Instructions For:

Auditor Programmable Epoxy Cure System

Code: **GM1042**

#200320

#200323

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Installation

The **E**poxy **C**ure **S**ystem (**E.C.S.**) is a stand-alone space saving design that can be secured to a work bench, shelf, or hung from a wall. Regardless of the preferred installation method, the following recommendations apply:

1. Plug the unit directly into a wall AC outlet. If an extension cord is used, the minimum spec is 20A /250V, 2 poles 3 wires, CSA 1.25 mm² corresponding to AWG 14~16

2. Make sure the power source conforms to the electrical requirements of the unit. The E.C.S. is available as a **50/60 HZ, 110 VAC or 240 VAC** system. If you have received a unit with the incorrect voltage, contact your local sales representative or sales@golfmechanix.com

Do not power the ECS with a transformer. Doing so may overload and trip your main power system.

3. If the unit is mounted to a wall; The wall must be able to support at least 20lbs (9kg). The spacers provided must be used for heat isolation. The minimum clearance should be no less than 3.0cm or 1.25".

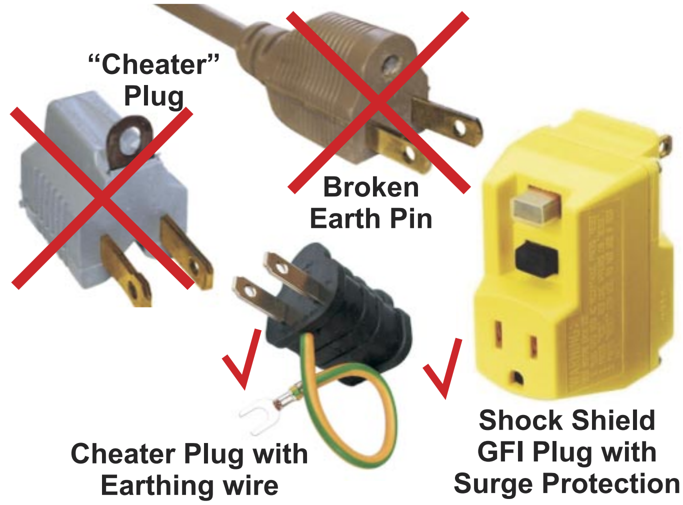
4. Keep the E.C.S. away from **flammable** substances and wet or damp work areas.

<u>**IMPORTANT GROUNDING INFORMATION**</u>

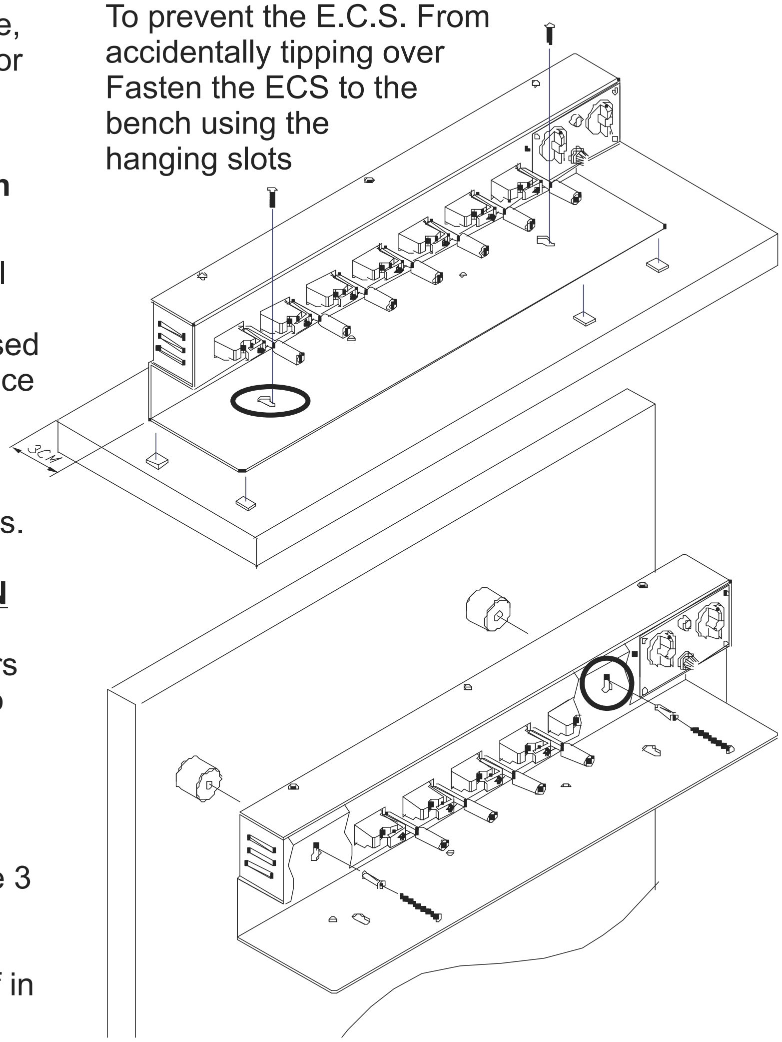
To protect against potential electric shock hazard, the use of 3 to 2 pin converters should be explicitly avoided because they do not provide a return to ground. Do not break the grounding pin on the main plug.

For your safety, ensure that:

a. Your main electrical installation is of the 3 wire system.
b. If your installation is a two wire system, use a GFI (Ground Fault Interrupter). If in doubt, check with your electrical subcontractor.



To prevent the E.C.S. From accidentally tipping over Fasten the ECS to the bench using the hanging slots



Overview:

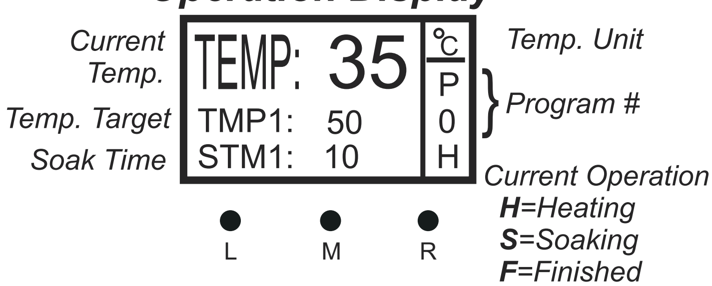
The Golf Mechanix Digital Epoxy Curing System (D.E.C.S.) is designed to give you complete control over the curing time of club assembly. With precise temperature control and the ability to preset up to ten programs variations the D.E.C.S. is the go to machine for OEMs and tour van professional clubmakers.

Startup Screen

Operation Display:

The large Operation Display clearly shows the current temperature, TEMP1 target, STMP1 time, unit measurement, program number and current operation. Three control keys allow easy access to settings and features.

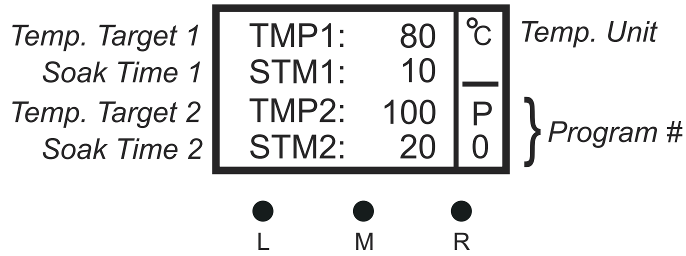
Operation Display



Program Display:

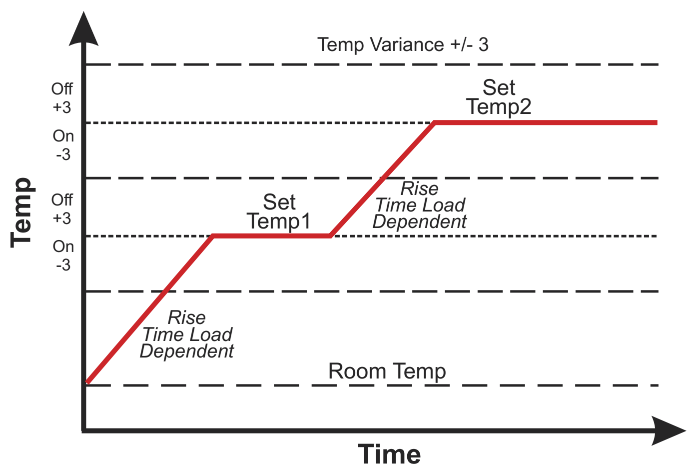
The Program Display is designed for easy navigation and direct input. You can set TMP1 and STM1 as your pre-warming temperature to get your clubs up the starting temperature. Then use TMP2 and STM2 as your recommended epoxy curing time. This is extremely helpful in areas with low ambient temperature.

Program Display



Temperature accuracy and overshoot:

The ECS design centers around heat conduction which is limited by the contact area of the heating element with the clubhead hosel. The thermal balance achieved over time at the club-head hosel tracks very well with the target temperature set on the thermostat. Also, due to the controlled rate of diffusion between the heating element and the clubhead hosel, overshooting the target temperature has a limited effect on the temperature rise at the hosel.



Pre-Heating:

The advantage of the D.E.C.S. system is that each program has two heating phases. The first phase can be used to pre-heat the club and the second phase used to cure the epoxy. As a general guideline, the D.E.C.S. has a temperature rise of 15°C / 27°F per minute at the pegs. For example, to pre-heat the D.E.C.S. to a target temperature of 100°C / 212°F from a room temperature of 20°C / 68°F, a time allowance of 5 minutes is required (i.e. 100-20°C/15=5min or 212-68°F/27=5min), provided there is no down draft or a steep drop in ambient temperature.

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$$\text{Pre-Heating In Minutes} = \frac{\text{Target Temp - Room Temp}}{15^{\circ}\text{C } (27^{\circ}\text{F}) \text{ per minute}}$$

Adhesive curing

The strength of high performance general purpose adhesives can be further improved by subjecting the bond to heat in a controlled manner. While adhesive curing parameters (time and temperature) vary by manufacturer, the method used for prepping, curing and testing lap shear strength is well established and standardized in the ASTM/ISO literature.

To ensure that minimum adhesive shear lap strength is achieved, the following rules have been established for curing golf clubs, post assembly; noting that ambient/room temperature and rack loading will affect (1) how quickly the target temperature is attained, and (2) the length of time remaining for the adhesive to fully polymerize and thus achieve maximum strength. This makes it necessary to adjust the manufacturer's recommended cure time in line with the workshop environment.

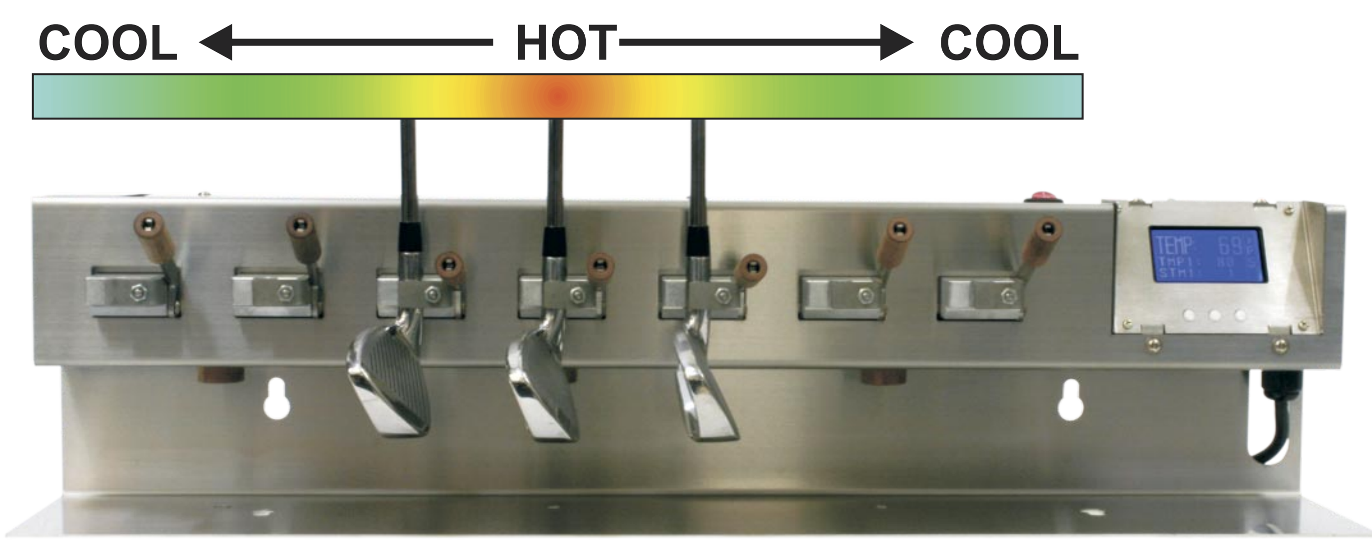
Adjusting cure time

The established temperature rise for a typical clubhead is 8°C (14.4°F) per minute - for woods, irons and hybrids - but is limited by the contact patch area between the hosel and peg . For the clubhead to reach the desired cure temperature of 100°C (212°F) from an ambient room temperature of 20°C (68°F), one must divide the difference by 8°C (14.4°F), giving a heating time of roughly 10 min, which should be added to the recommended cure time. Therefore, assuming a cure time of 30 min at 100°C (212.2°F) the correct cure time to compensate for rise time to temperature is 30+10= 40 min.

$$\text{Cure Time} = \frac{\text{Target Temp - Room Temp}}{8^{\circ}\text{C } (14.4^{\circ}\text{F}) \text{ per minute}} + \text{Recommended cure time}$$

Curing clubs

The ECS was extensively tested using temperature mapping and thermal imaging to eliminate potential hot spots and uneven temperature distribution. It has been determined that heat generated by the heating cartridge diffuses from the center of the rack towards both extremities, as shown by the color bar. Therefore, it is most effective to load the ECS starting from the middle peg.



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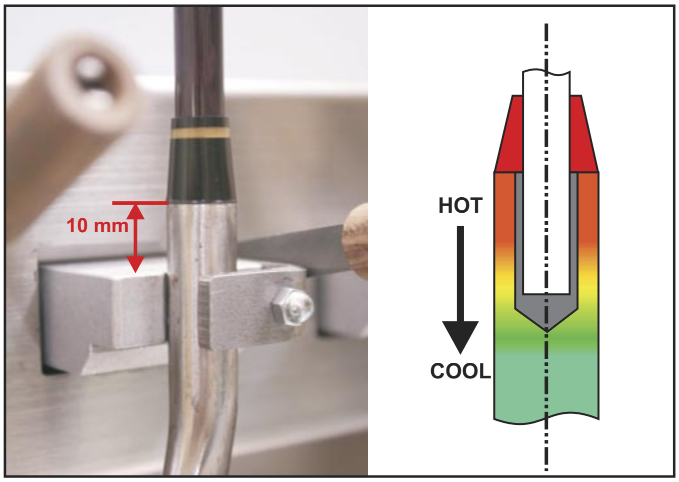
Mounting clubs on the rack

Cellulose, the material ferrules are made of, has a melting temperature of 260~270°C (500~518°F). This makes ferrules highly resistant to heat radiating from the rack and to conduction from the hosel. Nevertheless, to eliminate the possibility of heat shrinkage etc. the club-head should be clamped 10 mm below the ferrule whenever possible. This will ensure the bond line around the insertion depth is adequately heated. If the clubhead is clamped closer to the hosel neck, the clubhead will act as a heat sink and prolong the time it would take to reach the set temperatures.



Pre-Heating Club-Heads prior to assembly

Epoxy hardening reaction is exothermic. As a result, if adhesive is applied to a hot clubhead, the reaction could be hastened, resulting in a shortened handling time and a bond that is both brittle and weak. Thus, should the need arise to pre-heat heads prior to assembly (i.e. to speed up production), it is recommended to:

a. Heat up club-heads only until they are "warm to the touch".

b. Mix the two part epoxy in small amounts at a time so it does not sit in the cup too long. This also extends the pot life to allow time for aligning the shaft and wiping out excess glue from the joint.

c. Avoid applying too much adhesive. The epoxy will eventually sink to the bottom of the bore, creating a pool that could bubble. If the shaft doesn't center itself about the hose bore; use a glass bead filler mixed with the adhesive to reduce the hosel bore clearance(item#.22-GB15-2oz).

Please Note: Some adhesives must set before heat is applied to prevent "bubbling" Please consult with your glue manufacturer beforehand to eliminate potential issues with bond performance and durability.

Common golf club making adhesives and cure temperatures

Temperatures listed are the minimum requirements suggested for achieving maximum full bond strength. Please consult your adhesive data sheet for heat cure information.

Adhesive	Manufacturer	Cure Time							
		60'		30'		20'		10'	
		°C	°F	°C	°F	°C	°F	°C	°F
DP-405	3M			60	140				
DP-810	3M			49	120			66	150
AC-8810	Inovative Resins							66	150
EP-700	Inovative Resins					80	176		
EP-715	Inovative Resins	66	150						
EP-719	Inovative Resins	65	149						
AW-4859	Huntsman/ Araldite	130	266	150	302				
AW-4858	Huntsman/ Araldite			60	140			100	212

Quick Programming Guide

To Select A Program

-Press **M**iddle key.
-Press **M** to Scroll up or...
-Press the **L**eft key to scroll down,
-Press the **R**ight key to Select a program
-Press the **R** key again to start heating
H will appear in the lower right of the screen.
-To stop the heating cycle, press **R** again.
-To switch to TEMP 2 settings, press **L**.

To Set / Edit Programs Stage 1 & 2

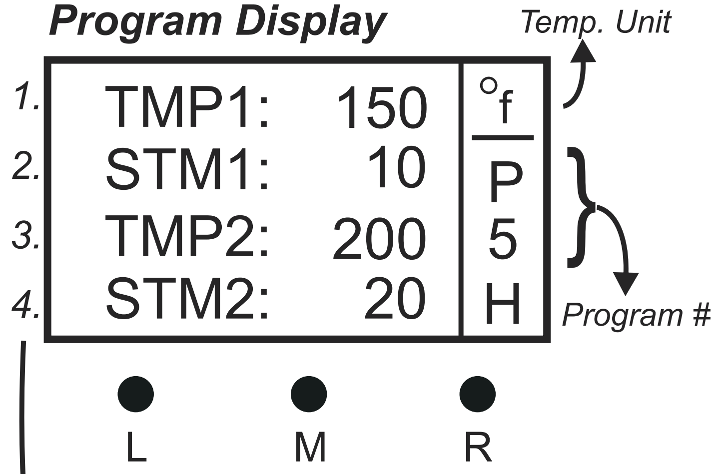
-Press **M to** engage.
-Press either **M** or **L** to choose a program.
-Hold **R** for 2 seconds or until the cursor under the temperature unit starts to flash.
-Press **L** to select Fahrenheit or Celsius.
-Press **R** to move cursor to **Temp** target.
-Press **L** to increment the first digit.
-Press **M** to skip the next digit. Repeat until TEMP1 value is entered.
-Press **R** to scroll down to **STM**
-Set desired time using **L** and **M**.

To Save Edited Programs

-Hold **R** for 2 seconds When prompted: - Press **L** for yes, **R** for no.

From the operational display:
-Press **R** to select current program
-Press **R** to start heat cycle.
-Press **R** to stop

Program Display



1. Temp. Target 1

2. Soak Time 1

3. Temp. Target 2

4. Soak Time 2

In this example of program 5, the D.E.C.S. will warm up to a temperature of 150F and then hold that temperature for 10 minutes. After the time is up, the D.E.C.S. will raise the temperature to 200F and then hold that temp for 20 minutes before finishing the cycle.

HEAVY DUTY INDUSTRIAL
200323

110V / 220V

Programable Epoxy Cure System 3

A compact version of our Auditor Omega Programable Curing Rack, this unit offers all the features and advantages of the original design but with a smaller foot print.

With just 3 heating pegs, this unit heats faster and is more responsive because of the smaller thermal load and higher power density available. Temperature rise and soak time at target temperature are controlled by the Auditor Omega proportional controller to a narrow band not exceeding +/- 3°C.

Best suited for smaller labs, custom club retail fitting stations and tour vans working to tight deadlines.

The Auditor Omega's bi-directional receipe upload/download function with cure cycle data recording capability are also retained on this unit.

Key Features:

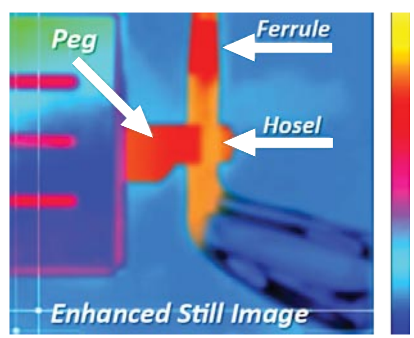
-Programable temperature controller with accuracy of +/- 3°C.
-On board memory for 10 user defined adhesive curing profiles.
-Handles 1 hour cure cycle at 50~200 °C / 122~392°F per step.
-Holds up to 3 clubs, allowing ample spacing between clubs.
-Powerful, 500W sealed heater cartridge.
-Data collection & programming software included.
-USB Upload & download of curing profiles.
-Compact wall mount installation reduces footprint!

Curing rack can be mounted onto a work bench, secured to a shelve or hung on a dry wall.

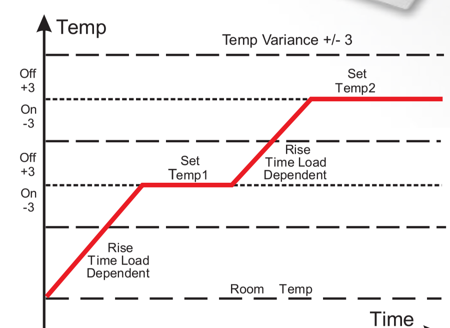
Data collection software, USB cable and fastners included.

▲Multi line LCD display with prompts and 3 Buttons interaction simplify operation

▲The epoxy curing rack is ideal for batch bonding adapters, as well as preheating adapters prior to shaft extraction



▲Thermal imaging shows heat transfer path and temperature distribution



▲Typical 2 stage cure cycle with rise time offset to ensure adequate soak time at temperature