Rising Costs and Price War - To the Debit of Quality, in Spite of European Standardisation? (Quality Requires its Price; Critical Views; Negative Examples by Means Of MT- and PT-Inspection Media)

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Abstract: European and International Standardisation; state of technology; economical situation through global market; cost reduction programs; job elimination; predatory competition; low-price mentality of buyers; negative effect on quality of NDT-inspections; presentation of adequate examples by means of MT- and PT-inspection media. Companies producing high quality products in a realistic price range are loosing shares of the market – a vicious circle!

Introduction

This paper is dealing with quality problems regarding NDT inspection media for surface inspection. These problems are caused by the actual market situation, characterised by rising costs, price war and predatory competition. On the other hand it must be realised that buyers tend to an excessive “low-price-mentality” while believing to get the same quality for less money. More and more the purchase departments are making the decision – not the NDT-experts, if still available at all. Job elimination lead to a remarkable decrease of experienced NDT personnel; their “treasure of experience” is getting lost especially in small and medium sized enterprises. The remaining staff just relies on the statements of manufacturers and suppliers.

In case of surface inspection media for Magnetic Particle– and Penetrant Testing this can turn out to be a fatal situation, since obviously the situation of rising costs and price war stopped at nothing – not at least at manufacturers and/or suppliers of surface inspection media.

There are media of different price level available on the market - all with declaration of conformance with the relevant EN ISO Standard. But an evaluation shows, that some of these – especially some of the low-price products – do not fulfil the standardised requirements, they are simply unsuitable!

It remains an old law: quality requires its price!

Nevertheless such low-price media are in use – to the debit of quality of inspection and finally to the debit of companies producing high quality products in a realistic price range, but loosing shares of the market – a vicious circle!

Using such cheep but unsuitable media will finally not detect harmful surface flaws! Later – perhaps after a severe damage – it will read: human error!

Correct! But not at the shop floor - at the executive floor!

Actions should be taken, to stop this disastrous development!
1. Standardisation and actual state of technology

European Standards – not least in the field of NDT - are an important contribution to free and uniform competition within the European market. They are being prepared and published since the beginning of the nineties, replacing numerous national standards of European countries and now serving as common European standards. Many European Standards merged into International Standards as EN-ISO Standards via the so called Vienna Agreement. European and ISO Standards are no laws; but their use is mandatory, if they are involved in legal directions and decrees, as for example the Pressure Equipment Directive (PED). However, standards are to be understood as technical rules. As such they are generally representing the actual state of technology, not least due to their young date of publishing. State of technology means specialised knowledge of experts which is
- scientifically well-founded
- practically experienced and
- sufficiently well-tried.
European and/or International Standards should therefore be applied in any case and everywhere in order to warrant quality, safety, reliability and constancy of products.

2. Market events

All the statements, mentioned above, seem to be self understanding. But in reality the market events are running a different way – besides all efforts made in conjunction with quality management targets, for instance based on ISO 9001 registrations. The market events are strongly influenced by the global market!
The global market has caused an economical situation, which is characterised by
- rising costs
- price war
- low sales
- low profit and
- predatory competition.
The consequence in nearly all industrial branches is
- Cost reduction programs
- closure of production facilities
- movement of production facilities into low-wage countries

3. Cost reduction programs to the debit of quality?

The measures of cost reduction are mainly
- reorganisation
- reduced operating range
- outsourcing
- closure of production sectors
- reduction of personnel costs
- staff reduction, job elimination
- purchasing or renting appropriate services, incl. NDT
Since savings of personnel costs are often taking place in so called “non productive departments” - like quality departments - these savings have a negative effect to product quality.
It can be noticed that especially in the personnel sector a “treasure of experience” is getting lost, not at least in the field of NDT:
Competent personnel
- which is familiar with the production process and its sources of error
- which has fundamental knowledge in NDT
- which knows the relevant European and/or International Standards
- which knows their interpretation
- which knows their way of application

is increasingly missing, especially in medium sized and small enterprises!
NDT-Level 3 individuals on call and/or employment of NDT services on rental base are just limited alternatives!
It can furthermore be noticed, that in many companies, actual European and/or International NDT-Standards, that means regulations for NDT-performance, qualification of inspection media incl. knowledge or use of appropriate calibration blocks are not existing or even unknown.
As supplier for NDT-equipment and inspection media we meet with an amazing ignorance of people at the shop floor, and we often hear the typical statement:

“We did it all time that way, that’s our in house standard since many years… ”

(possibly based on old expired national standards … )

It must furthermore be noticed that NDT-service, NDT-equipment and inspection media are more and more purchased by purchase people - just looking at the lowest price - with nearly no NDT-background!
At least the selection should be a task for an in house NDT-Level 3 individual! But such person does not exist.

As a consequence
- nobody knows how to evaluate or qualify the purchased media
- nobody argues whether these low-price media will detect a specific type of flaws
- nobody weighs possible consequences….!

Instead of this we hear another typical statement:

“We rely on the supplier’s declaration; look at the label!”

… and the label shows that the content of the appropriate containment is in accordance with for example EN ISO 3452.

4. Reliability of supplier declarations

Obviously the situation of rising costs and price war stopped at nothing – not at least at manufacturers and/or suppliers of surface inspection media i.e. media for Magnetic Particle- and Penetrant Testing - to the debit of quality!
There are numerous low-price media available on the market - all with declaration of conformance with the relevant EN ISO Standard!
But after testing and comparing the performance of different such inspection media, we found, that some of these do not fulfil the requirements of the relevant EN ISO Standards! These Standards (EN ISO 3452-2 for PT-media and 9934-2 for MT-media) exactly describe the extent of tests which have to be performed by the manufacturer and the user.
It must be assumed, that some manufacturers of these low-price-media are taking advantage of the above mentioned situation, which is characterised by lack of experienced NDT personnel at the user side, which would be capable to test or analyse these media by means of appropriate test blocks or samples.
4.1 Example by means of Penetrant Inspection Media in spray cans

The requirements for dye penetrants - in this example red on white – are described in EN ISO 3452-2. Sensitivity class 2 media should show $\geq 75\%$ of the total crack length in the 30 $\mu$m-test block.

In our example the detectable cracks in total have been made visible by the ultra high sensitive fluorescent penetrant inspection system.

For the comparison we selected a typical section of the test block. After careful, consecutive application of three penetrant inspection systems (penetrants, cleaners and developers) from different manufacturers we found that the above mentioned requirement of EN ISO 3452-2 is fulfilled by only one of the penetrant systems!

![Fig. 1 Test block Nr. 1 acc. to EN ISO 3452-2](image)

![Fig. 2 Comparison of three different dye penetrant inspection systems](image)
A comparison of developers showed a similar result. Developers in spray cans contain a more or less volatile solvent which has two functions:

- it serves as carrier fluid for uniform transportation and application of the developer particles to the surface to be inspected
- before it evaporates, it gets in contact with the penetrant which is penetrated into the surface imperfections and dilutes this slightly. Due to this the developer can better absorb the penetrant.

Developers which are too thin, are not suitable for the application on vertical planes. On the other hand they are excessively diluting the penetrant, penetrated into surface imperfections and leads to washed-out and in many cases not usable indications.

A simple comparison of developers regarding this criterion is possible after spraying a small quantity against a vertically erected glass plane.

The pictures below are showing the comparison of a developer which is dry after about 1 minute (on the right in the pictures) with those from other manufacturers. All the letter need a significant longer time for drying and are more or less running. Especially the developer in picture on the right should be assessed as not suitable!

![Comparison of developers](image)

It is true, that PT-inspection media in spray cans do not need to undergo an aptitude test by the user, but as shown above he will be on the safe side when doing this test, or let the supplier demonstrate the suitability of his products by means of the adequate test blocks.

4.2 Example by means of Fluorescent Magnetic Particle Suspensions

The quality of fluorescent magnetic particle suspensions is to be verified by use of the test blocks No. 1 and/or No. 2 according to EN ISO 9934-2. Hereby the quality of an indication is given by the bath concentration, size of the particles and their permeability. But there is another, very important component by which the quality of flaw indication is influenced – the fluorescence coefficient $\beta$.

This coefficient shall be >1,5 cd/W and is a measure for brilliance and contrast of an indication. The importance of this coefficient must be viewed in conjunction with the applied black light intensity $[E]$ which shall be >1000 µW/cm². As we will see in a moment the combination of the named (minimum) values is a minimum requirement which does not even make sure that defects are sufficiently visible detected.

As the determination of the fluorescence coefficient needs an adequate equipment (see EN ISO 9934-2), the simple user is forced to rely on the manufacturers’ declaration regarding this magnetic particle condition.

But as to be expected there are again low-price-sellers which turn out to be black sheep!
Figure 4 shows the crack detections of four magnetic particle suspensions of different producers. A special reference block with four sections showing a uniform distribution of cracks was used for this comparison (see Fig. 5). The bath concentration of the suspensions was selected in accordance with the producers’ recommendations.

![Crack detections for different magnetic particle suspensions](image)

**Fig. 4** Comparison of four magnetic particle suspensions of different producers regarding fluorescence coefficient (x-axis) and black light intensity (vertical axis)

![Special reference block](image)

**Fig. 5** Special, subdivided reference block for comparison of magnetic particle suspensions
The x-axis in Figure 4 shows the four different magnetic particle suspensions, arranged by rising fluorescence coefficients from 1,1(!) up to 11 and on the vertical axis we see how the visibility of cracks depends on the black light intensity. It is obvious that a magnetic particle suspension with $\beta = 1,1$ cd/W does not fulfil the requirements of EN ISO 9934-2 and should therefore not be put in the market. It is furthermore obvious that this suspension will not detect any crack at a black light intensity $[E]$ which is just exceeding the required value of 1000 $\mu$W/cm². Even a black light intensity of 3000 $\mu$W/cm² results in an insufficient crack detection! As mentioned above, the combination of $\beta > 1,5$ cd/W and $E > 1000$ $\mu$W/cm² is a minimum requirement of EN ISO 9934-2. Under these conditions a reliable inspection seems at least to be questionable since even a suspension with $\beta = 2,8$ cd/W shows a crack detection which is still insufficient. Careful tuning of both factors ($\beta$ and $E$) is necessary in order to be on the safe side!

5. Summary and Conclusion

It was reported about serious quality problems by means of NDT inspection media for surface inspection. These problems are caused by the actual market situation, characterised by rising costs, price war and predatory competition. On the other hand – or due to this - it must be realised that buyers tend to an excessive “low-price-mentality” while believing to get the same quality for less money. More and more the purchase departments are making the decision – not the NDT-experts, if still available at all. Job elimination in conjunction with cost reduction programs lead to a remarkable decrease of experienced NDT personnel; their “treasure of experience” is getting lost especially in small and medium sized enterprises. Beyond this it must be realised that the remaining staff often has only a poor knowledge and experience in NDT.

Result: In many places, actual standards, i.e. regulations for NDT-performance, qualification of inspection media incl. knowledge/use of appropriate calibration blocks are unknown. However, standards, while representing the state of technology, should be applied everywhere in order to warrant quality, safety and reliability of products. We should not forget: the state of technology is always the standard which is called when damages are to be judged e.g. in case of expert opinions!

In case of surface inspection media for Magnetic Particle– and Penetrant Testing this can turn out to be a fatal situation, since obviously the situation of rising costs and price war stopped at nothing – not at least at manufacturers and/or suppliers of surface inspection media.

There are media of different price level available on the market - all with declaration of conformance with the relevant EN ISO Standard. But an evaluation shows, that some of these – especially some of the low-price products – do not fulfil the standardised requirements!

It remains an old law: quality requires its price!

As it could be shown, there are media for surface inspection available on the market being simply unsuitable!

Nevertheless such low-price media are in use – to the debit of quality of inspection and finally to the debit of companies producing high quality products in a realistic price range, but loosing shares of the market – a vicious circle!

Using such cheep but unsuitable media will inevitably lead to missing of harmful surface flaws! Later – perhaps after a severe damage – it will read: human error!

**Correct! But not at the shop floor - at the executive floor!**

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