

**TOTAL QUALITY MANAGEMENT
FOR MANUFACTURE OF
FABRIC PRODUCT FOR THE
TRANSPORT INDUSTRY**

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NZ

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TOTAL QUALITY MANAGEMENT FOR MANUFACTURE OF FABRIC PRODUCTS FOR THE TRANSPORT INDUSTRY

by
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SATISFIED CUSTOMERS

Can we all say that the end result of every job we have done is a satisfied customer? How many times has a subcontractor, supplier or engineer been blamed for delays or rework because of incorrect fit? Excuses are of no consequence to the customer who wants a product fit for his purposes supplied on time. **Quality is satisfied customers.** Recognised Quality Standards are relatively new. In 1963 the US Military, tired of buying bombs that didn't bang, required suppliers to comply with a Quality Standard named MIL-Q 9858 and that got the ball rolling. Numerous "gurus" have offered their formulae for Quality Management but the Canadians set up the first National Quality Standard called CSA2299 in 1975. The British Standard BS5750 came out in 1979 and the Australian Standard AS11821/2/3 in 1985. The first ISO standard, the 9000 series was first published in 1987 and this has now been adapted by 40 countries including every trading partner of New Zealand and Australia. The Australian standard AS39000 and the New Zealand standard NZS9000 both replicate the ISO9000 series.

It is fascinating that as such a vital business ingredient, **Quality** has taken so long to be set out in a formal manner. Naturally every business has to have some Quality Management, as without any work instructions or completed order forms the business could not exist.

Structurflex believed itself to be an efficient organisation producing quality goods, (after all we already held a Design Mark and Design Award for one of our products). Demand from potential customers, in particular the Military, forced us to investigate formal accreditation to a recognised standard.

We approached Telarc, a New Zealand Accreditation Authority for Quality Assurance and decided to aim for ISO9002 (production level) and later on to ISO9001 (design level). Elated by the prospect of proclaiming to all the Quality Assurance we offered we rushed to compile our Quality Manual only to realise how deficient we were. Deflated we set aside the manual writing and began the grind from the bottom up. Setting out written work procedures for all our products, writing accept/reject criteria, finding all our drawings and putting them into one controlled system, writing a document control policy and eliminating all of the superseded documents from the system. On and on!

That was 2 years ago, and we still have the final few documents to prepare.

The 2 years work has resulted in a more efficient company, a more productive company, our rework level is greatly reduced, and we are able to confidently delegate responsibility. Our staff feel more involved.

HOW IS QUALITY BUILT IN TO PRODUCTS

The manufacture of fabric products for the transport industry requires the end product to fit tight strength and dimensional tolerances. Quality is essential - how do we build it in?

The first hurdle to overcome is management responsibility. Many of us here today are the management and we readily profess quality - committing to quality very different! My experience over the past 20 months is that problems extend from the management down not from the shop floor up.

QUALITY POLICY

A Quality Management programme begins with a written Quality Policy signed by the highest authority. Resources must be allocated to develop and implement the plan, develop and implement the systems.

DOCUMENTED INFRASTRUCTURE

A formal company infrastructure must be set up to handle the day to day requirements, filing, typing, data entry, report paths and job descriptions for all managerial and supervisory staff including the Quality Manager.

This sounds very basic and is very basic, any successful business has this infrastructure in place, but how well is it documented? When your filing clerk leaves does his or her replacement file in the same order or do you spend the next month searching for missing copies? A filing procedure take only a few hours to write and can be given to the new clerk ensuring continuity of files and saving many hours of searching and frustration.

What has this got to do with quality products I can hear you question? If the file that cannot be found is a specification request from your customer you can either recontact your customer, which demonstrates incompetence, or write your process control from memory, which risks non-compliance and therefore an unsatisfied customer.

A formal system for reviewing and auditing the policies and systems of the company must be set out and review documents retained. In other words - **plan - work the plan - review the plan - work the reviewed plan.**

DOCUMENT CONTROL

The company must establish and maintain procedures to control the authorisation and issue all essential documents. These documents comprise all of but not exclusively drawings, procedural instructions, computer files and the Quality Manual. To put it in simple terms everyone must have ready access to needed documents and nobody must have superseded documents.

Quite frankly this is a can of worms and considerable thought is required to devise a simple practical system that meets the criteria.

PURCHASING

No one can make a satisfactory product from unsatisfactory materials. Purchased materials must comply with specification and arrive on time.

A documented system must be set up to make it happen. A purchasing policy that ensures only competent, reliable suppliers are used - not the cheapest - and incoming goods must be inspected and rejected if they do not comply with the specification.

STAFF TRAINING

The last requirement of ISO9000 says identify staff training needs, provide the training and maintaining records of it.

After complying with all of the above the fabricator has reams of quality records which he may from time to time need to access. A plan must be made to establish procedures for identification, indexing, filing, maintenance and inspection of these records.

THE QUALITY LOOP

The principle of the Quality System is the Quality Loop which applies to and interacts with all activities pertinent to the product and involves all phases from initial identification to final satisfaction of customer requirements and expectations. This Quality Loop looks something like this for a fabric structure.

MARKETING

MAINTENANCE

DESIGN SPECIFICATION

INSTALLATION

ENGINEERING

PACKAGING

PROCUREMENT

**INSPECTION &
TESTING**

PRODUCTION

Let us look briefly at each function on this loop.

1 Marketing

The manufacturer must accurately determine his customer's requirements by a review of the contract or market needs and to include an assessment of any unstated expectations

held by the customer, ie can the job be done, can it be done on time, can it be done profitably, will the customer be satisfied? The format of this contract review should be documented and the results retained.

2 Design specification and engineering

In some cases the fabricator will have a design and build contract, in other cases he will be given the specifications to work to. Regardless, details need to be reviewed under a formal process. Can the specifications be met? Are the tolerances of the fabric and tensioning equipment adequate to cope with the permissible tolerances of the steel?

3 Procurement

Can material meeting the specification be obtained, and obtained within the required time frame? What quality specifications are required from the suppliers? Are the suppliers established and reliable? Will they supply compliance certificates?

4 Production

What are your company standards for the production of your products? What evidence is there that these standards are maintained? What can your customers expect?

We have included with this paper a copy of our **minimum** specifications and our process check sheets that cover set-out, cutting and welding of transport curtains. Completed sheets are retained with our job cards.

5 Inspection and testing

The responsibilities and the authority of various staff must be clearly defined. A person who is responsible for a procedure is the person who is implementing that procedure. The person with authority for a procedure is the one who has the right to give commands, enforce compliance and make final decisions. We have been told on good authority that the assembly line worker at Honda Cars in Japan has the authority to press the button and stop the assembly line if the product he is responsible for does not comply with the given specification. Now that is delegation!

I have always found it very difficult to delegate and it was only after embarking on our Quality Management programme that I found why. I was hesitant to delegate because I was not sure that the delegates would make the right decisions. How could I expect them to make the right decisions when the right decision was what I was **thinking**. Obviously, if I wrote down the process by which I reached a decision I could then delegate the authority. I know this sounds very obvious but it was a big breakthrough for me and is exactly the requirement of the ISO standard. About 50 drafts later out came our accept/reject criteria for products manufactured by us. These are attached to this paper.

6 Packaging

Written packaging instructions need to be developed for each product that will result in

the goods arriving at the customer site in good order.

Considerations need to be made for transport to and storage at the site. Weight and size of the package and available methods of handling must be addressed.

7 Installation and user instruction

The product must be installed and used in the way it was designed to be installed and used otherwise its life is likely to be reduced and the customer disappointed. Give your customer clean instructions that will allow him to get maximum performance from your product.

8 Maintenance

Specific details of maintenance requirements, emergency phone numbers, and emergency procedures should be documented and lodged with the customer.

From the first enquiry this Quality Loop must be put into a **documented** review process and the results must be positive before the potential contract is permitted to move to the next step, ie you are wasting your time and the customer's time if you carry on discussions on a job that cannot be constructed because of a technical flaw, the technical flaw must be overcome before proceeding further. These reviews should be structured to happen at fixed intervals and after criteria changes.

The two years of work on our QA programme has delivered great benefits to our company and our customers. My enthusiasm for compliance with the standard has increased with every progressive step we have made.

While we are not yet accredited we believe we are providing better service and products to our customers, we make fewer mistakes and have had a considerable increase in efficiency.



Title	
Document No	B.1
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Issue	A
Approved	Q
Date	12/5/91
Issued for indefinite/specific use	Issue Date
Reason for issue	Policy
Issued to	Q M AM Production Staff

Quality & Fabrication Procedures for Reinforced Thermoplastics

issued

April 1991

Revisions

Work Area

The work area must be cleared of all obstacles, clear and free of all extraneous contamination. If multiple layers of fabric are to be moved on the floor a fabric skid must be used to protect the fabric from direct contact with the floor.

Fabric Storage

Incoming fabric shall be stored under cover at a similar temperature and humidity as that of the fabrication area. All rolled goods, or partial rolls shall be clearly marked to indicate style and weight and stored separate from unlike fabric.

Operators

Cutters and operators shall wear clean soft shoes whilst working on the material. They shall be skilled tradespersons, experienced in the field and capable of high quality work.

Supervisor

The supervisor for the work shall have experience in the fabrication of this type of structure and shall be responsible for fully implementing Quality procedures.

Handling

The fabrication shop shall be clean and dry. No scuffs, cuts, abrasions or permanent marks are to be made to the fabric. The material surfaces shall be clean, dry and folded prior to leaving the shop.

The fabrication area shall have smooth floors and only people wearing soft soled indoor shoes, which do not mark the fabric are permitted in the fabrication area.

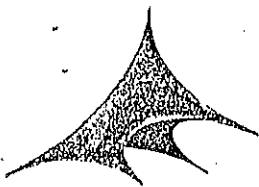
Fabric Quality Control

The fabricator shall inspect each panel of the material for any faults or marks which might be cause for rejection. Any such instances shall be reported immediately for inspection and determination of the appropriateness.

Production Planning

1.71 Prior to marking the supervisor will check all drawings and patterns. Any queries that arise must be answered before marking and cutting begin. USE FOAM SF 175

1.72 The supervisor shall document the complete cutting, fabrication, handling, folding and storage procedures



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Fabrication Details

Welding

Care must be exercised in aligning and welding of adjacent panels and it is stated that wrinkling and puckering on one panel caused by the gathering of one side versus the other will not be acceptable. Tension of adjacent panels must be set up evenly before welding commences.

All welds shall be continuous without gaps, holes or trap pockets.

All welds shall be performed such that the entry of air or water into the seams of fabric is prevented.

The welding bar used shall be checked for straightness and any irregularities shall be removed by machining prior to the welding process.

Two (2) sets of sample welds shall be performed and approved prior to commencement of fabrication.

Prior to commencement of welding on each day, a series of test welds shall be performed to a minimum number of six (6) so bar temperature is elevated from cold to an operating level.

The machine settings shall then be adjusted following the performance of a further five (5) welds to a final heated setting requirement.

At any time where a cessation of welding activity of more than ten (10) minutes occurs, reheating and adjusting of the bar shall be carried out. The Fabricator should not use the same settings throughout so that heating of the bar causes excessive frying of the surface PVC.

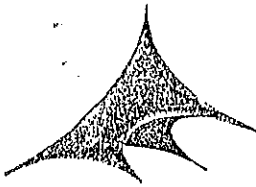
Welds shall be performed so that no excessive bleed of PVC occurs about the edges of the weld. Any exposure of the substrate is a cause for rejection.

Weld Testing

A properly performed weld shall be defined as one which when peeled apart, removes the PVC from one or both sides completely in an additive manner.

Tests shall be performed at two (2) hourly intervals. These samples shall be a minimum 600mm long with a 300mm section of each delaminated to test for appropriate weld strength. Any errors in welding shall be immediately reported for a decision as to the method of rectification.

All weld surfaces must be clean and free of foreign matter prior to welding. Cleaning materials used shall not damage the surface coating. Special care and attention should be paid to seams of more than two (2) layers. These must be treated specially and not pressed into the thickness of the remainder of the surrounding work with consequent extreme bleed of the PVC coating.



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Hot Wedge Welding

No use of hot wedge welding will be acceptable unless specifically permitted. If permitted two experienced operators practiced in the welding of long continuous seams must do all welding. Even tensions must be achieved on adjacent panels with no puckering or folds. Maximum acceptable variation in length is .25%.

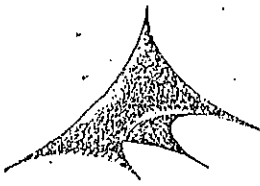
Where the wedge weld is stopped and restarted a visual check must be made in this area to ensure a continuous weld impervious to air or water. Test welds must be made to ensure wedge is given full width weld before welding of structure begins.

1.84 Reinforcing

Unless noted otherwise, all reinforced areas shall be fully welded. The fabricator shall weld such areas using specially made welding bars to minimise the number of strikes used to block weld. Unsightly and distorted finishes will not be accepted. Shrinkage in the weld zone is to be minimised by proper set up and machine adjustment.

Question

If in doubt ask for specific instructions before proceeding. (



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MANUFACTURING METHOD & QUALITY MANAGEMENT CONTROL ...

PRODUCT: DRY FREIGHT FLEXISIDER CURTAIN

Operator is to visually inspect previous work and sign for this plus his work.

	PROCESS	Drawing #.....	Job #.....
1	Calculate cut size		
2	Mark, cut and number curtain Job # Curtain #		
3	Pfaff on height extension (if applicable)		
4	Pfaff top hem and bottom hem		
5	Pfaff horizontal		
6	Check measure finished height HF vertical straps HF Corner Blocking HF End Detail		
7	Hardware		
8	Inspect and check measure AR1a AR2a AR3b		
9	Package and Despatch		



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AR1 c Weld to be physically tested using Air Lance, Vacuum Box or other prescribed method.

Air Lance Method A compressed air source will deliver 4Kg/cm² minimum to a 5mm nozzle. The nozzle will be directed to the lip of the field seam in a near perpendicular direction to the lip of the field seam. The nozzle will be held 100mm maximum from the seam and travel at a rate not to exceed 5m per minute. No loose flaps of 3mm or greater are acceptable.

Vacuum Box Method An approved proprietary vacuum box shall be used in accordance with manufacturers instructions. Negative pressure of 1.4 to 2.3 Kg/cm² shall be used. Leaks are acceptable.

Rejected goods shall be rewelded and re tested.

AR2 Visual Appearance

AR2 a The inspector shall visually inspect the outer surface (If both surfaces are to be seen when goods in use both surfaces are to be inspected). The goods shall appear free of defects visible from a distance of two metres.

No obvious patching, repairs or exposure of base fabric is permitted.

Rejected goods shall be referred to the Production Director. Goods will be offered to the customer at a discount or rejected for sale.

AR2 b The inspector shall be aware that these goods will be ~~in~~ ⁵⁶⁵ with backlighting. The inspector shall satisfy himself that the fabric has been passed over a light table prior to fabrication and that fabric with ~~faults~~ ^{DEFECTS} exceeding the permitted standard has not been used.

Defect

Any spot, stain, dirt or foreign matter(contamination) that will not pick out. Size exceeding 3mm diameter.

Any coated over knots that will not -leak - size exceeding 3mm diameter

Any blisters (Domed or craterised)

Any wrinkle that can not be removed by manual tension

Any visible scratch or abrasion.

Any non-uniform embossing

Any abnormal or strong odors.

Knots not coated over (bare)

Any hole, cut or tear



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Noticeable uneven coating or unbalanced face to back coating

Any delamination

Any uncoated or misscoated area

Color off shade, streaked, spotted or discoloured (burnt)

Folded over, scalloped or wavy edges precluding lay flat of fabric

Width less than minimum

Any tackiness (fabric must unroll readily)

Rejected Goods must have defective panels replaced

AR3 DIMENSION REQUIREMENTS

AR3 a Dimension of products are non critical. Tolerance $\pm 1\%$ is permitted.

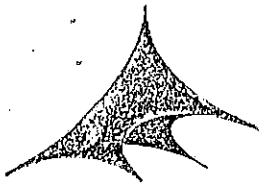
Rejected Goods shall be worked and re inspected.

AR3 b The products size is critical. A check sheet will be provided and must be completed. Where not specified tolerances are $\pm .1\%$

Rejected goods shall be reworked and re inspected.

AR4 Special Requirements

A specific written AR instruction will be provided with the job sheet



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AR REQUIREMENTS BY PRODUCT GROUP

		AR1	AR2	AR3	AR4
AS	Agency Sales				
AB	Air Bag				
BA	Banners	a	a	a	
BIG	Big Bags	a	a		
CS	City Sider	a	a	b	
CAN	Canopies Concertina	a	a	b	
EB	Earthball	a	a	a	
DZ	Flexidam	a	a	a	
FC	Flexidam Curtains	a	a	b	
F	Flexisider Hardware				
FA	Flexicryl				
GE	Geo Membranes	b			
HB	Helibucket	a	a		
IN	Inflatable Novelties				
MB	Marker Buoy	a	a		
MS	Material Sales	a		a	
OB	Oil Booms	a	a	b	
OF	Other Fabrications				
REP	Repairs				
SA	Slide A Side	a	a	b	
ST	Soft Tank	b	a	b	
SU	Structures	b	b	b	
SUPT	Tarps General	a	a	a	
TA	Tensile canopies	a	b	b	
TT	Tufftarp	a	a	a	