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**METCAL**

*Precision Systems for the Electronics Bench*

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# BGA CSP

BGA & CSP Rework Systems.  
The comprehensive solution to array package rework.

**METCAL**  
*Precision Systems for the Electronics Bench*

## Metcal. Your quality assurance in Electronics Assembly Systems.

Over 50 years of experience in ongoing product development and manufacturing position Metcal as a leader in electronics assembly systems. Systems that assure our customers complete process control.

Keeping with our commitment to be on the leading edge of rapidly changing component technology, we now introduce our redesigned Metcal BGA and CSP array package rework systems.

These new models combine our extensive industry expertise with our long-established relationships with technology leaders in the computer, telecommunications and components industries.

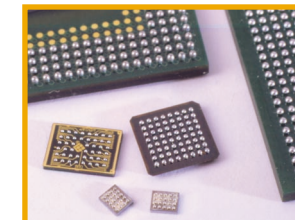
These enhanced systems offer greater ease-of-use, and are cost effective production systems with the flexibility to handle today's expanding range of components.



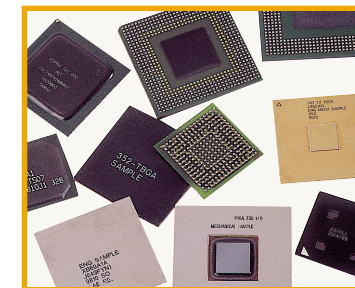
## What is an Array Package?

**BGA** Ball Grid Array indicates an array of solder balls, underneath the component, used to connect it to the circuit board, instead of peripheral leads as used with a QFP or PLCC.

This enables the space under the device to be used, allowing increased numbers of connections with reduced component sizes. BGAs come in different forms such as PBGA (plastic package), TBGA (tape carrier package) and CBGA (ceramic package).



These components are assembled using the normal surface mount process. However, some components "float" on eutectic solder balls, while other heavier components (such as the ceramics) are supported by non-melt solder balls. These factors may affect the subsequent rework process chosen.



**CSP** Chip Scale Package has been described as "a component whose overall size is no greater than 1.2 X the size of the silicon die inside the component." CSPs are generally smaller than BGAs and have a typical ball pitch of between 0.5 and 1mm.

These parts are increasingly common on products where space is at a premium and the ultimate volumes are expected to far exceed that of BGA. CSPs offer new challenges in terms of accurate placement and material deposition during rework.

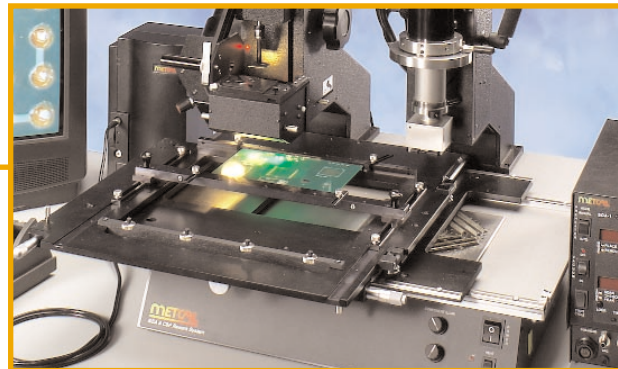
**Flip Chip** A bare silicon die that has solder bumps attached and is assembled face down onto a substrate. This package offers the smallest possible component size, with the fastest possible operating speeds. There are concerns to the protection of the die and thermal stability after attachment. Normally, these components are encapsulated or under-filled, making subsequent rework impossible.

Flip Chips are used predominantly in low-cost disposable consumer products or in high speed (above 500 MHz) computing applications.

# visionary

## Metcal BGA/CSP Rework Systems

The rework of an array package requires process control and repeatability, to replicate the original assembly thermal process. When reworking BGA, a greater level

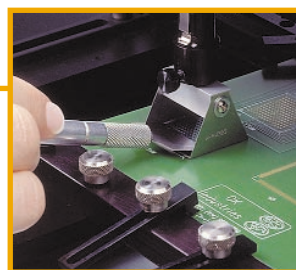


of process control is required to reduce the risk of a defect and to ensure the perfect result: right first time.

To enhance performance, the newly redesigned Metcal BGA and CSP Rework Systems have incorporated new features that facilitate easier use and improve process control.

- **Improved ergonomics and simplified controls** make using the system easy and natural for the operator.
- **Improved vision clarity** provides better control of component placement.
- **Larger pre-heater** provides increased power for thermally demanding boards.

**Metcal Vision System** The BGA-3590 and CSP-3500 both offer an integral vision system for accurate component and stencil alignment. The vision system utilizes a prism that allows the user to look simultaneously at the topside of the printed circuit board (PCB), and a superimposed image of the underside of the component.



Using micrometer adjustment, the images can be accurately aligned in the X, Y & Theta axis, prior to placement. The BGA 3590 incorporates a corner overlay mechanism to facilitate alignment on large components, while the CSP 3500 offers higher magnification and greater clarity for smaller components with reduced ball pitches.

The vision systems include facilities for either solder paste or flux application to the rework area — without the need to remove the board from the machine. Consistent solder paste deposits can be printed using the vision-mounted stencils that allow accurate alignment and co-planarity adjustment.

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**Dip Transfer** Flux dipping is a process pioneered by Metcal in conjunction with a British university and a major industrial partner. The process involves dipping the component into a known depth of gel flux, depositing an exact amount onto each solder ball. The process is quick, consistent, clean, and negates the need for cleaning after reflow. Both processes have proven successful, even on fine pitch CSP.

**Reflow Profiling** As with production reflow oven technology, both Metcal Rework Systems use low airflow forced convection heating. The Patented Micro Oven reflow head delivers temperature uniformity, assuring safe and simultaneous reflow of the component being removed — without disruption to adjacent parts.



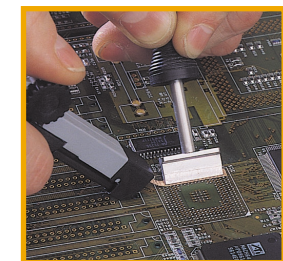
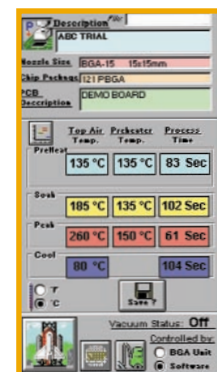
The systems are fitted with an under-board heater. The CSP version has a 1000W convection heater suitable for smaller PCBs, while the BGA version is fitted with a 1400W large area heater with the capacity to work with thermally demanding multi-layer boards. This eliminates problems associated with warped boards.

# innovation

**Windows Based Software** This interactive software precisely controls both heaters, making profile set up simple. Using closed loop feedback monitoring, the user-friendly software controls the four stages of the reflow profile: Preheat, Soak, Reflow and Cooling.

The board temperature can be monitored using the integrated flying thermocouple, and real time adjustments can be made to the times and temperatures — while the profile is running.

**Metcal Soldering System** To assist with pad cleaning and preparation, all units are supplied with a Metcal MX Direct Power Soldering System that reduces the risk of track and pad damage caused by overheating.



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# integration

## Integrated solutions for flux and paste applications

**Nozzles** There is a comprehensive range of standard reflow nozzles available to suit most common array packages. In addition, Metcal offers the flexibility of custom manufactured nozzles for unusual or odd shaped components, such as EMI shields and plastic surface mount connectors.

### BGA REFLOW NOZZLES

| PART NUMBER | INTERNAL DIMENSIONS IN MM      |
|-------------|--------------------------------|
| BGA-220-220 | 22mm x 22mm                    |
| BGA-228-228 | 22.8mm x 22.8mm                |
| BGA-252-291 | 25.2mm x 29.1mm                |
| BGA-276-276 | 27.6mm x 27.6mm                |
| BGA-315-315 | 31.5mm x 31.5mm                |
| BGA-380-380 | 38mm x 38mm                    |
| BGA-403-403 | 40.3mm x 40.3mm                |
| BGA-450-450 | 45mm x 45mm                    |
| BGA-490-490 | 49mm x 49mm                    |
| BGA-NA      | Nozzle adapter for FCR Nozzles |

### CSP NOZZLES

| PART NUMBER | INTERNAL DIMENSIONS IN MM |
|-------------|---------------------------|
| CSP-060-060 | 6mm x 6mm                 |
| CSP-077-095 | 7.7mm x 9.5mm             |
| CSP-080-080 | 8mm x 8mm                 |
| CSP-080-095 | 8mm x 9.5mm               |
| CSP-085-099 | 8.5mm x 9.9mm             |
| CSP-085-102 | 8.5mm x 10.2mm            |
| CSP-091-132 | 9.1mm x 13.2mm            |
| CSP-093-090 | 9.3mm x 9mm               |
| CSP-096-118 | 9.6mm x 11.8mm            |
| CSP-097-144 | 9.7mm x 14.4mm            |
| CSP-097-184 | 9.7mm x 18.4mm            |
| CSP-100-100 | 10mm x 10mm               |
| CSP-100-122 | 10mm x 12.2mm             |
| CSP-110-110 | 11mm x 11mm               |
| CSP-120-120 | 12mm x 12mm               |
| CSP-130-130 | 13mm x 13mm               |
| CSP-150-150 | 15mm x 15mm               |
| CSP-180-180 | 18mm x 18mm               |



**Stencils** The unique vision stencil-printing feature allows the user to perform accurate stencil alignment and co-planarity adjustments under high magnification, taking the guesswork out of single component solder-paste printing. The vision system can also be used for solder-paste print inspection.

Metcal can supply a wide range of standard and custom stencils to suit most ball & lead patterns. Please contact your local Metcal representative for details.

### STENCIL ACCESSORIES

| PART NUMBER | DESCRIPTION                  |
|-------------|------------------------------|
| BGA-SPAT-L  | BGA Spatula assortment large |
| BGA-SPAT-S  | BGA Spatula assortment small |
| CSP-SPAT    | CSP Spatula assortment       |
| QFP-SPAT    | QFP Spatula assortment       |
| 21149       | Co-Planar stencil adapter    |



**Dip Transfer Plates** Metcal dip transfer plate sets are available for QFP, BGA and CSP applications as listed below. All kits are supplied with a metal squeegee blade.

### DIP TRANSFER PLATES

| PART NUMBER | DESCRIPTION                                            |
|-------------|--------------------------------------------------------|
| DTP-BGA     | Set of 3 plates, apertures 28, 35 & 45mm, depth 0.012" |
| DTP-CSP     | Set of 3 plates, apertures 10, 16 & 21mm, depth 0.006" |
| DTP-QFP     | Set of 3 plates, apertures 30, 35 & 45mm, depth 0.012" |



**Training and Applications Engineering Support** Metcal offers expertise in process engineering and can provide solutions to your application problems via phone or on-site. In addition to our standard products, we also produce custom stencils, nozzles and other accessories to help you work with non-standard components and boards. Please contact your Metcal representative for more information.

# systems and specifications

## BGA-3590/CSP-3500 SYSTEMS AND SPECIFICATIONS

Standard units are supplied with a self-contained air pump providing easy installation and flexibility.

| PART NUMBERS | DESCRIPTION                                                                                                                         |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------|
| BGA-3591     | BGA rework system with high power under-board heater, split field vision system & monitor 115v NTSC                                 |
| BGA-3592     | BGA rework system with high power under-board heater, split field vision system & monitor 230v PAL (Contact Metcal for NTSC format) |
| CSP-3501     | CSP rework system with under-board heater, high magnification vision system & monitor 115v NTSC                                     |
| CSP-3502     | CSP rework system with under-board heater, high magnification vision system & monitor 230v PAL (Contact Metcal for NTSC format)     |

Please note: Monitor will be supplied locally and specification will vary

### SYSTEM INCLUDES:

|                      |                                                   |
|----------------------|---------------------------------------------------|
| MX-500S              | Metcal soldering system                           |
| SMTC-062             | Blade style desoldering tip                       |
| 19759                | Windows Software (RS232 connection lead supplied) |
| FS-24                | Footswitch                                        |
| 19984 & 21104        | Thermocouples (thick & fine gauge)                |
| 19782                | Adjustable centering nest BGA                     |
| 21077/21095/21137    | Vacuum pick up heads for placer (3 sizes)         |
| 19219                | Rubber vacuum cups (4 sizes)                      |
| 20066                | Calibration tooling set                           |
| 19993                | Component height adjustment block                 |
| 20534                | Squeegee blade holder                             |
| 21149                | Co-planar stencil adapter                         |
| 20092                | SVHS connection lead                              |
| BGA-BS               | Under board support rail                          |
| AC-CLAMPSET          | Set of board holding clamps (5 small & 5 large)   |
| Various              | Allen key sets for calibration adjustment         |
| CSP versions include | Extra magnification lenses (21097 & 21118)        |
| BGA/CSP/UG           | Flat mirror assembly                              |
| upgrade kit          | CSP vacuum pipette set (CSP-VAC)                  |
|                      | CSP Adjustable pick up nest (20987)               |
|                      | SMTC-1167 Mini hoof tip                           |

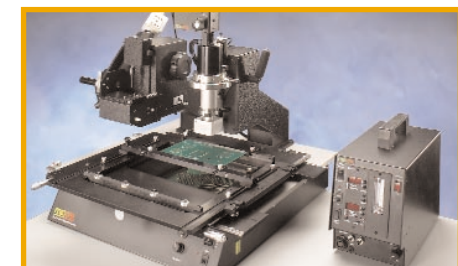
**Minimum Hardware Requirements** The following minimum PC specifications are required to run software: PC 486 or higher running Windows 95, 98, 2000 or NT; 8MB of memory space; 20MB Hard-disk; VGA screen; mouse; and a free RS232 com port.

## SPARE PARTS & ADDITIONAL ACCESSORIES

| PART NUMBERS  | DESCRIPTION                                              |
|---------------|----------------------------------------------------------|
| BGA-BS        | Under board support rail                                 |
| AC-CLAMPSET   | Set of board holding clamps (5 small & 5 large)          |
| BGA-BH-30     | Upgrade kit for board holder (Includes rails and clamps) |
| CSP-VAC       | Vacuum needle accessory kit for CSP pick up              |
| BGA-CSP-UG    | Conversion kit to CSP configuration (Optics & Vacuum)    |
| SPARE-101     | Level 1 spares kit for BGA/CSP 3501/3591 100/115v        |
| SPARE-102     | Level 1 spares kit for BGA/CSP 3502/3592 230v            |
| SPARE-201     | Level 2 spares kit for BGA/CSP 3501/3591 115v            |
| SPARE-202     | Level 2 spares kit for BGA/CSP 3502/3592 230v            |
| AC-525-PH-SET | Set of 525W pre-heater elements (1 pair)                 |
| AC-700-PH-SET | Set of 700W pre-heater elements (1 pair)                 |

## DEMONSTRATION EQUIPMENT

| PART NUMBERS | DESCRIPTION                                                                 |
|--------------|-----------------------------------------------------------------------------|
| BGA-K3       | BGA demo board kit including bare PCB, 5 x PBGA169 & 5 x PBGA225 components |
| CSP-C10      | Pack of 10 Micro BGA dummy components for use with BGA K3 kit               |



# systems and specifications

## BGA/CSP 115V & 230V SYSTEMS SPECIFICATIONS

|                                                 | BGA-3590 SERIES                          | CSP-3500 SERIES       |
|-------------------------------------------------|------------------------------------------|-----------------------|
| Input voltage 230v Models                       | 230v AC, 50/60Hz                         | 230v AC, 50/60Hz      |
| Input voltage 115v Models                       | 115v AC, 50/60Hz                         | 115v AC, 50/60Hz      |
| Power consumption                               |                                          |                       |
| Base unit                                       | 1400W                                    | 1050W                 |
| Control box                                     | 420W max                                 | 420W max              |
| Reflow head heater element                      | All voltages: 28v AC 280W max            |                       |
| Temperature control                             | Closed-loop K-type thermocouple feedback |                       |
| Maximum source temperature                      |                                          |                       |
| Under-board heater                              | 200°C (572°F)                            | 200°C (572°F)         |
| BGA reflow head                                 | 400°C (752°F)                            | 400°C (752°F)         |
| Airflow                                         | 3-20l/min                                | 3-20l/min             |
| Component maximum weight                        | 55g (.92 oz.)                            | 55g (.92 oz.)         |
| Maximum PCB dimensions                          | 17" (432mm) x open frame                 |                       |
| PCB thickness                                   | 0.8 to 3.2mm                             | 0.8 to 3.2mm          |
| Vision system magnification range               | 10 to 50X                                | 20 to 100X            |
| Maximum field of vision at lowest magnification | 46 x 46mm                                | 18 x 18 mm            |
| Mirror type                                     | Split field mirror                       | Flat Mirror           |
| Dimensions                                      |                                          |                       |
| Base unit                                       | 22" x 24" x 19" (560 x 610 x 485mm)      |                       |
| Control box                                     | 13" x 6" x 9.5" (330 x 153 x 241mm)      |                       |
| Weight                                          |                                          |                       |
| Base unit                                       | 76.5 lbs. (34.7 kg)                      | 76.5 lbs. (34.7 kg)   |
| Control box                                     | 20 lb. 7 oz. (9.27kg)                    | 20 lb. 7 oz. (9.27kg) |
| System warranty                                 | 1 year excluding consumables             |                       |

100v systems are available for Japan. Please contact your Metcal representative for more information.



*For information on the full range of  
Metcal Precision Systems for  
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