enough surface area will be left, and the distribution of the forces on the die surface will be affected.

3. Material Considerations:

Pick Up tools are made of a variety of materials, Metalic and Non Metalic.

Metallic materials:

- Mainly the hardest Tungsten Carbide (WC)
- Stainless Steel

Non Metallic materials:

- Vespel
- Torlon
- Ceramic

Pick Up Tools Material Table

	Name	Hardness	Polished Surface	Operation Temp.	Remarks
Non Metallic Materials	Vespel	Low	Possible	Up to 480°C	Very High Temp.
	Torlon	Low	Possible	Up to 260°C	Very High Temp.
Metallic Materials	Stainless Steel	Medium	Partly	Very High Temp.	Used for sample only.
	Tungsten Carbide	Very Hard	Can be mirror polished	Very High Temp.	Long Life Tools

DIE COLLET - PART NUMBERING SYSTEM

4YY MM - X WWW - LLL - TTT

Type:
406 - Die Collet
407 - Open Collet

Model:

07	34
10	44
18	54
19	64
20	

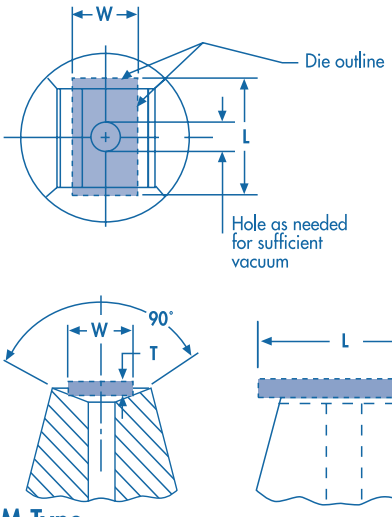
Tip Options:
0 - Basic
1 - ICR
2 - ICR + VF
3 - ECR
4 - ECR + VF
5 - VF

Die Thickness
(mil of Inch)

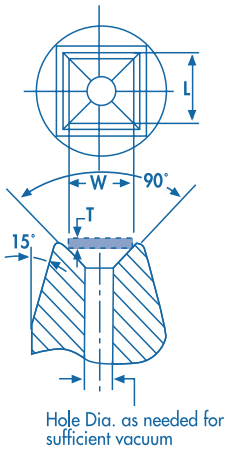
Die Length
(mil of Inch)

Die Width
(mil of Inch)

Example:
Bonder Type: K&S 6495
Die Size: .050" x .050" x .010"
Die Collet with ICR+VF
P/N 40607-2050-050-010



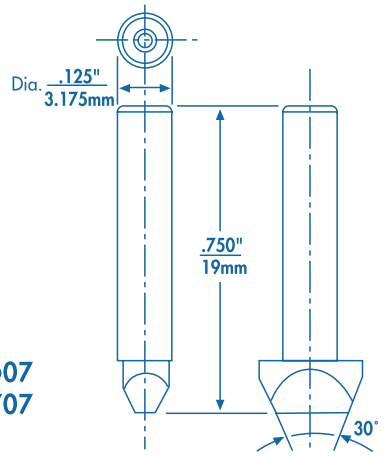
407MM Type



406MM Type

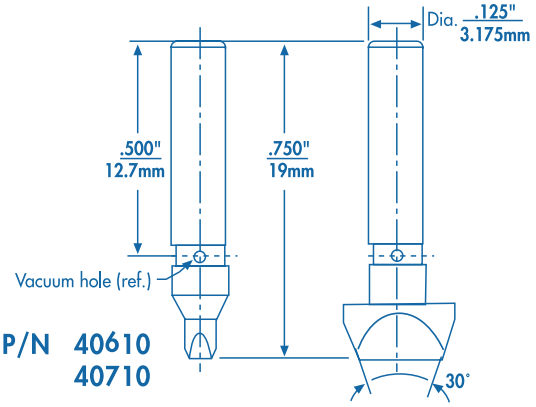
DIE COLLET MODELS

K&S 6300, 649X, 6900 and ASM Bonders



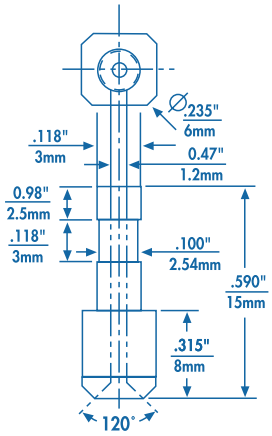
P/N 40607
40707

K&S 643 Bonder



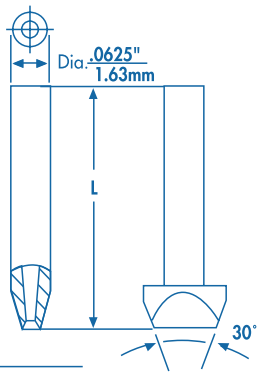
P/N 40610
40710

Shinkawa Bonder



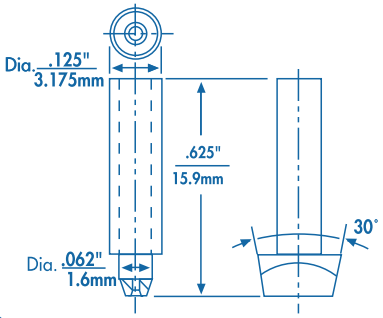
P/N 40620
40720

ESEC, Hughes and West Bond 7200A Bonders



P/N 40634 40734	L= .315" (ESEC)
P/N 40644 40744	L= .437" (Hughes)
P/N 40654 40754	L= .625" (West Bond)
P/N 40664 40764	L= .828"

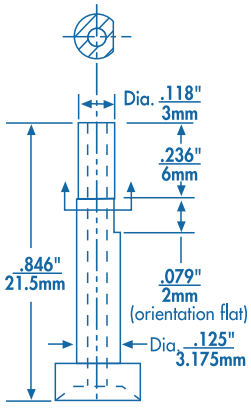
Foton, Elmont and Mullen 8-140-06 Bonders



P/N 40618
40718

Body 303 stn. stl.
Tip - Tungsten - Carbide

Alphasem Bonder



P/N 40619
40719

FLAT FACE PICK UP TOOLS - PART NUMBERING SYSTEM

4040 S - TTTT - HDα - H L C

Model

Shank OD:
0 -.0625"
1 -.1250"
(See Drawing 1)

Tip Diameter
As specified
(mil of Inch)
(See Detail "A")

Hole Diameters:
(mil of Inch)
(See Detail "A")

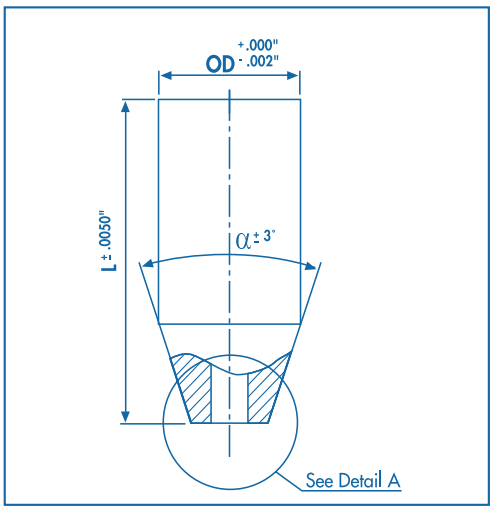
Configuration:
0 Round
1 Square
(See Detail "A")

Length:
1 - .315"
2 - .375"
3 - .437"
4 - .625"
5 - .750"
6 - .828"
7 - 1.00"
8 - .650"
(See Drawing 1)

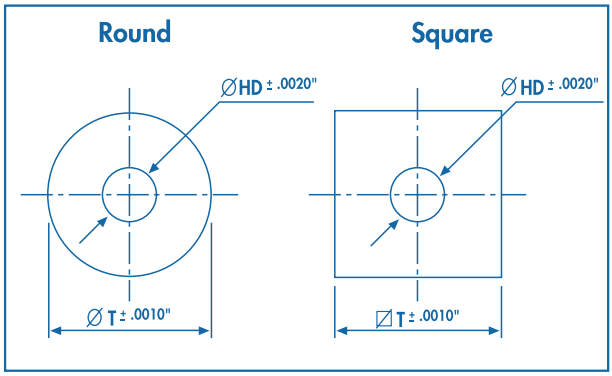
Example:
Shank Diameter: .1250"
Tip Diameter: .0140"
Hole Diameter: .0050"
Cone Angle: 30°
Material: Tungsten Carbide
Length: .750"
Configuration: Round
P/N 40401-0014-05N-150

Cone Angle:
C - 20°
N - 30°
V - Vertical (0°)
(See Drawing 1)

Material:
1 - WC (Tungsten Carbide)
3 - Ceramic
5 - Torlon
7 - Stainless Steel



Drawing 1



Detail "A"

46MMM - OODD - H O C - 000

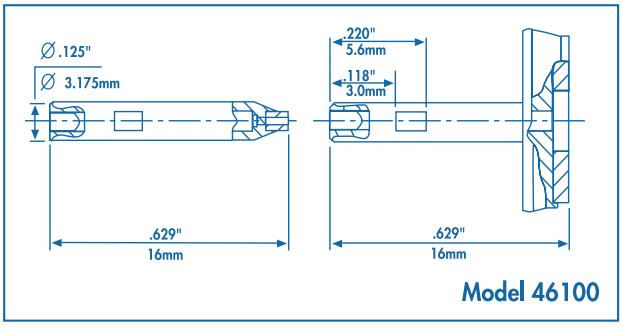
Model:
46100
46300
(See Drawing 1)

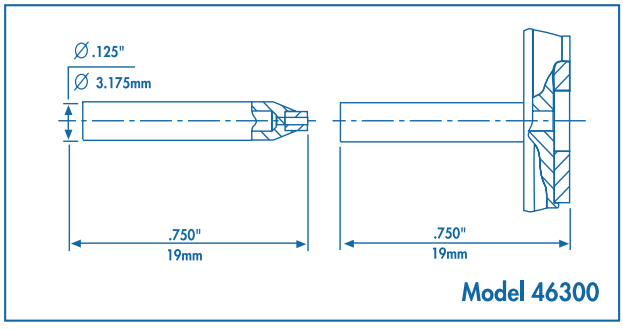
Face Diameter
(Choose Series
from Table 1&2)

Configuration:
0 - Round
1 - Square

Material:
8 - Vespel

Example:
Model: 46100
Face Diameter: .0811"
Material: Vespel
Standard Length: .750"
Configuration: Round
P/N 46100-0004-800-000





Drawing 1

TABLE FOR 46100 MODEL

Series	Tip Diameter
00	.0209"
01	.0300"
02	.0433"
03	.0610"
04	.0811"
05	.1209"
06	.1610"
07	.2012"
08	.2500"
09	.3000"
10	.3500"
11	.4000"

Table 1

TABLE FOR 46300 MODEL

Series	Tip Diameter
00	.060"
01	.100"
02	.200"
03	.300"
04	.400"

Table 2

40405 - CC RR - M L S - O OO

Model Description

Cone Angle (α):
10 - 10°
15 - 15°
20 - 20°
(See Drawing 1)

Tip Radius
(Tenths of mil Inch)

Material
1 - WC (Tungsten Carbide)

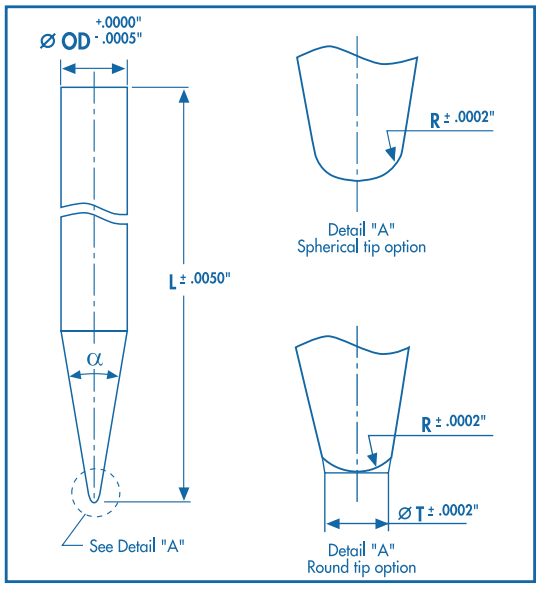
Length:
1 - .562"
2 - .590"
3 - .669"
4 - .709"
5 - .760"
6 - 1.250"
(See Drawing 1)

Shank Diameter:
1 - .0275"
2 - .0260"
(See Drawing 1)

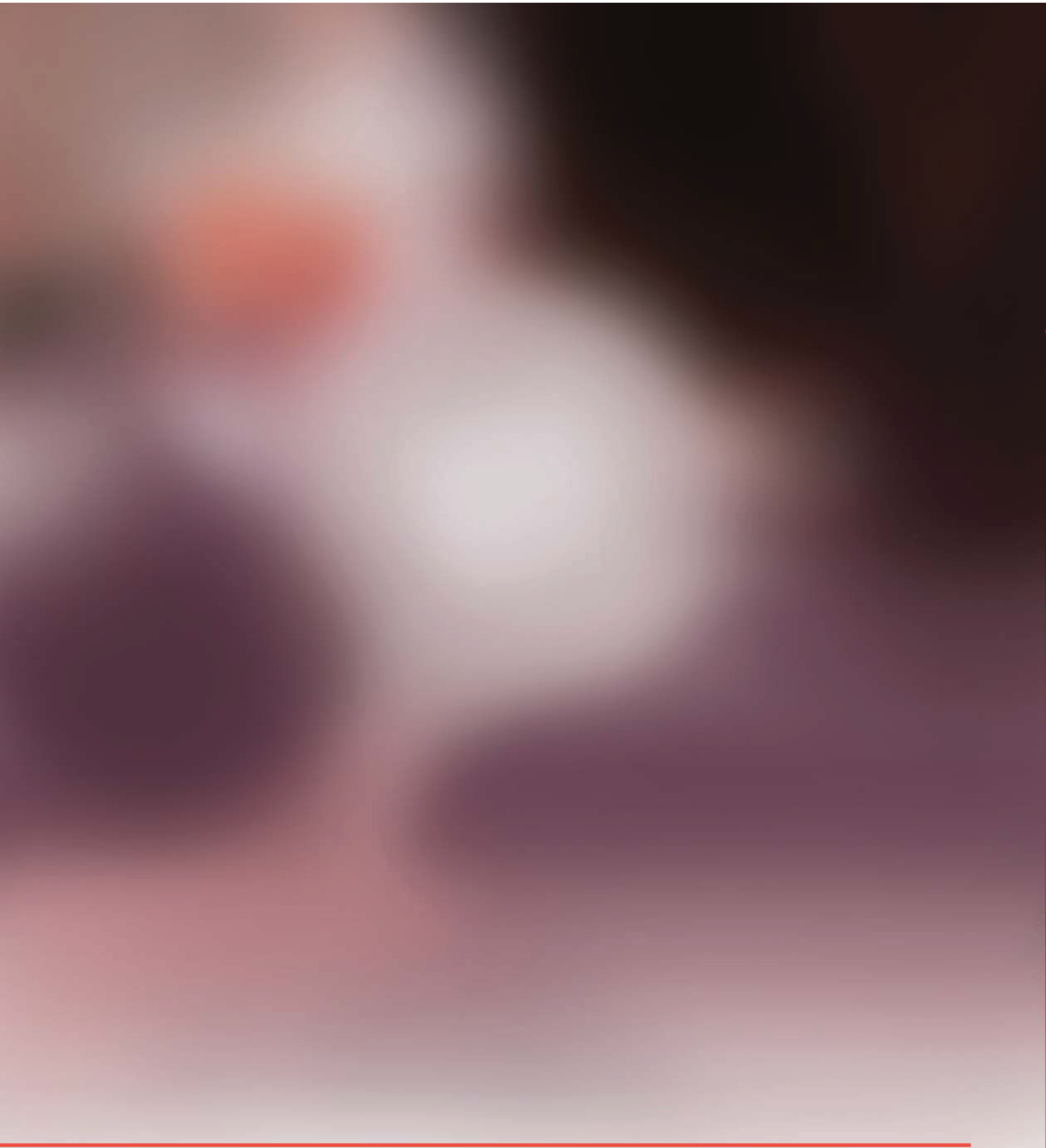
Tip Option:
0 - Round
1 - Flat
2 - Spherical
(See Detail "A")

Tip Diameter:
(Tenth of mil Inch)
For Round or Flat
Tip Option Only

Example:
Model: 40405
Cone Angle: 10°
Radius: .0008"
Material: Tungsten Carbide
Length: .709"
Tip Option: Spherical
Shank Diameter: .0275"
P/N 40405-1008-141-200



Drawing 1



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