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ACP PROTOTYPE ASSEMBLY PROCESS USING M400 ISOTHERMAL SYSTEM (ITS)

REVISION HISTORY

Revision	Description	ECR Number	Date	Owner
A	Initial Release	ECR 202007-01	December 17, 2020	WS

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1.0 OBJECTIVE

This document is intended to guide customers on the assembly of RJR's Air Cavity Plastic (ACP) packages for prototyping using the M400 isothermal sealing system (ITS).

2.0 ACP PACKAGE PLATFORM

2.1 The ACP package is made of three parts: sidewall (also known as “ringframe”), lid (also known as “cap”) and flange (supplied by customer) as shown on **Figure 2**. The sidewall and lids are molded using liquid crystal polymer (LCP) material.

A typical assembly of the ACP package is shown in **Figure 3**. The portion involved with the sealing of the package has two steps:

1. Flange to sidewall attach: after the flange has the active and passive dies attached to it through a die attach process, the flange is epoxied to the sidewall at 165° C temperature in the ITS sealing system. The resulting component is known as the flange/sidewall (for a ceramic package, this is known as the “header”); and
2. Lid to flange/sidewall attach: After step (1), the header is taken to the wire bonder and wire bonds are used to create the matching circuits and the connections to the leads. The package is then sealed from the environment by attaching the lid to the flange/sidewall B-stage epoxy into the ITS sealing system which is done automatically at 165° C. The final step consists of testing the product for compliance to product specifications.

The ACP's sidewall is epoxy attached to the flange (**Figure 2**) rather than brazed like in a ceramic package (**Figure 1**). This reduces the stress and deformation of the flange, which allows the customer to not only improve the assembly of the product but also, it's performance and cost. A cross section of the ACP package is illustrated in Figure 3.

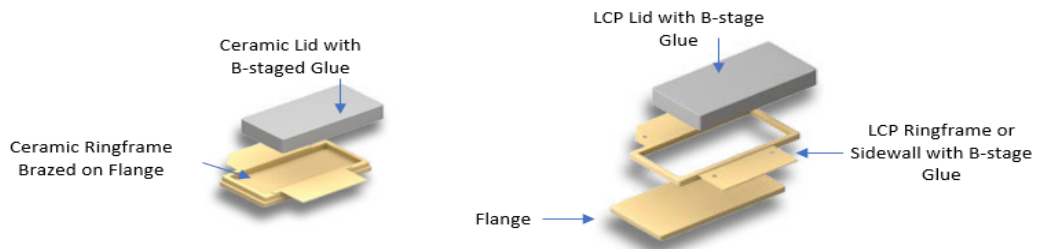


Figure 1: Air Cavity Ceramic Package

Figure 2: RJR Air Cavity Plastic Package

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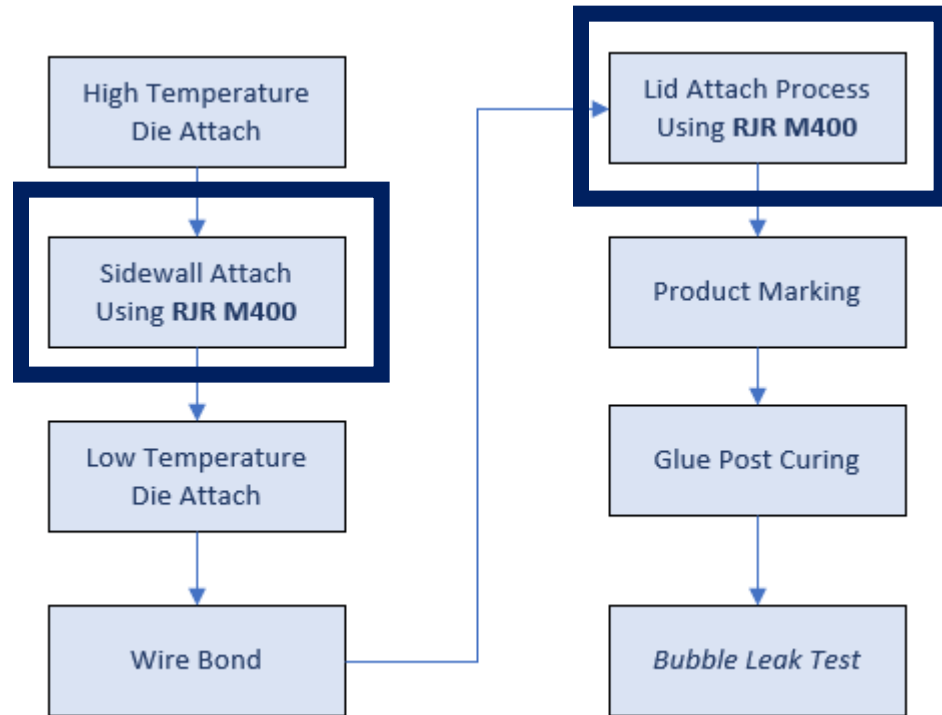


Figure 3: ACP Typical Assembly Process Flow for Prototyping

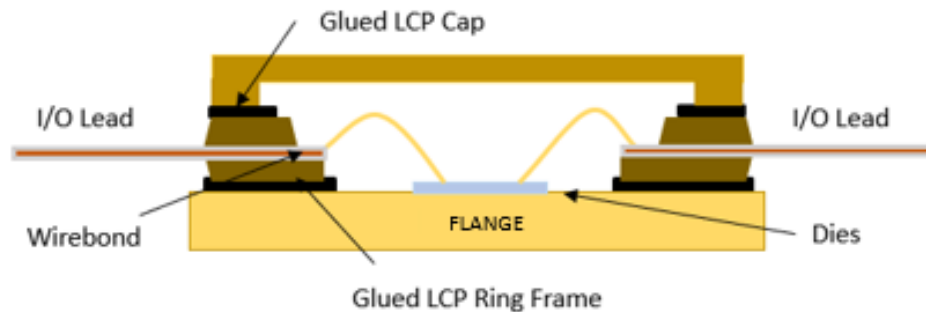


Figure 4: ACP Product Cross-Section

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2.2 RJR's ACP Material Presentation

2.2.1 Sidewall

- 1) The sidewall is supplied in singulated format with B-staged glue. They are dry packed in an ESD bag with desiccants and kept in cold storage with the temperature ranging from 3°C to 8°C.
- 2) Prior to assembly, the sidewall must be placed outside the cold storage into ambient for at least 2 hours to acclimatize. During this period, it is advised not to remove the parts out of the ESD bag.

2.2.2 Lid

- 1) The lid is supplied with B-staged epoxy. They are also dry packed in ESD bag with desiccants and kept in cold storage with the temperature ranging from 3°C to 8°C.
- 2) Prior to assembly, the sidewall must be placed outside the cold storage into ambient for at least 2 hours to acclimatize. During this period, it is advised not to remove the parts out of the ESD bag.
- 3) For a full list of open tooled sidewall and lids, please visit: www.rjrtechnologies.com or contact customer_service@rjrtechnologies.com.

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3.0 M400 MACHINE DESCRIPTION:

Machine: The M400 isothermal sealing system is custom designed by RJR to guarantee the seal integrity of the ACP package.

- Physical dimensions:
 - Length: 33inches (838.2mm)
 - Width: 17.73inches (450.48mm)
 - Height: 19.23inches (488.67)
 - Weight: 60lbs (27.3 kg)

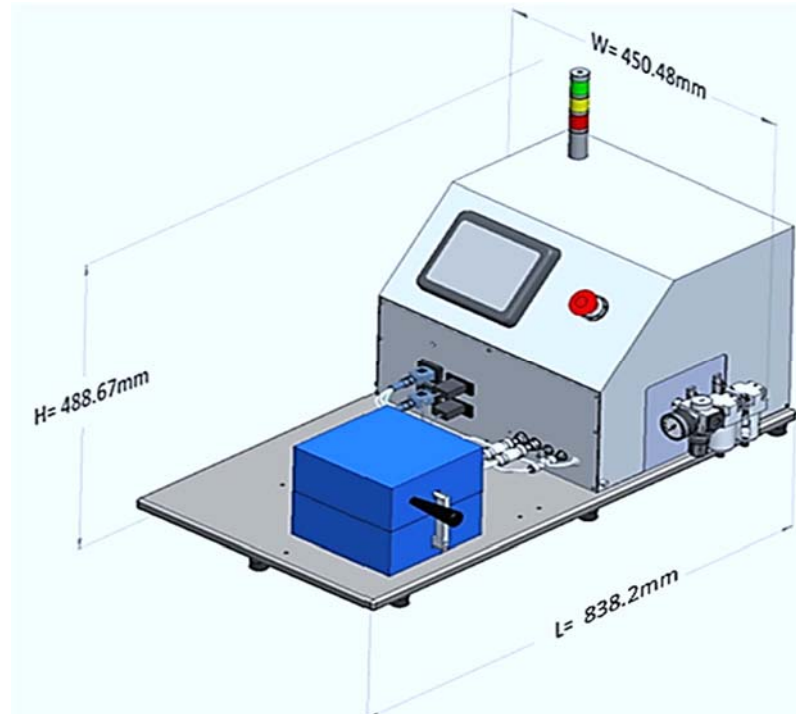


Figure 5: M400 Machine Dimensions

- Machine Facilitation:
 - Power Supply: user Selected 115/230VAC, 15A, single phase
 - System Compressed Air Pressure: 40-80 PSI (2.76-5.5 Bar)
 - Vacuum pressure: minimum 9.82 psi (0.68 bar)
- Machine Tool-up:
 - The sealing plates included with the Model 400 are custom designed.
 - The two sealing plates will be designed with four 4 cavities to perform 2 different assembly processes.
 - Two cavities will be designed specifically for sidewall to flange attach; and

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- Two cavities will be designed specifically for lid to sidewall/flange attach.

Note: Outlines of the flange can vary as this is specified by the customer. Therefore, RJR requires samples of flanges before confirming the plate design and fabrication.

4.0 PACKAGE PROTOTYPE ASSEMBLY INSTRUCTIONS

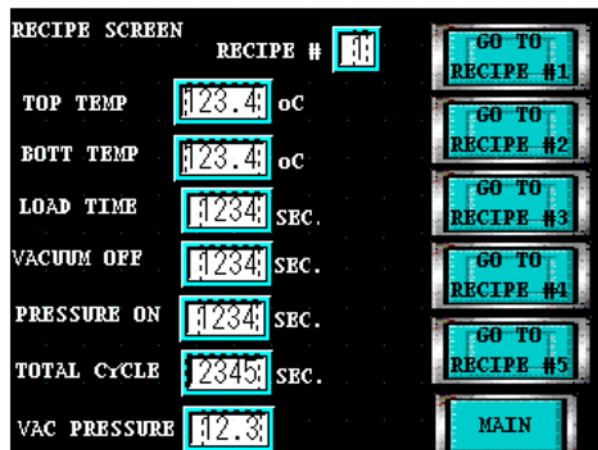
4.1 Machine Setup

- 4.1.1 The setup of the machine can be checked in the ITS 400 User Manual.



ITS400 User Manual
Upgrade June 17 20

- 4.1.2 A sealing plate is used in the RJR Model 400 Isothermal sealing system, which has to be properly installed, according to the operating manual (see ITS400 User manual). For ACP packages the plates will be specific to a package outline, such as a 1230, 0800, 0600 or 0462 size.
- 4.1.3 The next step is to either (1) download the program; or (2) select the program (if preloaded); then turn on the unit and you are ready to assemble parts after a half an hour of warm-up time to reach the proper operating temperature. In the case that the machine program will be provided during on-site process dial-in and training by an RJR Engineer, then wait for the RJR personnel to initially set up the unit.
- 4.1.4 ACP sidewall to flange attach or ACP lid to sidewall/flange attach needs to be selected dependent on the sealing step to be processed, which can be confirmed on the touch screen as follows:

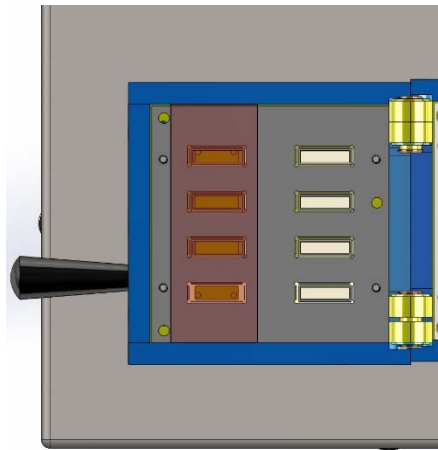


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4.2 Sealing Plate Setup

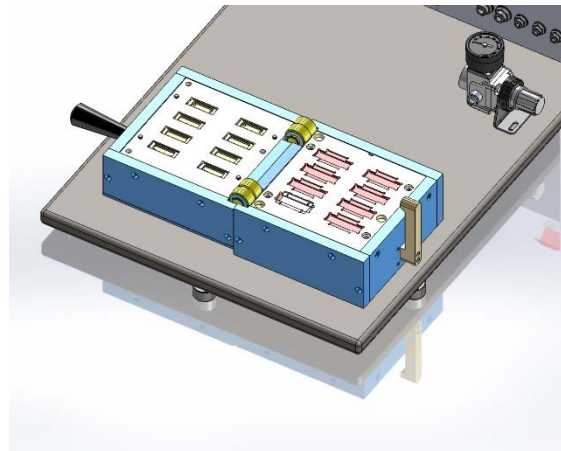
4.2.1 The ACP prototype sealing plate is a four-cavity design where two cavities are being used to do flange to sidewall attach, and the two other cavities are for flange/sidewall to lid attach. Therefore, upon start up and or if you are only doing one of the two choices: flange to sidewall attach or lid to flange/sidewall attach, the empty two cavities have to be taped off, otherwise, the vacuum channels of unused cavities will leak and the parts that need to be held by vacuum will fall out. Thermal tape should be used to cover the unused cavities for the sealing process to work properly.



4.3 Sealing Processes

4.3.1 Sidewall to Flange Attach

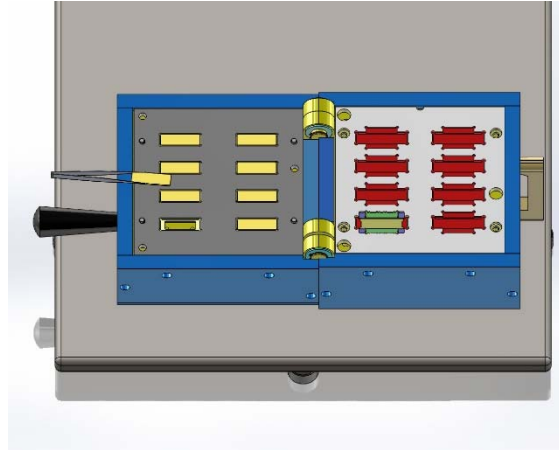
- 1) Open the top clamshell of M400.



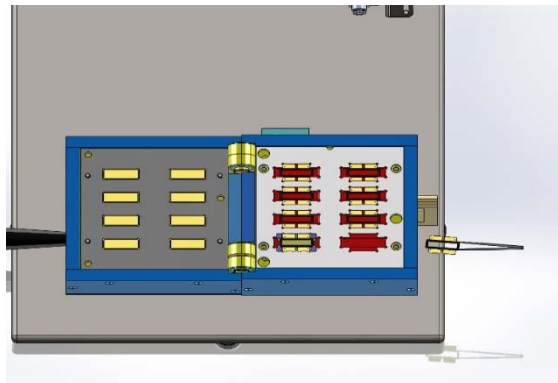
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- 2) Using a plastic tweezer, place the flange with pre-bonded dies in the top plate flange cavity of the M400 sealing plates.



- 3) Using a plastic tweezer, place the sidewall to the sidewall cavity/slot in the bottom plate of the M400 sealing plates. The epoxy side must be facing up.



- 4) Press “**LOAD**” button in the HMI and wait for 1 minute (as pre-heating of the materials).
- 5) When the “**LOAD**” time is completed, the operator will hear the buzzer, signaling it is time to close the clamshell.
- 6) When the clamshell is closed, press “**START**”.
- 7) After pressing “**START**”, sealing cycle starts and ends in 12 minutes. After 12 minutes the, clamshell lock is released and “Total Cycle Complete Press “**Enter**” to Continue” appears in HMI.

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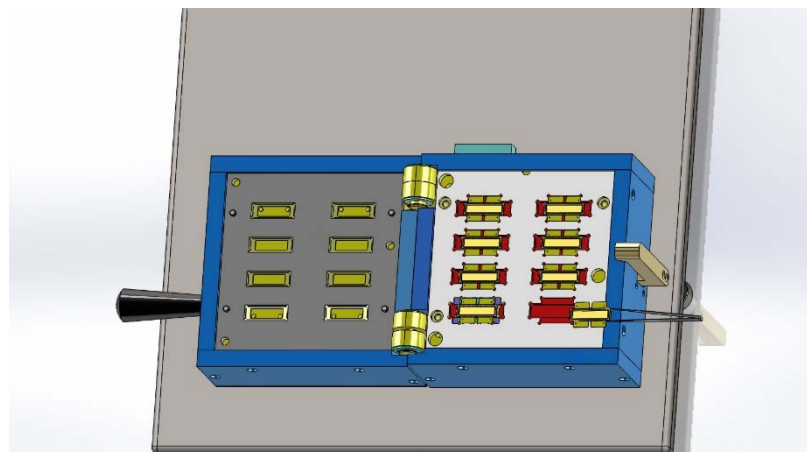
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- 8) After pressing “ENTER”, then the top clamp can be opened.
 - 9) The operator can now remove the Flange-Sidewall assembly from the sealing plates. Use plastic tweezers to unload and place the unit/s on a clean metal surface to cool down.
- **Notes:**
 - Since the units are functional, make sure that the M400 machine and cooling plates are properly grounded to avoid ESD.
 - Close the M400 clamshell when not in use.
 - The sealing plates temperature is 160°C.

4.4 Lid to Sidewall / Flange Attach

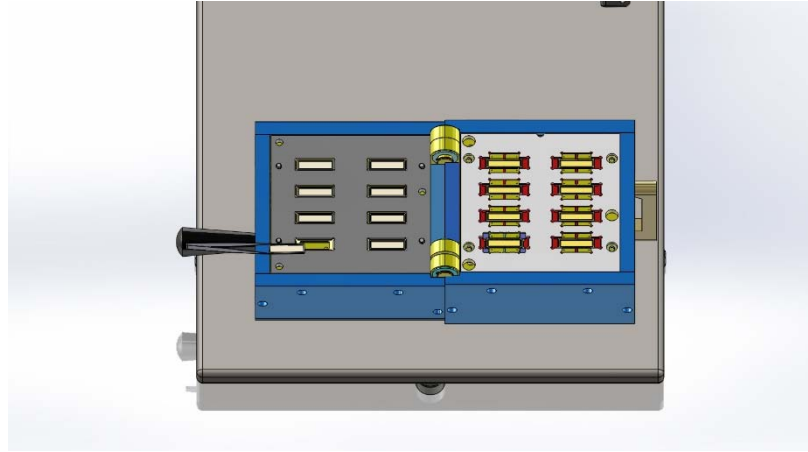
- 1) Open the top clamshell of the M400 machine.
- 2) Using plastic tweezers, carefully place the side-wall-flange with pre-bonded dies and wirebonds on the sidewall-flange cavity in the bottom sealing plate of the M400 sealing plates.



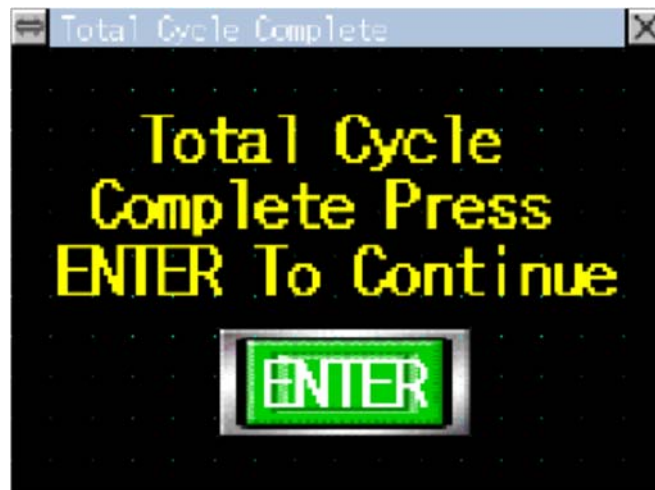
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- 3) Using plastic tweezers, place the lids in the lid-cavity slot in the top sealing plate with epoxy side facing out in the M400 sealing plates.



- 4) Press the "**LOAD**" button in the HMI and wait for the 1 minute (as pre-heating of the materials).
- 5) When the "**LOAD**" time is completed, the operator will hear the buzzer signaling it is time to close the clamshell.
- 6) When the clamshell is closed, press "**START**".
- 7) After pressing "**START**", sealing cycle starts and end in 12 minutes. After 12 minutes the, clamshell lock is released and "Total Cycle Complete Press Enter to Continue" appears in the HMI:



- 8) Press "**ENTER**", then the top clamp can be opened.

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- 9) The operator can now remove the sealed ACP package from the sealing plates. Use plastic tweezers to unload and place the unit on a clean metal surface to cool down.
- 10) **Notes:**
- Since the units are functional, make sure that the machine M400 and cooling plates are properly grounded to avoid ESD.
 - Close the M400 clamshell when not in use.
 - The sealing plates temperature is 160°C.

5.0 POST CURING

After the sealing process in the M400, the units must be post cured on a batch oven at a temperature of 180°C ±5°C for 1 hour.



Figure 6: Batch Curing Oven

6.0 BUBBLE LEAK TEST


- 6.1 To package sealing integrity is subjected to gross leak test. RJR recommends following MIL-STD-202G (see MIL-STD-202G document). In general, the assembled ACP package is submerged in an indicator fluid tank at a temperature of 125°C for at least 30sec. The fluid typically used is Fluorinert® Liquid (FC-40).



Figure 7: Trio-Tech Bubble Leak Tank

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