Sterile Medical Device
Impulse Sealer Validation:
Trials and Tribulations

Jan Gates
PackWise Consulting

March 14, 2013
General Outline

- Validation review
- Sealing review
- Sealing elements/information required for validation work
- Commonly seen issues discussed
- Testing: equipment, method and people
- Validating
- Questions
Validation Principals Review

- FDA Process Validation General Guidance Document:
  - quality, safety, and effectiveness must be designed and built into the product;
  - quality cannot be inspected or tested into the finished product; and
  - each manufacturing process step must be controlled to maximize the finished product probability for meeting all quality and design specifications
Pouch Seals and Validation Review

- Pouch seals cannot be continuously tested; therefore, the seal made must be made on a validated process.
- The manufacturing process must be controlled.
Sealing Review

- Seal occurs when the hot materials melt and cool together

- Three sealing parameters**
  - Time
  - Temperature
  - Pressure

**Vacuum/gas flushing may affect sealing, when used → test to see with the product included
Impulse Heat Sealers?

- Safer than continuously on hot bar sealer
- Allows pouch seal to be handled quickly
- Low power consumption
- Typically lower initial equipment costs
- Quick and repeatable calibration
- Generally an easy validation
- Larger range of materials useable
- Maintenance required easier to see
We Have a Sealer
We have Pouches
Let’s Validate Sealing
User Requirements, examples

- Regulatory
- Materials sealing
- Sterilization effects, if applicable
- Stability required
- Seal type
- Testing
- Production requirements
- Use environment
- Performance requirement
Regulations: *FDA Quality System Reg*

- Design controls: 820.30
- Production and process controls: 820.70
- Inspection, measuring, and test equipment: 820.72
- Device packaging: 820.130
- Storage: 820.150
- Distribution: 820.160
- Installation: 820.170
- Statistical techniques: 820.250
Regulations: European

- **Medical Device Directives**
  - *ISO 11607-1/-2*: packaging requirements validations
  - *EN 868-2 to 10*: making pouches
  - *EN ISO 11135-1*: worst case loads
  - *Soon: ISO 16775, based on AAMI TIR22*

- **Packaging and Packaging Waste Directives**
  - *ISO 18601*: packaging and the environment
  - *ISO 18062*: packaging optimization
Materials

- Tyvek to Tyvek
- Tyvek to Olefin coated Nylon or PET
- Tyvek to something else
- Olefin coated nylon, PET, foil, paper, or other
- What type of Olefin:
  - LDPE
  - LLDPE
  - Additives: EVA, Surlyn, antistatic, blocking agent, or something else
- Other
Stability

- **Sterilization affects**
  - AAMI TIR 17 and suppliers are helpful

- **Aging**
  - Brittle, bloom, static, ultra-violet light, etcetera

- **Storage temperatures**
  - Before and after pouch use

- **Seal Type**
  - Tack (peel) or weld seal
  - Multiple bands, ridges, cross hatch, other

- **Product exposure**
  - Changes with time, light, temperature, other
Seal Type

- Basically two:
  - Weld
  - Tack/Peelable

- Other options:
  - Patterns in the seal
  - Multiple lines
  - Heating band shape
Seal Testing

- Visual test (ASTM F1886)
- Seal test (ASTM F88)
- Burst test (ASTM F2054, restrained, and ASTM F1140, unrestrained)
- Dye penetration (ASTM F1929)
- Pressure decay (ASTM F2095)
- Other
Seal Testing Notes:

- Seal strength testing on a one inch wide coupon
  - Seals are generally wider than one inch
- Multiple seal coupons on one seal needed
  - Depends
- Entire seal length tested for a continuous seal Seal failure at sealant layer or adhesive layer
  - May be important
- Seal strength may change with sterilization
Production Requirements

- Seals made per day
- Cooling time required
- Preventative maintenance (PM)
- Testing after PM
- Training/trouble shooting
- Pouch insertion
- Handling after sealing
- Vacuum/flushing
- Product fit
Use environment

- Clean room/classification
- Power
- Air
- Gases/Vacuum
- Heat exchange system(s)
- Safety features
- Pouch guidance features
Performance Requirements

- Storage
- Handling
- Distribution environment
- Customer use
User Requirements Done—Let’s Validate Sealing
Before Equipment Installation

- Know your impulse sealer basics:
  
  - Cushion
  - Bar
  - Thermocouple
  - Spring
  - Heating wire/band
  - Non-stick covering
  - Other bar side

![Diagram of impulse sealer components](HealthPack)
Equipment Basics

- Bars parallel
- Bars flat
- Bars aligned
- Spring flexible
- Heater wire/band length
- Cushioning flexible
- Non-stick covering on both sides
Pressure #1

- Consistent and even pressure
Consistent and even pressure

Pressure #2

Pressure #3
Bars and Seal Cooling

Bar
Cushioning
Heater Band
Non stick covering

Non-stick covering
Cushioning
Bar
Thermocouple

- Placement, type, attachment, response time
Thermocouple Response Time
Cushioning

- Often called: silicon rubber
- Important to know:
  - Durometer
  - Thickness
  - Shelf life/aging
  - Consistency
Non-Stick Covering

- Often called: Teflon or glass webbing
- Important to know:
  - Weave
  - Coating
  - Thickness
  - Adhesive placement
Notes on Preventative Maintenance

- Do not depend on line workers to see all issues
- Consumable equipment parts:
  - use validated parts or revalidate
  - set-up equipment checks with replacements
  - shelf life must be considered
- Moving parts must be monitored
- Flat, parallel, and perpendicular surfaces must be monitored
- Process monitoring needed for seal strength drifting
Equipment Installed and Operating

- **Installation Qualification (EIQ)**
  - Powers up
  - Jaws close
  - Bars flat, parallel, aligned
  - Other options
  - Alarms work
  - Safety features function
  - Other

- **Operational Qualification (EOQ)**
  - Minimum/Maximum temperature
  - Pressure consistency
  - Timing range
  - Other options
Packaging Equipment, EOQ

- Equipment Operational Qualification (EOQ)
  - Keep process development and packaging qualifications activities separate from EOQ

EOQ Parameters

Material Sealing Parameters

<table>
<thead>
<tr>
<th>Low</th>
<th>Material 1</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Material 2</td>
<td>High</td>
</tr>
</tbody>
</table>

HealthPack
IQ/OQ Done – Let’s Validate Sealing
Develop Sealing Parameters

- Determine sealing parameters
  - Design of experiment (DOE) best
  - Testing from no seal to burnt seals
  - Find the maximum and minimum settings
Under/Over Seal Limits
Notes on Seal Testing

- Validate the test method at the laboratory
  - Cut sample coupons correctly
  - Mount coupons for testing correctly
  - Understand the test curve
  - Test peak or average
  - Calibration correct on test equipment
- Use statistical samples sizes and analysis
- Burst strength based on acceptable seal strength
Seal Parameters Set – Let’s Validate
Sealing Equipment

- How many sealers validating?
  - One sealer, continue on
  - Validating more than one sealer
    - Decide whether validating each sealer or grouping
    - If grouping sealers must determine whether the equipment all seal the same
      - *Normally the same model sealers do not seal alike*
      - Often easier to validate equipment individually than group but not always economical

- Validate to the process using
Let’s Validate the Sealing
Validate the Sealing

- Engineering tests conducted with product or simulated product first
- Write protocol and document
  - Sealing parameters
  - PM, equipment change parts
  - Document calibration
  - Process speed
  - Materials used
  - Acceptance criteria
  - Statistical analysis
Statistical Notes

- Magic sampling number does not exist
- Magic minimum seal strength does not exist
- Statistical analysis relies on normal data distribution
  - Seal strength data is often not normal
  - Transforming seal strength data does not always work
  - Have a plan for non-normal data in the protocol
- Statistical sampling dependent on a company’s acceptable risk level
Packaging System OQ/PQ
Process Monitoring

- Required by the FDA and ISO Standards
- Process monitoring ≠ minimum seal strength
- Tests used:
  - Visual
  - Seal strength or burst strength
  - Pressure decay
  - Others
- Periodic review
Summary

- The manufacturing process must be controlled
  - Know your equipment
  - Set up appropriate PM
  - Validate testing methods
  - Determine the sealing limits and set production process well within
  - Monitor the process
- Test an appropriate sample size for OQ and PQ
Thank You for Pictures and Comments

- PackWorld USA (Sealers)
- Accu-Seal Corporation (Sealers)
- Sencorp White (Sealers)
- VanderStahl (Sealers)
- Vertrod (Sealers)
- Beacon (Pouches)
- Oliver Tolas (Pouches)
- Mangar Medical Packaging (Pouches)
Questions?
Jan Gates
Phone/Cell: 650.743.5780
E-mail: jan@packwiseconsulting.com
Website: http://www.packwiseconsulting.com/
Based in Temecula, CA