(sealnote)

ELECTRONIC SEALING NOTES

BRIEF DESCRIPTION

Electronic sealing is accomplished by sending a high frequency heating current through two or more layers of thermoplastic material placed between two sealing electrodes or dies. One die is shaped in the image of the required seal. The other die may have the same shape or may be a flat plate. The dies are usually mounted in a pneumatic or hydraulic press to provide pressure for fusing the material. The seal is made as the High Frequency current heats and liquefies the material, whereupon the press exerted on the material brings about a thorough fusion. The current is then shut off, the material is then allowed to solidify during a brief cooling period, and the seal is completed.

In the most common set-up, the material is sealed between a die of the desired shape and a flat, stationary steel plate covered with a brass or aluminum liner. The shaped electrode, too, is usually made of a brass strip one or two inches high, as thick as the seal desired, and fastened to a plate which is mounted on the press ram. The type and size of the press, shaped electrode, and lower platen will, of course, depend on the required application.

GENERAL CONSIDERATIONS

The quality of a seal is determined by three factors:

1. Heating Current (Power)
2. Heating Time
3. Pressure

To some extent these three factors are independent of one another; for example a larger current, or more pressure does not necessarily reduce the sealing time. The type and thickness of the material, the total area of the seal will determine what these factors must be.

HEATING TIME

As the power is turned on, the material heats up and its temperature rises. Naturally, the higher the temperature rises, the more heat is conducted off through the dies and the air until what may be called a state of heat balance is reached. At this point, the amount of heat generated within the plastic material remains constant.

This temperature, indicating a sort of equilibrium condition between heat generated and heat loss in order to seal must be above the melting point of the plastic. It is time required (measured in seconds of fractions thereof) to reach this melting point that is defined as the "heating time."

The heat loss is naturally larger with thinner materials and smaller with thicker materials. Indeed, very thin material (less than .004") lose heat so rapidly that it becomes very difficult to seal them. From this it can be seen that in general, thicker materials require less power than more thinner materials. Furthermore, it was found that certain poor heat conductors which do not melt or deteriorate under the impact of high frequency can be used as buffer materials. Bakelite silicone glass, and teflon, for example, are excellent buffers, and help materially in improving the seal. (See paragraph below on buffers.)

The usual heating period ranges from one to four seconds. To minimize failures it is suggested that the time determining the heating cycle should be set slightly above the minimum time found necessary for a good seal.

PRESSURE

The electrodes provide both the heating current to melt the material and the pressure to fuse it. Generally, the lower the pressure, the poorer the seal. Conversely, a higher pressure will usually produce a better seal. However, too much pressure will result in an undue thinning out of the plastic material and in an

objectionable extrusion along the sides of the seal. As a result of the two electrodes moving close to each other, arcing may be caused, damaging the plastic, the buffer and possibly the die.

To obtain high pressure and avoid the above disadvantages, the moving die is restrained in its motion by a "stop" on the press which is set to prevent the dies from closing completely through the material and, at the same time, gives a seal of predetermined thickness.

To insure a uniform seal, the proper pressure must be obtained at all points of the seal. To effect this,

the dies are ground perfectly flat, and held parallel to each other in the press. The dies must also be rigidly constructed to prevent warping under pressure.

POWER

The amount of power required for a good seal is directly proportional to the area of the seal. Moreover, thicker materials require less power than thinner materials because thinner materials lose heat to the dies more rapidly. The attached graph shows the maximum area of seal obtainable with each size machine. However, it must be borne in mind that these figures are for concentrated areas.

The sealable area/Kw will be
less for long thin seals, and for certain materials which are hard to weld.

ADJUSTING POWER,TIME AND PRESSURE

When setting up a new sealing job, the first test should be with minimum power, minimum time, and medium pressure. If the seal is weak, the time should be increased gradually up to 3 or 4 seconds. Then the power should be increased carefully. For the greatest freedom from burning or arcing, the power should be kept as low as possible consistent with good sealing.

The dies must be held parallel to produce even pressure at all sections. Where leveling screws are used, be sure the leveling is correct. On other types of presses, where the die plate is loosely connected to the ram, the shaped die must be mounted so that the ram force is applied at the center of the seal. If there is too much extrusion, or if the seal is too thin, the stop should be used. To set the stop, place half the total thickness of material to be sealed on the lower platen. Close the press and set the stop nut finger-tight. Then, the full thickness of material in the press and make a seal. Check the result, and if not good, lower or raise the stop as required to give more or less extrusion.

However, for thinner gauge material, the stop is unnecessary.

If a good seal cannot be made with the maximum power and time, the seal area must be cut. This can be done by beveling the edges of the die with a file.

If the seal is weak at certain spots, the dies are

probably not level. This may be over- come by putting shims on the lower plate between the thin brass liner and steel base plate. Check and adjust leveling screws. If these adjustments are unsatisfactory the die may have to be surface ground.

After making a number of seals, the dies warm up somewhat, and the time and power may be reduced after a satisfactory seal is obtained.
At times, because of the type of materials used in the sealing die construction, it may be necessary to re-cycle or make repetitive seals in order for the sealing die to "warm up" in order to make a good seal. Once this point is reached, it may be possible to reduce the power or time setting, depending on the material being sealed. This condition is usually encountered when sealing materials other than plasticised PVC film.

ARCING

If the various adjustments are not made correctly, arcing through the material may occur. Arcing may also occur when the material to be sealed has different thicknesses at different parts of the seal, or where the die overlaps the edge of the material. In these cases, there is arcing in the air gaps between the material and die. Sometimes this can be remedied by increasing the pressure or decreasing the power.

Arcing may also occur because of dirt or foreign matter on the material or dies. To avoid this, care must be taken to keep the machine and material clean.

Sharp corners and edges on dies may also cause arcing. The die edges should always be rounded and smooth. When arcing occurs, the dies must be carefully cleaned and smoothed with fine emery cloth. Never try to seal on material that has arced before.

ARC SUPPRESSION

The use of the arc suppressor will minimize damage caused by arcing. The arc suppressor cannot eliminate the cause of the arc, but due to its extremely fast reaction time, the duration of the arc is held to micro-seconds. The arc suppressor should be reset for maximum sensitivity each time a die is changed.

BUFFERS

In many cases, sealing is improved by a thin layer of insulating material called a buffer. This is attached to one or both dies to insulate the material to be sealed from the die. This does several things. It lowers the heat loss from the material to the dies; compensates for small irregularities in the die surface, and may help to make
a good seal even if the die is not perfectly flat. It decreases the tendency to arc when too much time or pressure is used. In general it makes a better seal with less arcing. Buffers should have good heat resistance and high voltage breakdown. Many materials may be used:- bakelite, paper, glassine, teflon, glass, mycalex, silicone fiberglass, etc. Bakelite grade XXX about .010 to .030 inches thick can be used successfully in most cases. A strip of "scotch" cellulose or acetate tape adhered to the shaped die is sometimes used to advantage.

REPRESENTATIVE LIST OF PRODUCTS FABRICATED WITH HIGH FREQUENCY WELDING EQUIPMENT

Advertising Premiums & Novelties
Air Force Press Suits
Airhouses, Fixed or Portable
Attache Cases
Automatic Components
- Arm Rests
- Car Seats
- Carpet Heel Pads
- Convertible Tops/Rear Windows
- Door Panels
- Harness Cables
- Headrests
- Litter Bags, Disposable
- Seat Covers
- Seats (Embossing Panels)
- Sun Visors
- Water Reservoirs

Awnings & Canopies

Baby Baths
Baby Pants
Badges
Bags
Bathroom Scales
Belts
Bibs
Billfolds
Blood Plasma Kits
Boat Seats
Bottles
Boxes
Briefcases
Bullet Proof Vests

Car Seats (Juvenile)
Carpeting - Stair Treads
Carriages, Juvenile, Toy
Chaise Lounge Pads & Mats
Clothing PVC
- Aprons, Chemical,Industrial
- Hats & Caps
- Jackets; Weather, Chemical,
- & Industrial Raincoats, PVC

Cosmetic Cases & Kits
Computer Cards
Covers
- Air Conditioner
- Aircraft
- Boat
- Book
- Checkbook
- Fluorescent Light Grids PVC
- Furniture
- Hamper
- Industrial Equipment
- Lamp
- Mattress
- Missile
- Pillow
- Pool
- Truck & auto

Crib Bumpers
Crib Mattresses
Curtains, PVC

Desk Sets
Diaper Bags
Dog Collars
Drapes, PVC
Dress Forms
Drill Bit Holders

Electric Blankets
Emblems, Decals PVC Transfers
Embossing Designs
Envelopes PVC

Eyeglass Cases
Eyeglass Temples

5-E
Flags
Folding Doors
Furniture
   Chair Backs & Seats
   Upholstered Cushions, Seats & Headboards

Golf Cart Cushions
Golf Club Covers
Gun Belts & Holsters
Garment Bags

Hair Dryer Hoods
Handbags
Handles, Luggage, Handbags
Hat, Wig & Wiglet Boxes
Headrests
Honeycomb Curing
Hunting Gear & Cloths

Industrial Gloves
Inflatable Products Beach, Camping
Inflatable Structures

Key Cases
Kits, Tools, Packaging

Labels
   Transfer Labelling
Lawn Furniture; Pads, Covers
Lettering for Sports Jerseys & Athletic Equipment
Life Jackets, Vests & Floats
Looseleaf Binders
Luggage Bindings, Linings & Pockets

Mats
Medical Products
   Catheters
   Bags; Colostomy, Ileostomy, Enema, Urinal
   Pulsating Mattresses
Metal-Vinyl Clad/Adhesive

5-F

Movie Screens

Notebooks
Nuclear Fallout Protection
   Garments & Equip. Covers

Outdoor Furniture Pads & Covers
Oxygen Breathing Tents

Packaging
   Ball Bearing
   Blister
   Candy
   Clam Shell
   Commercial
   Cosmetics
   Drug
   Hardware
   Stamps
   Tools
Pads
   Beach
   Chaise Lounge
   Crib
   Gymnasium
   Heating
   Patio
   Play Pen
   Pool
   Seat
   Station Wagon
Paper Cups, Cartons & Containers
Paper Drying

Photo Albums
Place Mats & Coasters
Pocket Protectors
Pocket Secretaries
Pool Covers
Pool Liners, Swimming , Chemical
Portfolios
Powder Puffs
Protective Clothing, Gloves
Purses

Quilting, Vinyl Synthetic Fabrics

Record Envelopes, PVC Reinforced Plastic
Pultrusions
Ribbons for Typing Packages

Safety Equipment
Salt Water Conversion Kits
School Supplies
Shoe Components
- Bow, Ornaments
- Heel Pads
- Insoles (Plain & Topical)
- Ornaments
- Seal & Cut
- Shoe Embossing
- Shoe Trim
- Shoe Uppers
- Shoe Vamps
- Sock Linings

Shower Curtains
Signal Flags; Safety, Highway
Sporting Goods Accessories
- Athletic Bags
- Bowling Bags
- Golf Club Covers
- Gun Cases
- Stadium Cushions

Sterilizers
Sweaters
Stationery Products
Tablecloths, PVC
Tarpaulins
Teething Rings
Tents
Tool Kits, Industrial
- Packaging

Toys,
- Beach Balls
- Dolls
- Game Kits
- Gun Belts, Holsters & Cases
- Inflatables
- Kites

Travel Cases
Truck Covers

Umbrellas
Umbrella Covers

Waders
Wading Pools
Wallets, PVC
Water Beds
Water Filled Head & Eye Pads
Window Shades

Zipper Bags
Zipper Reinforcements
Zippers

BARSEALING SUPPLEMENT

TECHNICAL BULLETIN #241

HIGH FREQUENCY WELDING OF TARPAULINS, AWNINGS, SWIMMING POOLS,Etc.

1. RECOMMENDED EQUIPMENT:

10Kw, 15Kw or 20Kw, High Frequency Technology Series HFT/OSHAPAL1 shielded barsealing machines are selected for most applications. Usually, when welding a 20oz. heavyweight material, a sealing area of 5 sq. inch/kilowatt may be realized, and consequently a 10Kw output heatsealing machine will have sufficient power to weld a 1" x 50" bar seal area. (50 sq. in.)

However, this factor of 5 sq. inches/kilowatt, (when using 20oz. heavyweight material) should be considered only as a guide line since the sealing capability of various materials is dependent upon type, grade and manufacturer.

For most applications a 10Kw output heatsealing machine would be the most suitable type of equipment.

Welding presses for bar sealing applications are generally manufactured with a "deep throat" press clearance of 24". This is more than adequate for handling 48" wide materials through the throat of the press.

Standard bar sealing equipment is normally equipped with a 1" x 50" electrode, bar holder, and suitable welding surface such as a precision ground workbed; usually an "I" beam reinforced bedplate with dimensions of at least 4" x 54" in length.

2. WELDING ELECTRODES:

Welding electrodes are supplied in various configurations such as solid, serrated; and double spaced parallel bar seal widths up to 2" wide.

Specialized electrodes having a double spaced bar sealing pattern may also be constructed so that there are no electrical connections to the

upper
super structure of the bar sealing press, leaving the entire press throat
area free for material handling.

Electrodes may be assisted in their performance characteristics by either
thermal heat assist or temperature stabilization controls, and the
selection of either method is dependent upon the nature of the materials
to be welded and end use of the product to be fabricated.

The High Frequency Technology Co., Inc. Series HFT-OSHAPAL1 "deep throat"
bar sealing press is supplied with an exclusive shielded press design
to minimize stray RF radiation.

3. **MATERIAL HANDLING EQUIPMENT:**

There are many approaches and production methods utilized in the welding
of large area covers, tarpaulins, etc.

The three basic material handling methods are as follows:

A. The heatsealing machine is stationary, installed in a fixed position
with reference to a large material lay-up table. The table may serve
a dual purpose for cutting fabric and handling sections through the
bar sealing equipment for welding. The table is sufficiently large
enough to handle the normal length of fabric to be welded along the
longest seam.

B. The heatsealing machine is stationary with reference to a moveable
lay-up table (or conveyorized system) onto which the fabric to be welded is pre-positioned and then indexed through the heatsealing machine.

C. The third generally accepted method for bar sealing production

requirements utilizes a "trolley" onto which the heatsealing machine is mounted; which then rides on a track alongside the large stationary lay-up table. The trolley is generally motorized with a "forward-reverse" drive mechanism carrying both the operators and equipment alongside the edge of the material lay-up table. The press bed (working bed) of the heatsealing machine is generally positioned so that it rides underneath and alongside the leading edge of a metal extension on the lay-up table so that it is possible to pre-position the material, align it accurately, and held in a stationary position so that it may be welded as the heatsealing machine is moved in seal length increments on the trolley.

Of the three systems, the motorized trolley method is preferable since it is generally faster and requires less floor space.

4. **MATERIAL ALIGNMENT METHODS & FIXTURES:**

There are several methods utilized for the alignment of materials in order to easily facilitate "over-lap" seam welding of laminated and coated fabrics.

A. The simplest method consists of very basic and elementary guide marks or edge guides affixed to the surface of the working bed of the heat-sealing machine; properly spaced for the desired overlap seam width.

B. Automatic material positioning gauges (drop guides) are also utilized when upon being actuated by the machine operators will release a "gate" or edge guide to properly position the two layers of material for the appropriate overlap seam width.

This method is not widely used since it requires an extra action or effort by the heatsealing machine operator and lowers the overall production output rate.

C. A more sophisticated type of alignment employs the use of a vacuum holddown material positioning fixture which, although considered to be more accurate and sophisticated, generally requires the use of expensive vacuum pumps, gauges and controls. There is also the danger of reverse flow when using oil type vacuum pumps which could saturate the work bed area with a film of oil/lubricant in the event of malfunction.

D. The use of light projectors and/or lasers is a more preferable method since alignment marks could be projected and focused on the work surface of the heatsealing machine (or materials) and do not require any secondary action or effort by the machine operator.

Laser projectors, standard equipment on all High Frequency Technology "OSHAPAL/1" Barsealers, of this type have been used in the past and are proven to be highly successful.

5. **PRODUCTION SPEEDS:**

The normal welding time for any given heatsealing machine usually varies from 1 to 4 seconds depending upon the type of material, area of seal to be made and size of high frequency generator. Although the seal time is relatively short, the material handling of the fabric through the bar seal press consumes most of the production cycle.

Although it has been said that up to five seals per minute can be achieved through the 48" bar sealing press, a more conservative estimate would approach three welds per minute, when taking material handling time into consideration, and would be more accurate.

Increasing the length of the bar seal from 48" to 54", 60", 72" or 84" is not necessarily the solution to increased production output since the material handling and lay-up time for very long bar seals usually reduces overall production output.

Shorter bar seals are always possible with standard bar sealing equipment, inserting sub-liners underneath the materials or buffer materials on the heatsealing machine.

A point to always consider is that as the seal width is increased, the seal length is decreased in order to maintain the proper sq.in. of seal area/Kw output ratio. Therefore, the production output (sealed lineal feed of seam welds) will decrease with seams requiring a wider weld and consequently a shorter sealing increment. The alternative is to utilize higher powered R.F. generators in order to avoid reducing the seal

length increment as the width increases.