INTRINSIC

UniLok® HTR Installation & Removal

Handling and Storage:

Heat-To-Recover UniLok rings are supplied in the expanded condition. They begin to shrink in diameter when heated to a temperature above 45°C (113°F). Handling and storage procedures should insure that the rings are kept below this temperature. The rings have an unlimited shelf life.

Installation:

The HTR rings return to their smaller memory diameter when heated above room temperature. They begin to shrink when heated above 45°C (113°F). If the rings are freely recovered, with no resisting substrate inside the ring, the rings will be essentially fully recovered by 100°C (212°F). However, when installed on a substrate, the ring does not build up its full clamping force until heated to 165°C (330°F). To insure complete heating, each ring is marked with thermochromic paint which changes color from green/blue to black/brown at 165°C. Rings can be tight after heating to lower temperatures, but full clamping force is insured only by heating until the paint changes color. The recovery process requires no dwell time at temperature, the recovery is complete as soon as all of the ring has reached temperature. There is no benefit to heating for longer times or to higher temperatures.

A variety of methods can be used to heat the rings; hot air gun, direct resistance heating, oven bake, belt oven, induction, propane or butane torch, etc. The choice is based primarily on the constraints of the application. There are two considerations for the ring. The ring should not be heated to above 300°C (572°F) to avoid the possibility of stress relaxation. The heating method should not heat the thermochromic paint faster than the ring, as could happen with infrared, if a propane torch were used at close range, etc.

Recommendations for various heating methods are given below. Contact Intrinsic Devices for additional assistance on selecting the heating method, designing tooling, and locating suppliers for tools.

Hot Air

Any hot air gun that produces temperatures above 165°C may be used. Heating times can vary from 10 seconds to several minutes depending on the ring size and substrate. A reflector, sized to the ring, can reduce the heating time somewhat. Because of the long heating time and operator involvement required, this method is generally only used for prototyping and small scale production.

Oven

A conventional or belt oven can be used to heat the rings. The oven temperature should normally be set between 165°C (330°F) and 200°C (392°F). The higher temperature will give more rapid heating. Temperatures up to 300°C (572°F) may be used to accelerate heating. Use of a convection oven will reduce heating times. The optimum process is one that heats the rings to 165°C consistently, without overheating.

Direct Resistance

UniLok rings can be rapidly heated by passing electricity through the rings at high amperage and low voltage. This is done by contacting the ring at two points, diametrically opposed, and passing current around the circumference of the ring from one contact point to the other. Typical voltages range from 1 to 10 volts, amperage from 25 to 300 amps. Standard resistance soldering power supplies are typically used to provide power in this range.

If the substrate is electrically conductive, the ring must be insulated from the substrate so the current does not short through the substrate. This dielectric barrier can be produced by anodizing the substrate, placing a wrap of DuPont Kapton® film between the ring and substrate, or by using UniLok rings which are pre-coated with a dielectric on their ID surface. (Contact the factory for availability of insulation on particular ring sizes.) Since the heat is generated in the ring, the substrate undergoes very little heating, getting only the heat that is thermally conducted from the ring. Typical heating times range from 1 to 5 seconds.

Uninsulated rings can also be installed on conductive substrates by resistance heating. In this case the ring and substrate are heated together to 165°C. Typical heating times for this method range from 3 to 100 seconds. The heating time can be reduced by running more current through the assembly. However, current should be limited to prevent localized overheating of the ring at the electrode contact points. Overheating is evidenced by gross discoloration of the ring in the contact area. Rings smaller than .25 inch diameter are generally good candidates for heating without insulation on a conductive substrate.

Contact Intrinsic Devices for assistance in the design of resistance heating tools; electrode design, fixture design, and power supply selection.

Induction

Induction heating can be used. However, resistance heating generally offers faster heating at lower equipment cost and with less substrate heating.

Torch

Due to operator sensitivity, torch heating is not recommended. Rings may be heated with propane or butane torches on a limited basis. However, care must be taken to heat the rings uniformly and to avoid heating the thermochromic paint faster than the ring. This requires holding the torch back some distance from the ring so that the flame is not directly on the ring. Welding torches are much too hot and should not be used.

Removal:

UniLok rings are normally used for permanent fastening. Depending on the application, rings can be removed by cutting or by cooling with liquid nitrogen.

Cutting

Rings may be cut off using abrasive wheels or with carbide cutting tools. Since the rings are under hoop tension, they will break once 2/3 to 3/4 of the cross-section has been cut through. The sudden release of elastic energy when the ring breaks can cause it to open up and shoot off with great force. This poses a serious safety hazard. **Fixturing used during cutoff must contain or grip the ring so it cannot move enough to cause damage.**

Cooling

If a ring is cooled below -120°C (-184°F), the ring will relax and spontaneously open about 0.2% above its installed diameter. In applications where the ring is installed on a rigid substrate, such as directly on a shaft or on an elastic collet over a smooth pin, the relaxation of the ring is enough to release the assembly. On these types of assemblies rings can be used as multi-cycle fasteners. The ring will re-grip on warming to room temperature. However, the diameter of the substrate must be tightly controlled to achieve repeatable clamping on re-installation. Please contact Intrinsic regarding the design issues involved.

Liquid nitrogen is used to cool rings for removal. Typically parts are immersed in liquid nitrogen, or a collar containing felt is clamped around the ring and liquid nitrogen is bled into the felt. The felt wicks the LN, holding it against the ring. Dispensers created for dermatologists are readily available for applying LN to the felt collar.

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