MesaLabs

QS-509 Validation Summary
ProLine Product Line

Executive Summary

The ProLine manufacturing process is validated according to QS-501 *Validation Master Plan for the Mesa Labs, Inc., Bozeman Manufacturing Facility 625 Zoot Way*.

The ProLine process, under anticipated conditions, will consistently produce product that meets pre-determined specification requirements.

Process Performance Qualification

Process Performance Qualification (PPQ) conducted under Protocols:

- Protocol #180204P *Performance Qualification for the Manufacture of Industrial BIs – Absorptive Carriers.*
- Protocol #180205P *Performance Qualification for the Assembly and Packaging of ProLine.*

This PPQ qualifies manufacturing of catalog number PL-3-6-15 at 625 Zoot Way, Bozeman MT 59718.

Validation Lots

PL-3-6-15; GST log 6 paper disc 15ct/box, Lot PL-001

Rationale for selection of products

ProLine manufacturing is a multi-phase process: inoculation of paper carriers, packaging in glassine envelopes, qualification testing and packaging. The inoculation phase consists of distributing a known quantity of bacteria onto the paper carrier. Then the inoculated carriers are packaged in glassine envelopes. Once packaged, the carriers are subjected to qualification testing consisting of population and resistance testing. The results are used to generate the label claim for each lot of product. After qualification testing is completed the carriers are assembled and packaged. Satisfactory completion of the qualification testing results in release of catalog #PL-3-6-15 for distribution.

- The components used to manufacture this lot is representative of the components used to manufacture all lots of ProLine.
- One lot with three work order releases was considered sufficient to simulate conditions that will be encountered during routine manufacturing, such as start-up, shut-downs, breaks, and manufacturing over multiple days.

As compared to the manufacturing process prior to transfer to the new facility, there were no changes to the manufacturing process, no changes to specifications, and no changes to components or component suppliers. Procedures were renumbered to align with the quality system, and a number of minor changes occurred to allow for slightly different workflow in the new facility; they otherwise remained unchanged.

Acceptance criteria and results

One lot of inoculated product and three work orders releases of assembled units meeting the criteria provided below were required to confirm that the ProLine manufacturing process, under anticipated conditions, will consistently produce product that meets pre-determined specification requirements.

For the QA final inspection per QSWI-103, the Acceptable Quality Level (AQL) for acceptability of a particular lot's inclusion in this qualification was based on criticality and frequency of the defect. If the lot in question fell within these established limits it was deemed acceptable for use as a validation lot. The defects were divided into two tiers. Defects considered *Critical to Performance* were assigned an AQL of 99%. Defects considered as having *No Impact to Performance* were assigned an AQL of 95%. Results are reported below for each validation lot.

Inoculated Product and Qualification Testing

PL-3-6-15, Lot PL-001		
Critical to Performance	**Results**	**Pass/Fail**
Population on assayed carriers must be the targeted population log: Log6	$2.0x10^6$	PASS
Steam resistance at 121°C in the range of 1.5-3.0minutes	2.5minutes	PASS

Assembly and Packaging of Finished Product

PL-3-6-15, Lot PL-001 Work Order #023247		
Critical to Performance	**Results**	**Pass/Fail**
Primary/Secondary Labeling, specific to product traceability (lot number and expiration)	0 labeling errors	PASS
No Impact to Performance	**Results**	**Pass/Fail**
Inclusion of C of A in package	0 packages without a C of A	PASS
Quantity per box: 15pk box	One box out of 100 total boxes had 16 units instead of 15 units (ZT-NMR-1876). The lot still met the 95% AQL.	PASS
No breakage visible inside the package	No visible breakage was identified during final inspection	PASS

PL-3-6-15, Lot PL-001 Work Order #023248		
Critical to Performance	**Results**	**Pass/Fail**
Primary/Secondary Labeling, specific to product traceability (lot number and expiration)	0 labeling errors	PASS
No Impact to Performance	**Results**	**Pass/Fail**
Inclusion of C of A in package	0 packages without a C of A	PASS
Quantity per box: 15pk box	Confirmed to be within acceptable range	PASS
No breakage visible inside the package	No visible breakage was identified during final inspection	PASS

PL-3-6-15, Lot PL-001 Work Order #023249		
Critical to Performance	**Results**	**Pass/Fail**
Primary/Secondary Labeling, specific to product traceability (lot number and expiration)	0 labeling errors	PASS
No Impact to Performance	**Results**	**Pass/Fail**
Inclusion of C of A in package	0 packages without a C of A	PASS
Quantity per box: 15pk box	Confirmed to be within acceptable range	PASS
No breakage visible inside the package	No visible breakage was identified during final inspection	PASS

Deviations to protocol

There were two deviations encountered during the execution of protocol #180205P.

- 180205P-D-001; section 5.1 of the protocol stated "Three work order releases each consisting of ~1500 ProLine units will be assembled and packaged. Due to a shortage of component 79-03067 'ProLine Brown Cone' the third work order was reduced to 50 boxes. There is no negative impact. The three work orders totaled together required staff to manufacture 3750 individual units of ProLine which provides a substantial multiple day challenge to the A&P staff and is representative of varying work order release sizes based on customer demand.
- 180205P-D-002; this protocol was specific to the assembly and packaging portion of the ProLine manufacturing process, protocol 180204P covered the inoculation and testing of the paper carrier. Per a planned deviation the results of the inoculation and testing of the paper carrier will be issued

in this report rather than the report for 180204P. There is no negative impact. Reporting the results for the entire manufacturing process in a single report is a positive change that results in all information housed in a single central report.

Method Verification

The following Compendial Method Verifications were completed as part of this protocol:

- Population assay testing of paper carrier biological indicators per ISO 11138-1 and Mesa procedure LP-305.
- Steam resistance testing on paper carrier in glassine envelopes per ISO 11138-3 and Mesa procedure LP-302.

Equipment Qualification

The following equipment qualifications were completed in order to execute this protocol:

Equipment Number	Equipment	Qualification document(s)	Protocol Deviations	Conclusion
STZ-101	Steam Autoclave	STZ101-IOQ-001	None	The Steam Autoclave has been installed successfully. The installation, operation, and performance criteria have been met.
		STZ101-PQ-003	None	
DPM-101	Dot Punch Machine	DPM101-IOQ-001	None	The Dot Punch Machine has been installed successfully. The installation and operation qualification criteria have been met.
RES-101	Steam Resistometer	RES101-IOQ-001	None	The Steam resistometer has been installed successfully. The installation and operation qualification criteria have been met.
RES-109	Steam Resistometer	RES109-IOQ-001	None	The Steam resistometer has been installed successfully. The installation and operation qualification criteria have been met.
INC-103	30-35°C Incubator	INC103-IOQ-001	None	The 30-35°C incubator has been installed successfully. The installation and operation qualification criteria have been met.

Equipment Number	Equipment	Qualification document(s)	Protocol Deviations	Conclusion
INC-105	55-60°C Incubator	INC105-IOQ-001	None	The 55-60°C incubator has been installed successfully. The installation and operation qualification criteria have been met.

Utility Qualification

The following utility qualifications were completed in order to execute this protocol:

System Number	Utility	Qualification document(s)	Protocol Deviations	Conclusion
AIR-101	Compressed Air System	AIR101-IOQ-001	None	The Compressed Air System has been installed successfully. The installation and operation qualification criteria have been met.
STM-101	Steam System	STM101-IOQ-001	None	The Steam System has been installed successfully. The installation and operation qualification criteria have been met.
WPU-101	RO/DI Water System	WPU101-IOQ-001	None	The RO/DI Water System has been installed successfully. The installation and operation qualification criteria have been met.
		WPU101-PQ-002	Six deviations, described below. No impact to protocol	The RO/DI water system meets acceptance criteria. Data confirmed that the system generates water that meets or exceeds Type II RO/DI water specifications

Deviations to WPU101-PQ-001:

- WPU-101-PQ-001-D-01 was opened to document that microbial data gathered before 11Jul2017 were determined to be invalid, as it was discovered that the filters used for testing were not sterile. No impact to the protocol; the required 30 business days of testing was completed.

- WPU101-PQ-001-D-02 was opened for using expired test strips to record the ozone levels. Data were invalidated. No impact to the protocol; the required 30 business days of testing were completed.
- WPU101-PQ-001-D-03 was opened for having a detectable level of ozone present in the water when ozone wasn't being generated. Data was invalidated. No impact to protocol; the reason ozone was detected was that Facilities had run the ozone cycle less than 90 minutes before the testing was performed.
- WPU101-PQ-001-D-04 was opened to document that the form used to record data for this study included an action limit for a sampling point before the RO tanks. No action limit should have been set, as this data was being gathered for information only, is not part of the RO system, and was not included in the performance qualification. No impact to the protocol, as all data required for the protocol were gathered and are reported.
- WPU101-PQ-001-D05 was opened to document that all microbial testing was performed at 10 Evergreen Drive instead of at 625 Zoot Way. No impact to protocol; testing was performed and documented according to procedures and forms identified in the protocol.
- WPU101-PQ-001-D-06 was opened to document that microbial samples were incubated at room temperature instead of in a 20-25°C incubator as specified in the protocol. No impact to protocol; room temperatures were confirmed to have remained within 20-25°C for the period of the study.

Standard Operating Procedures

The protocol was executed under the following standard operating procedures:

Document Number	Revision	Title
LP-205	3	Preparation of Spore Dilutions for Production
LP-209	1	Hand Inoculation
LP-302	3	Resistance Determination of Biological Indicators
LP-305	3	Population Assay of Biological Indicator Products
LP-404	1	Operation of Steam BIER Vessels
LP-431	1	STM Disc Punch Machine
AP-203	2	Hand Assembly of Biological Indicators
AP-102	1	Printing Labels with the Brady Printer
QSWI-103	1	QA Release of Finished Product Inventory

Training

The operators in the table below completed qualification training on the SOPs identified above during the PPQ.

Operator	Procedure(s)	Status of read-and-understand training on SOPs	Status of qualification training on SOPs
DS	LP-205, LP-209, LP-302, LP-305, LP-404	Complete	Complete
NA	LP-205, LP-302, LP-305, LP-404	Complete	Complete
EA	LP-205, LP-209, LP-302, LP-305	Complete	Complete
AS	LP-302, LP-305, LP-404	Complete	Complete
RM	LP-302, LP-404	Complete	Complete
CV	LP-205, LP-209	Complete	Complete
DG	AP-102, AP-203	Complete	Complete
LG	AP-203	Complete	Complete
ES	AP-203	Complete	Complete
EA	AP-203	Complete	Complete
HG	AP-102, AP-203	Complete	Complete
NF	AP-102	Complete	Complete
CS	AP-203	Complete	Complete
KM	AP-203	Complete	Complete
VK	AP-203	Complete	Complete
HR	AP-203	Complete	Complete
DF	AP-203	Complete	Complete
GS	AP-203	Complete	Complete
JW	AP-203	Complete	Complete
KR	AP-203	Complete	Complete
JS	AP-203	Complete	Complete
BT	AP-203	Complete	Complete
CW	AP-203	Complete	Complete
ED	AP-203	Complete	Complete

Approvals:

Validation:_____ Date: 17 JUL 2018

Kurt McCauley - Director of Manufacturing

Production:_____ Date: 16 JUL 2018

Robert Bradley - Director of Manufacturing

QA:_____ Date: 17 JUL 2018

Jole Wilson – QA Manager