TREATMENT OF QUALITY IN UTILITY SPECIFICATION AND PROCUREMENT OF NETWORK EQUIPMENT

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ABSTRACT

In this paper the authors outline ESB Network's approach to ensuring quality through the use of:

- *quality criteria in the Tender Specification*
- *Factory Inspections prior to contract award.*
- *Routine and Type Test as standard contract requirements*
- *Ongoing assessment of equipment performance*

to ensure continuous high quality product.

BACKGROUND

In a Networks business the cost of installation, maintenance and loss of service of a component can be many times the initial cost of the component itself, so that it is critical that all Network equipment is of high quality with a very low probability of failure i.e. high long term reliability in service.

However assessing the long term reliability of equipment from different manufacturers is difficult as the statistics on reliability are held by different utilities, so that the equipment performance fragments across all utility customers, and is also affected by the maintenance and service conditions within each utility.

So as a proxy for 'long term reliability' it is necessary for the utility to establish a threshold level of quality through the specification and procurement process so as to provide a good predictor of long term equipment reliability

ESB Networks use the following approach:

(a) Quality Control requirements in the Specification
(b) Reference lists from Utility users
(c) Pre-Award Factory inspections of Manufacturers
(d) Ongoing Quality assessment for the equipment

QUALITY CONTROL IN SPECIFICATIONS

The EU Utilities Directive requires that tenders are assessed in an open and transparent manner, subject to EU audit. Accordingly the assessment criteria tend to be quantitative rather than qualitative, so that the evaluation is clear-cut, usually on the basis of 'most economically advantageous tender'.

Quality can however be difficult to translate into terms which can be economically assessed, as the critical requirement – Mean Time to Failure (MTTF) – is unavailable.

This is because knowledge of MTTF depends on the tenderer having statistics on the actual performance of the equipment in service, and that the service conditions are appropriate e.g. equipment was maintained as required.

Furthermore, as the MTTF would quite likely be one of the main determinants of success in the tender there could be a possibility of 'moral hazard' affecting any figures provided, and endless scope for later disputes by unsuccessful tenderers.

However given that the impact of poor equipment performance will be many times the initial cost of the equipment it must be regarded as a significant factor in the tender and therefore must be addressed.

Specification of Quality

Realistically the best that a utility can do is to choose from equipment that has had a good track record which is expected to continue. In addition the utility can set requirements for specific technical features to overcome known problems and require particular routine and type tests to reduce the risk of others.

Obviously the degree of stringency in the Specification will depend on the level of risk and the consequences of failure.

Track Record
Routine and Type Tests only search for known problems - ones by definition will show up during these tests. They will not show up problems which take any significant time to develop, or which arise later from changes in raw materials or manufacturing process changes.

So the first requirement in the Specification is that

The Tenderer shall have:

*(a) At least **X** years experience in the production of the relevant voltage/current range (or higher) of the product specified,*

(b) Service experience:

- *Installation of the product in at least **S** EU utilities*
- *with a service experience of the product range of at least **Y** years duration in these EU utilities of at least **Z** units.*

(c) As an alternative to such experience within the EU, similar experience with ---, --- or --- utilities would be considered.

(e) At least 5 years production in the particular plant proposed is required, although if the particular plant proposed is a relocated existing plant using substantially the same workforce a lesser time would be considered.

The intention here is that the Supplier will have significant experience in making this type of product, and will have a service experience in European (or more severe) climatic conditions, with utilities who have good levels of engineering competence.

In addition, the product to be supplied should be from a factory which has a track record of producing this product.

FACTORY INTERNAL QUALITY CONTROL PROCEDURES:

Typically every Specification asks for ISO 9001 or similar and most tenderers can respond positively to this question. The real issue however is to determine what Quality Control procedures are actually applied in the factory, particularly to inspection and control of raw materials, to identification and traceability of bad product and to the speed at which problems can be identified and bad product segregated.

Again, in the Specification the key questions are:

(a) What are the Inspection procedures for Raw Materials?
(b) What is the actual Quality Control sheets currently used within the factory?
(c) Who are the Sub-Suppliers and who supplies the Raw Materials?

Typically problems tend to arise when there is a change in either sub-supplier or in raw material. From the supplier's point of view, problems that arise from changes in material are found over time and eliminated so that a stable product is produced. However, from the utility's point of view, raw material changes can create new problems which are not trapped by incoming inspection as they have never occurred before and may not become apparent until some time in operation on the Network.

Particular problems arise in items such as steelwork where a change in sub-supplier, if not managed properly, can result in steel of different metallurgical properties which are not visible on normal inspection, and which require metallurgical tests in order to be identified. Such steel can take many years to manifest as a major problem on the Network.

As a rule of thumb if the existing internal QC procedures and Raw Material Inspections are good, or if the Sub-Supplier and Raw are stable, then the likelihood of future problems is low. In contrast if 'spot market' purchases are used it's nearly certain that unusual quality problems will arise.

Consequently, since it was the original product with its raw materials and sub-suppliers which was technically approved by the utility, any proposed change in raw material or sub-supplier must always be first approved by the utility.

It is critical that if any problem arises with the product being manufactured for the utility or with similar product being manufactured in the factory for another customer, that the utility is informed immediately. For the utility to continue installing potentially faulty product is a disaster and can be very costly for both the utility and the supplier.

The capability of the factory to carry out routine and Type tests is also important, as this facilitates the factory in its own internal Quality Control, allowing the factory itself to carry out sophisticated tests at more frequent intervals. As testing is on site it takes less time and can be scheduled when convenient. This allows incipient problems to be detected at an earlier stage before too much bad product has been produced. So, a good pointer toward good quality is the range of Test equipment available on site.

REFERENCES

References are essential, not only to confirm what volumes have been supplied, when and to whom, but also to provide a named individual in each utility who can be contacted to verify the reference.

From the Suppliers point of view, they can only know how their products actually work in the field if they keep in contact with their customers and obtain feedback on the equipment's performance.

In some cases, when attempting to follow up on references, difficulties can be found, especially where the supplier has

sold through an intermediary to the reference utility. But if the Supplier cannot provide utility contacts the obvious question is whether the supplier is actually getting feedback on the performance of the equipment they've manufactured?

Realistically fault levels on most equipment is generally low so that if a poor reference is obtained it is unusual and worth following up. It could be stated that references won't allow the utility to pick the best, but will help avoid the worst.

FACTORY INSPECTIONS

Factory Inspections prior to finalising tender selection are essential as they provide the utility with an opportunity to see the facilities, meet the production personnel, and verify the quality procedures are as described.

In addition they can provide utility engineers with first hand experience of the equipment's production and provide information to improve future specifications.

A template for a factory inspection is worthwhile, particularly as much of the background information should be available in advance, so that time is not wasted going through pedestrian data on site.

Different equipment factories will have certain critical features e.g. in transformer factories typical issues would be the size of the test area (which can act as a bottleneck to production), the availability of test equipment on site (which speeds up tests and ensures faults are discovered earlier), the experience of the Test Engineers, the experience of the Winding staff and the general cleanliness and layout of the factory itself.

However in all factories it is worthwhile to begin with incoming raw material and then follows the production process through to final shipping. Comparing the actual raw material with that declared in the tender is an obvious first step but more interesting is to check the QC procedures for incoming raw materia usedl, and to inspect the actual results produced that day.

Neat storage of raw material is also an issue, as damage within the factory due to poor handling and storage can be an issue.

During the tour it would be expected that QC charts showing critical indicators are available at the Operators stations, along with work instructions – good factories will show these clearly as quality should be a normal feature of how they work.

The range of equipment, how new it is and what impact it has on quality and production capacity is also important. If a procedure that required a lot of experience can be automated then the requirement for older skilled staff can be less.

Plans for improvement are also interesting - is the factory moving forward or stagnating? Similarly questions on safety statistics and procedures - if the factory is at a level where this is well organised then the quality system is also likely to be quite sophisticated.

The last audit of quality system should be requested and a quick check made of the recommendations and whether these have been implemented. Instead of working through the quality procedures listed it is more instructive to ask what problem they have had recently, how this was uncovered, how did it arise and how was it resolved – in particular how long did this take and were they able to isolate and trace the faulty product? This can then be correlated with the procedures outlined in the quality system charts.

Photographs are useful for internal utility records as they document the process and act as a reference for the next audit. Factories can occasionally be sensitive to photographs being taken in certain areas but are often amenable to taking the photographs on the utility's behalf so that any sensitive items can be screened.

In general if the factory is modern and well equipped, they are often keen to highlight this in the internal factory report of the utility's visit.

Finally, the range of Test Equipment available in the Factory should be inspected and the Calibration Dates checked. Equipment is normally found marked with a Calibration label indicating when last tested and when next due. It would be unusual – but telling - if equipment were past calibration date.

POST-TENDER QUALITY CONTROL :

Tender awards are conditional on satisfactory Type Tests being received. These Type Tests may be ones specifically for ESBN, or, if the product is standard, may be ones which have been previously carried out by a suitable independent laboratory and which have been witnessed by another utility known for their high standards. However on some contracts e.g. conductor, ESBN require that the manufacturer must also forward Type Tests for each individual order

Routine Tests are also performed by the Factory on each production batch and the results forwarded to ESBN.

In addition, initial deliveries are closely checked, as this is the first area where misinterpretations of the Specification are apparent, as well as where more subtle flaws such as incorrect packaging become evident. Ongoing QA by

ESBN also involves formal interim reviews and feedback from staff using the product.

As Suppliers providing poor quality product are dropped from the contract it is important that alternative Suppliers are available, ideally through the use of more than one Supplier, as this also improves security of supply.

QA Groups

Feedback from users on an ongoing basis is one of the best sources of Quality Assurance available, as it provides early warnings of problems and suggestions for improvement. To this end there is a meeting every quarter of a representative group of ESBN users of Overhead and Underground equipment, with a log kept of each query raised and when resolved.

Quality Newsletters illustrating problems raised and solved are then issued on Depot Notice boards to heighten awareness and show that concerns raised are followed up and resolved.

EXAMPLES OF QC ISSUES AND SOLUTIONS :

Steelwork can be a particular source of quality problems, particularly in aggressive corrosion environments such as Ireland.

As Steelwork is a low value added product , much of it is sourced from the Far East and quality can be poor, particularly due to the extensive and uncontrolled use of sub-contractors, misunderstanding of the specification requirements and sometimes poor quality control in the factory itself.

Typical problems would include:

- inadequate galvanising
- use of a grade of steel unsuitable for galvanising
- poor temperature control during bending
- steel with high impurity content

Such problems lead to the embrittlement of the steel, which is a serious problem, as it is for strength that steel was used in the first place.

Furthermore, faulty steel components are difficult to trace once installed on the network, making rectification extremely expensive.

In addition, such problems can potentially create serious supply shortages for the utility due to long lead times, and the low stock levels often held by suppliers as a result of a 'just in time' approach to deliveries. Yet it is a fact of life that Suppliers will source steel components in the Far East.

One ESBN Supplier is addressing these concerns through having their own staff working on the Suppliers site in the Far East, and testing all batches of imported steel equipment for quality, dimensional accuracy, chemical composition, tensile strength and hardness.

In addition, to reduce the risk of a quality defect creating a shortage of essential material, the Irish Supplier carries a minimum stock of an order lot size for every Far Eastern item sourced - typically 6 months stock.

Materials which have passed testing are passed to a quarantined area on the Suppliers site where they are then held for despatch to ESBN

VALUE OF QUALITY TO A UTILITY:

The value of high quality to a utility is exceedingly high, particularly for items which are themselves inexpensive, but whose failure would result in a loss of supply or have an impact on safety. The cost of rectifying a problem with equipment after it has been installed is very high as the location of each item must be determined and then an outage arranged to facilitate its replacement.

If a reliable and objective measure of Quality was available it would probably be the determining factor in many tender assessments, as the cost of failure is many orders of magnitude greater than the initial cost of the product. Surprisingly, many large high quality manufacturers , devote little attention to developing such objective standards, and this means that it is difficult to give adequate weight to the higher quality of their products in any tender assessment.

Obviously, the Supplier who does come up with an objective Quality standard for their product will find that it may then become a Specification requirement, with manufacturers unable to meet this requirement being unable to Tender., or being at a competitive disadvantage.

SUMMARY:

Quality Assurance in ESB Networks is not a replacement for Suppliers in-house Quality Control, but is a focused way of dealing with suppliers to ensure acceptable standards exist in all plants in the Supply Chain.

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