Superior
Dual Laminate Products

How to Improve Dual Laminate Equipment Quality

through Risk Assessment & Implementation of ISO 9001:2015

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KNIGHT
MATERIAL TECHNOLOGIES

PLAN THE WORK,

WORK THE PLAN!

Contents

- **Overview of ISO 9001:2015 Functions**
  - Risk Assessment of Critical Operations
  - Establishing Quantifiable Company Goals & Objectives
  - Performing Quarterly Business Review Mtgs
  - Meaningful Non-Conformance and Corrective Actions
- **Key Risk Reducing Areas of Primary Concern**
  - Determining Customer Requirements & Expectations
  - Welding and Joining of Component Parts
  - MOC Selection and Procurement
  - Ability to train/execute thermoforming, layup and assembly
  - Charting and Gathering Customer Feedback
- **Direct Improvements as a Result of Implementing ISO**
  - Customer Survey - Points to the need for new mandrel – Increased satisfaction
  - Improvement of Work Instructions (WI) – combines molding & joining steps
  - Charting Rework – Points to delays in tank leg assembly – improves delivery time
  - Review of Work Instruction – reduction in % weld seams in tank lids/bottoms
  - Customer Return – Cracked flange during shipment – overhaul of all packaging
  - Recorded production logs - More consistent VE batch mixing - Barcol Hardness
  - Internal Audit – Relocate Dimension Tolerances Chart from wall to shop Dwgs

CERTIFICATE
OF REGISTRATION

This is to certify that

SUPERIOR DUAL LAMINATES (KMT CANADA) LTD

1621 Langan Avenue, Port Coquitlam, British Columbia V3C 1K6 Canada

operates a

Quality Management System

which complies with the requirements of

ISO 9001:2015

for the following scope of certification

Specialty engineering and fabrication of FRP & dual laminate components.

Certificate No.: CERT-0143576
File No.: 1726918
Issue Date: October 31, 2022

Original Certification Date: November 9, 2021
Certification Effective Date: November 9, 2021
Certificate Expiry Date: November 8, 2024

Calin Moldovean
President, Business Assurance
SAI Global Assurance

ISO 9001

Say what you do!

Do what you say!

Prove it!

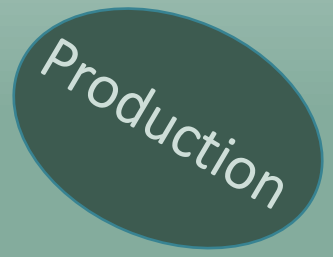
Risk Assessment of Critical Operations

1. Types of Risk to consider
    a. Customer Risks – directly impact customer satisfaction
    b. Strategic Risks – directly impact roles of Mgmt
        - should include a SWAT Analysis
    c. Operational Risks – directly impact the product
    d. Financial Risks – directly impact a company's bottom line

2. Risk analysis for each step of the operation
    a. Mapping (flow chart) of Critical Processes
    b. Risk Identification
    c. Risk Analysis: High, Medium, or Low
    d. Risk Evaluation
    e. Risk Control

Mapping/Identification of Critical Operations

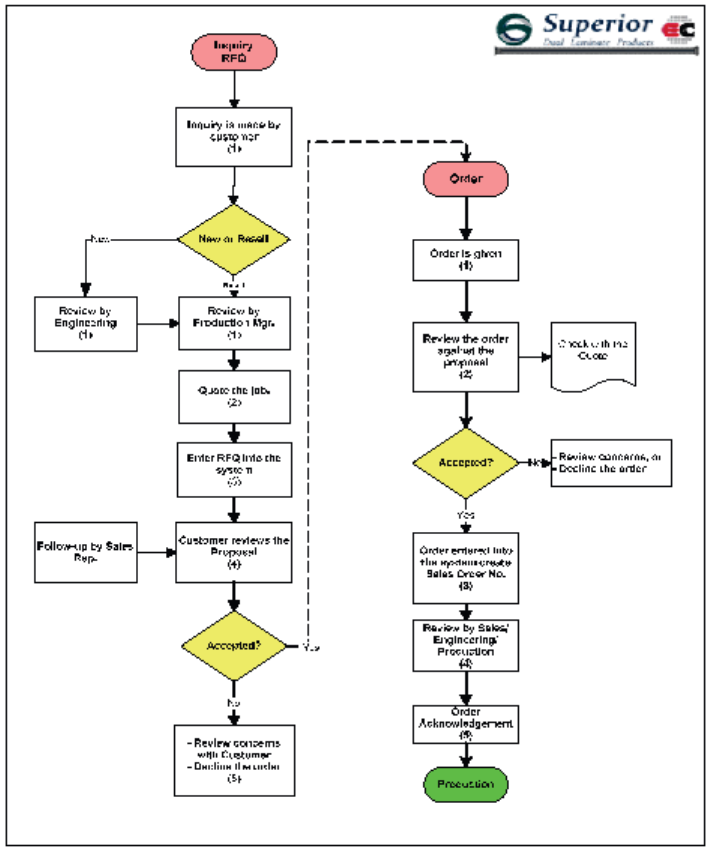
Sales	Technical Review of Specifications; comparing, contrasting, establishing scope
Purchasing	Vendor relations, procedures, review BOM,
Receiving	Receipt of purchased goods, inspect, record, label
Production	Mfg of DL components, assembly of spools, batching of resin, training, inspection
Inspection	Paper flow, inspection of semi-finished goods, sign-off, reporting
Shipping	Procedures, Packaging, inspection, shipping



Mapping/Flow Chart of Critical Processes

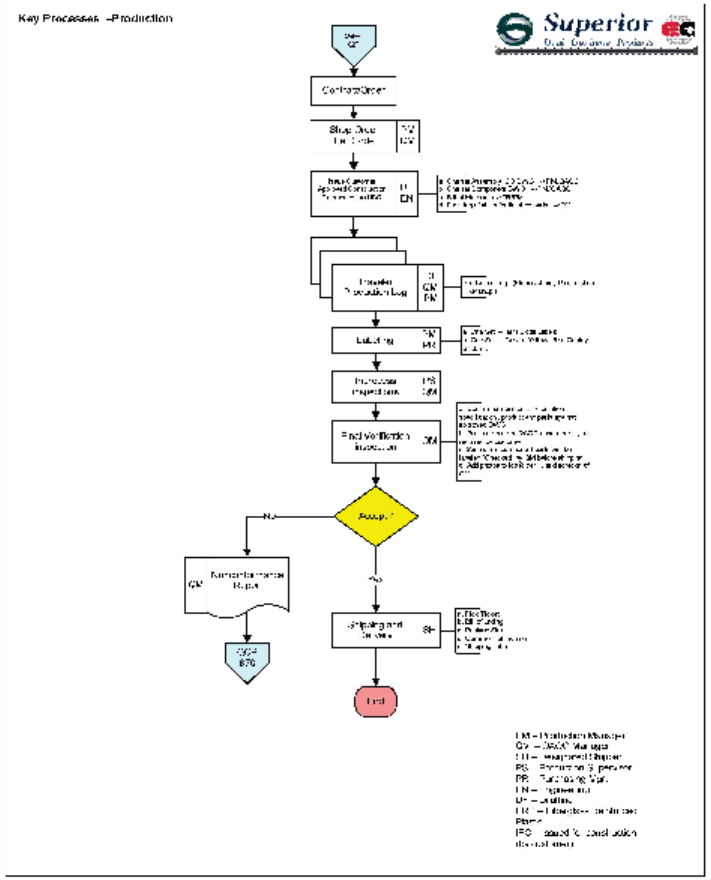
Superior	Quality Operational Procedure	QOP- 820
		Revision: 0
	Customer Related Processes	Date: 2021-02-09
		Page: 4 of 7

5.2 Sales Process – Flowchart



Superior	Quality Operational Procedure	QOP- 850
		Revision: 2
	Production Processes	Date: 2021-07-08
		Page: 7 of 8

5.9 Production - Flowchart



Each Identified Risk must be prioritized and rated:

HIGH MEDIUM LOW

Critical Processes Identified:

SIX

Critical Production Processes Identified:

FORTY-FIVE

Controlling & Reducing the Risk

- **Determining Customer Requirements & Expectations**
  - Technical Sales Review Format
  - Charting and Gathering Customer Feedback – Surveys, audits, deliveries
- **Process Work Instructions – Heart and Soul of QMS system**
  - Critical Risk - Welding and Joining of Component Parts
  - Must train regulary using the Work Instructions – Great time for revision
- **Must monitor and adapt to Internal & External forces**
  - Critical Risk areas – availability of raw materials, employment staffing
  - Internal & External forces will bring about changes to your QMS program

Example: Critical Operation - Purchasing

DIN EN ISO 15013

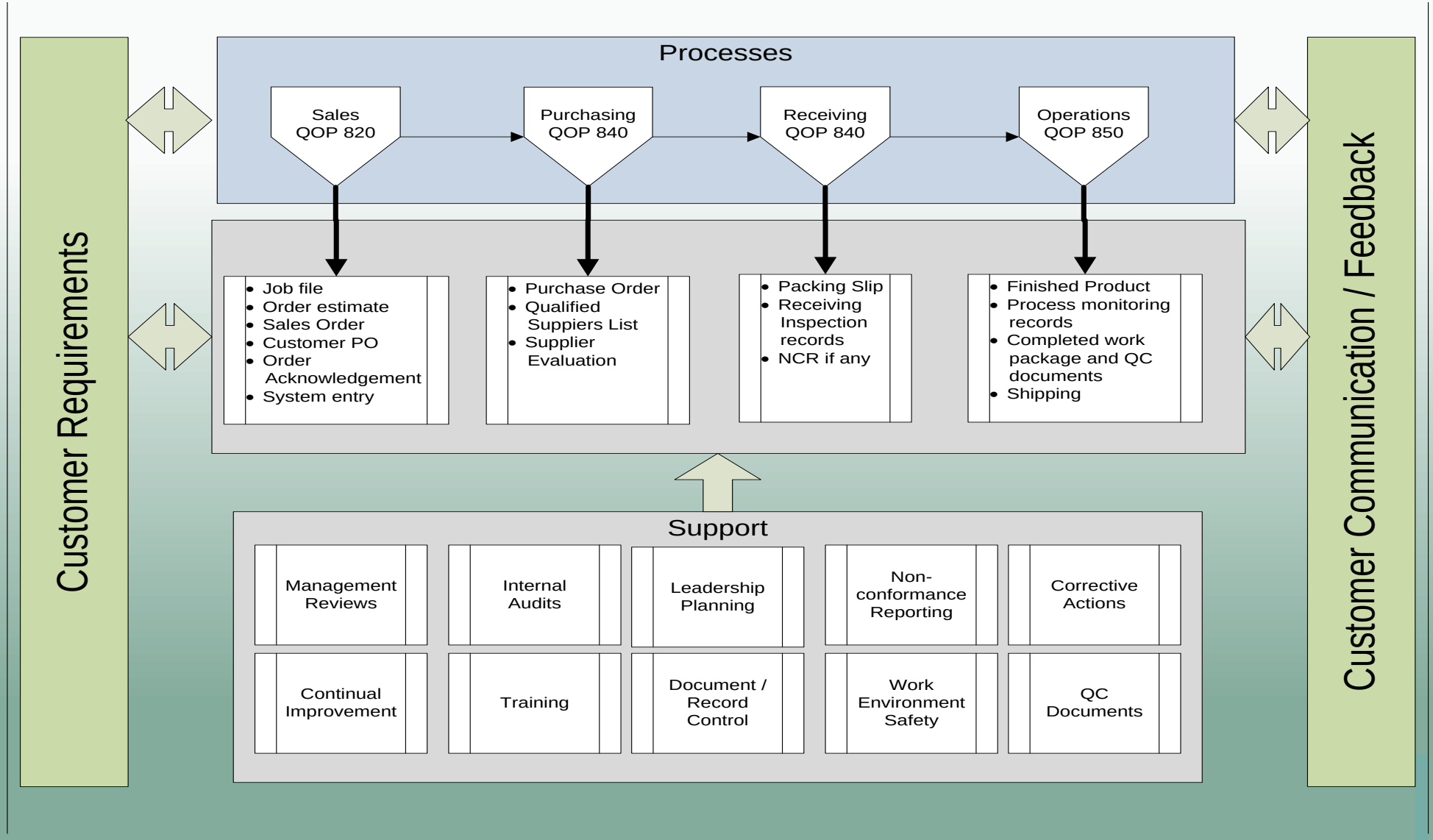
Table 2 — Mechanical and thermal properties

Property	Unit	Requirements (average values)							Test method subclause
		PP-H			PP-B		PP-R		
		Group 1.1 [a]	Group 1.2	Group 1.3	Group 2.1	Group 2.2	Group 3.1	Group 3.2	
Tensile stress at yield	MPa	⩾ 30	⩾ 30	⩾ 30	⩾ 25	⩾ 25	⩾ 20	⩾ 20	5.5
Tensile strain at yield	%	⩾ 9	⩾ 9	⩾ 8	⩾ 12	⩾ 8	⩾ 12	⩾ 8	5.5
Modulus of elasticity in tension	MPa	⩾ 1 200	⩾ 1 200	⩾ 1 200	⩾ 1 000	⩾ 1 100	⩾ 700	⩾ 800	5.6
Charpy impact strength of notched specimens [b]	kJ/m^2	⩾ 6	⩾ 6	⩾ 4	⩾ 15	⩾ 15	⩾ 15	⩾ 15	5.7
MFR (230 °C/2,16 kg)	g/10 min	0,2 to 0,7	0,2 to 1,0	—	0,2 to 0,7	—	0,2 to 0,7	—	5.8
Heat resistance	°C days	150 ⩾ 100	150 ⩾ 100	150 ⩾ 20	150 ⩾ 80	150 ⩾ 20	140 ⩾ 40	140 ⩾ 20	5.9

[a] Sheets of group 1.1 shall be manufactured only from extrusion compounds approved by all interested parties.

[b] Only valid for nominal sheet hicknesses $h_n \geqslant 4$ mm.

Internal & External Communications Impact Information Flow



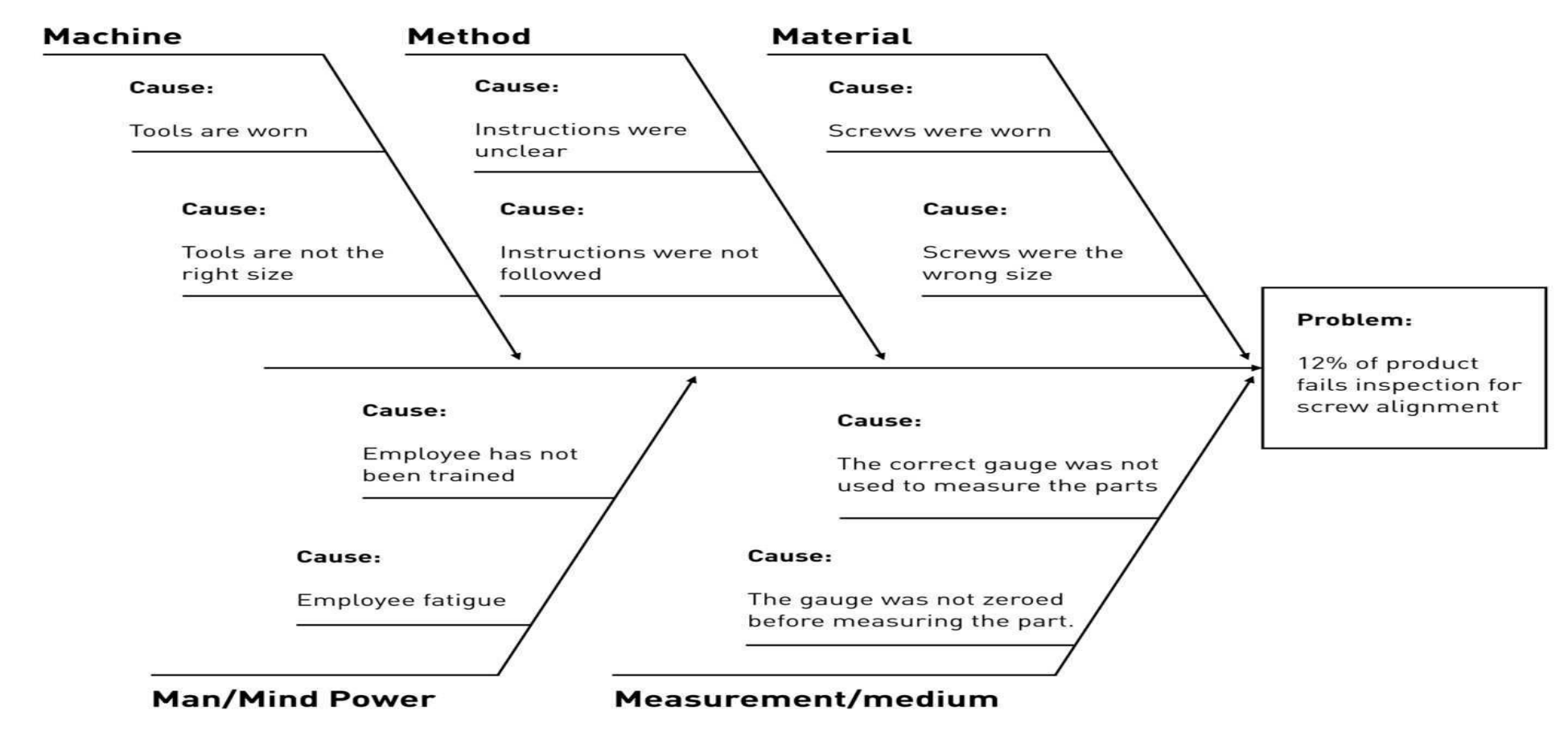
Quantifiable Goals & Objectives

- **Periodic Mgmt Reviews will Insure a Well Running Program**
  - **Customer Satisfaction – Monitor Customer Complaints – set a quarterly Goal**
  - **Customer Satisfaction – Monitor Customer Surveys – Ask “would you recommend“**
  - **Reporting of NCRs – Causation Analysis – set a Goal for NCR completions**
  - **Employee Training – Monitoring performance – Pareto Charting on Rework**
  - **Tracking Product Efficiency – monitoring budget vs actual; labor, R/M, rework**
  - **Tracking Ship Dates – monitoring lead times, backlog, deliveries**

Objectives		Measurements			Target date
		Metrics	Target	Actual	
Customer Satisfaction	Improve customer satisfaction	Review of Customer Complaints	< 2/Quarter	1	Annual
	Improve customer satisfaction	Feedback – Survey Responses as Agree and/or Strongly Agree	>95%	100%	Annual
Purchasing/ Receiving	Supplier Performance	Monitor critical supplier performance	>90% of them rated excellent / Good	95 % (Dec 22)	Annual
NCR	Reporting of NCRs	Analysis of NCRs	Closed in less than 3 months	All closed in Dec 2022	Annual
Training	Monitoring employee performance	Reduce number of mistakes.	Pareto Chart < 1.0 %	Pareto Chart < 1.0 %	On Going
Product Quality	Job efficiency (Labour and Materials)	ESTI Track Cost	>90%	97%	Quarterly
	Tracking mandatory delivery dates	PO and Backlog, NCR	>95%	98%	Quarterly

Importance of Non-conformance

Root Cause Analysis
Corrective Action Reports



Your future Quality, work instructions, and flow charts – depend on getting this RIGHT!

With your ISO 9001:2015 system Up and Running

Let the IMPROVEMENTS Begin!

Improvement #1
Reducing Potential Damage to Liner

ISO SOURCE: Customer Complaint from survey – the customer found minor surface scratches on the interior FEP lining.

Improvement: Created a collapsible mandrel which shrinks when removing the completed header.

Risk Reduction: Newly designed mandrel dramatically reduced the risk of damage & scratching of the soft Fluoropolymer lining. No complaints of scratching received since.

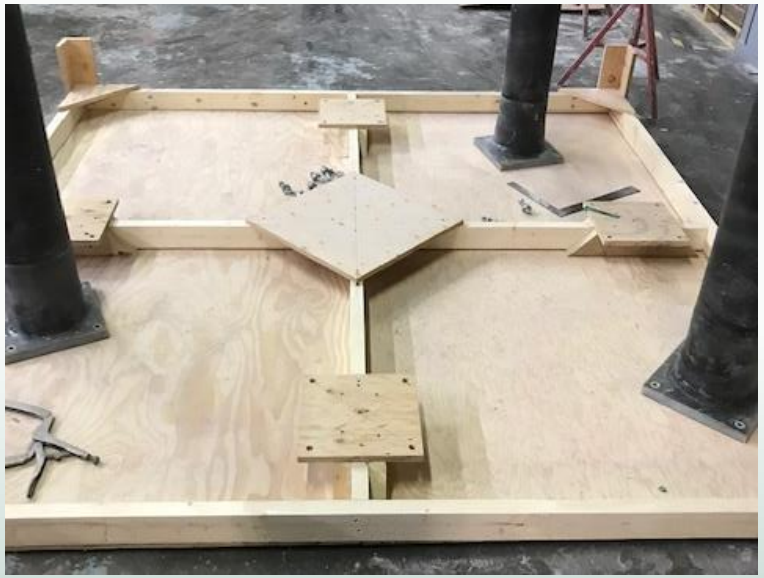
Improvement #2
Work Instruction modification for molding ECTFE Liner

ISO SOURCE: Creating the Fluoropolymer molding Work Instruction.

Improvement: Reduced the number of heat cycles from 2 to 1 by combining the thermoforming step with the longitudinal fusion step.

Risk Reduction: Customer benefited from less heat history, less chance of damaging thermoplastic liner. Customer/company benefited from lower costs, work instruction was changed to reflect the more efficient procedure.

Improvement #3
Day Tank Jig



ISO SOURCE: Tracking of Technician Efficiency – reducing delays

Improvement: Reduced the overall time of manufacture by 10 days.

Risk Reduction/Benefit: Jig holds all four legs simultaneously square and level. This reduces the risk to unevenness, need for rework, less potential for delay of project due to rework.

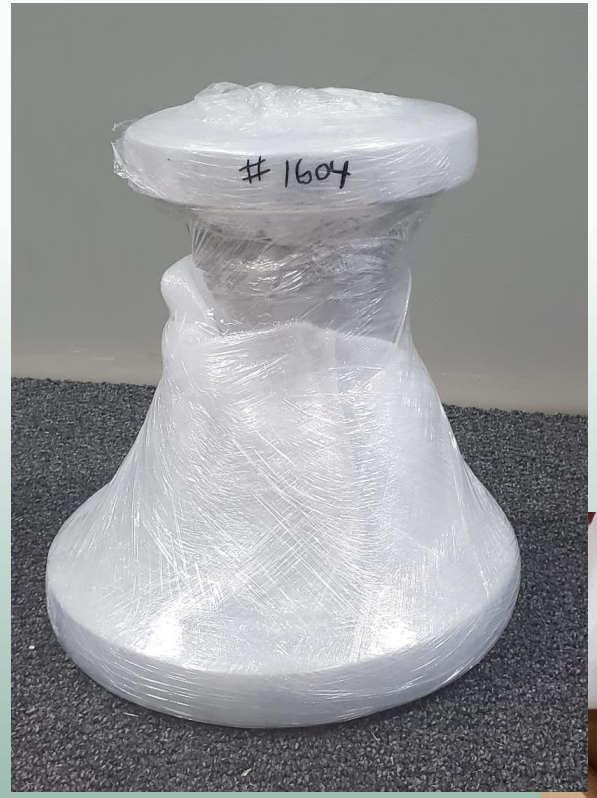
Improvement #4
Minimizing Weld Seams

ISO SOURCE: Review of Work Instruction – Supervisor level

Improvement: Reduce the amount of thermoplastic weld seams by 25%, from 8 to 6 petals.

Risk Reduction: By lowering the amount of weld seams reduces the risk of leakage of a vessel, therefore improving the life expectancy.

Improvement #5 – Packaging



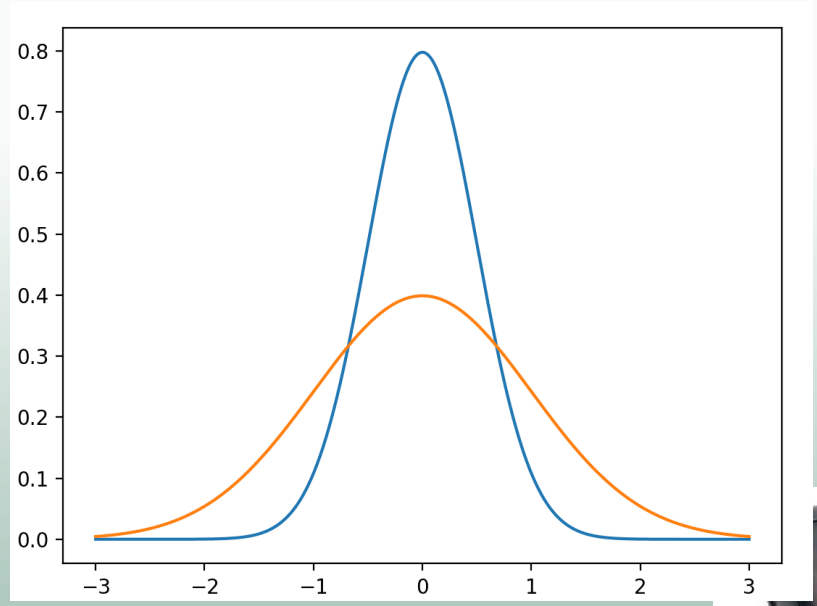
Included a revision of Shipping/Handling Guide

Improvement #6
More consistent VE Batch Mixing

ISO SOURCE: Production Log – recording of Barcol Hardness for each component or spooling

Improvement: Purchased stationary mixer for batching of VE. Tightened the Barcol Hardness bell curve, created more consistent surface hardness for all of our dual laminate products.

Risk Reduction: Lower the risk of fluctuations between VE batches which improved the consistency of our reported Barcol Hardness numbers, improving FRP quality across the board.

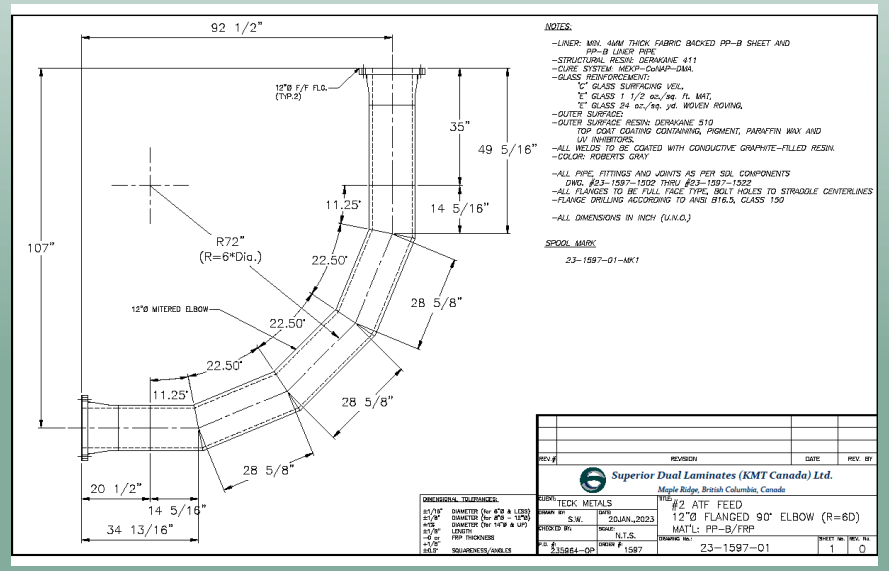


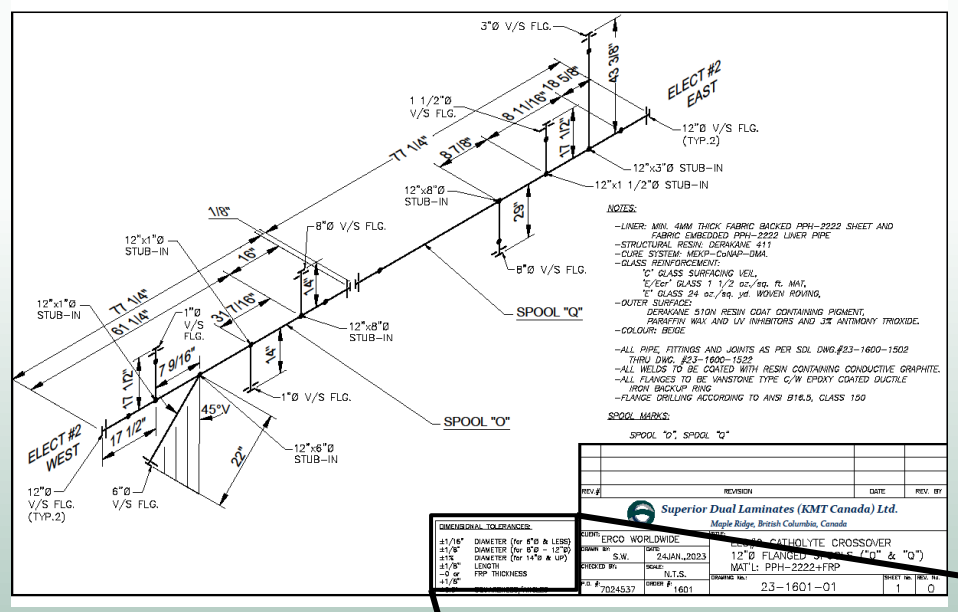
Improvement #7
Dimensional +/- Tolerances

ISO SOURCE: Internal Audit Program

Improvement: Moved Tolerance Tables from Wall postings to each individual shop drawings.

Risk Reduction: Less risk of wrong tolerances being transferred to each project.





Dimensional Tolerances:

± 1/16”	Diameter (6” and less)
± 1/8”	Diameter (8” – 12”)
± 1%	Diameter (14” & UP)
± 1/8”	Length
- 0”	FRP Wall Thickness
± 1/8”	FRP Wall Thickness
± 0.5°	Squareness/Angles

Conclusion

- ISO is mandatory for experiencing sustainable improvements within a company
- ISO is about reproducibility, so your identified processes & WI must be accurate
- All levels of the Company MUST have input into the Quality Program
- Internal & External forces MUST be monitored on a regular basis
- With a solid ISO 9001:2015 system in place – Improvements will follow!

Thank You for Your Attention!

Any Questions?