The other side of the fence*

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SYNOPSIS

An examination is made of quality standards in castings produced by the South African foundry industry, and some examples are given of the consequences of poor quality to the user. Corrective measures are suggested.

SAMEVATTING

Die kwaliteitstandaarde in gietstukke wat deur die Suid-Afrikaanse gieterybedryf gelewer word, word ondersoek en daar word 'n paar voorbeelde gegee van die gevolge van 'n swak gehalte vir die verbruiker. Korrektiewe maatreëls word aan die hand gedoen.

There are many definitions of quality, and even more definitions of a standard. In the foundry industries, where the production processes are as much an art as a science, not only are these definitions elusive but their achievement is sometimes impossible.

A manufacturer often has little or no guide to the quality and standards required by the purchaser, and, predictably, the quality of the output is variable from one foundry to another. A more important point is that, in the experience of many users, output quality can be extremely variable from any given foundry even when standards are specified.

This leads to the inevitable conclusion that, in general, the quality-assurance techniques used by the foundry industry are not adequate for the purpose, which is the economical achievement of a consistent quality. Further, the quality-assurance techniques used by different foundries appear to have very little in common.

Two Problems

From these remarks it is reasonable to conclude that there are two distinct problems:

(1) a lack of performance by foundries against adequate quality standards supplied by the purchaser, and
(2) a lack of detailed material and quality standards specified by purchasers.

The solution to both problems is of paramount importance, and to find solutions it is necessary to state the causes. Problem (1) arises from a lack of adequate quality control by the producers, and problem (2) is due to a lack of ability on the part of the purchasers, be they direct end-users or intermediaries between foundry and end-users. The most a producer foundry can lose as a result of poor quality is the cost of the castings and possibly a customer. From 'the other side of the fence' — the viewpoint of the user — these problems have, from time to time, considerable financial implications and three actual instances are given to illustrate the point.

The Drum Rolls of Heavy-medium Separators. The roll castings were poorly produced, and their slow, hidden surface deterioration led to irreparable damage to the drum tyres. The grain size of the castings showed that the specified heat treatment had been inadequate. Three units were involved, and twelve rollers costing some R300 each. The consequence to the user was that the drums had to be removed for re-tyring, and part of the drum house had to be removed, repaired, and replaced, with a consequent loss in production.

Crusher Liners. There is a process in which austenitic manganese steel is hardened by the detonation of explosive, in sheet form, on the working surfaces of castings. The object is to improve the life of the castings by preventing abrasion attrition in the period between their installation and the point where they are sufficiently work-hardened on the surface. An organization attempted to evaluate this process on crusher liners, and discovered that the quality of the castings often led to disintegration during detonation. Investigations showed that the heat treatment of these castings had not been in accordance with the requirements. A programme to improve the quality assurance of the material, based on the requirements of SABS 407 (a specification of the South African Bureau of Standards) has led to a general improvement in quality and life. Since the expenditure on these items by the organization concerned exceeds two million rands a year, a life improvement of just 5 per cent saves thousands of rands a year. From the foundry point of view, nothing was lost or saved in the processing since all the fundamental requirements were met, but the quality assurance was inadequate.

Mill Liners. Two new expensive mills were damaged extensively by partial disintegration of their shell and end liners. Subsequent investigation showed that the material did not conform to the metallurgical specification for 11/14 per cent austenitic manganese steel, and had been air-cooled instead of water-quenched. The cost to the foundry was a new set of liners, amounting to some R100 000; the cost to the user exceeded this amount in direct costs, and far exceeded this in lost production.

Quality Assurance

A foundry can be defined as a batch-production processing unit. As such, it requires both batch and process quality-control techniques. The latter consists in tests and consequential adjustments as strategic points of the process. The former consists in the application of statistical sampling procedures that are defined in such publications as *British Standard* 6001.

It has been observed that many foundries do not use either technique. This is substantiated by the difficulty that some foundries experience in acquiring the SABS mark for castings. Some authorities have stated that the South African foundry industry lags behind the re-

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mainder of the Western World in quality assurance by a decade or more. This is an unacceptable generalization since there are foundries that compare favourably with any of comparable size in Europe. However, there are foundries that do deserve this criticism.

There are three avenues by which the problem of inadequate foundry performance can be solved.

(1) *The SABS 'Mark Scheme'*
The implementation of *SABS Specification* 407 for austenitic manganese steels has been the cause of substantial improvement in South African foundries that produce castings in this material. These improvements have been most notable in the field of heat treatment, and the quality of austenitic manganese steel has improved appreciably as a direct result. Improvements have also been made in the fields of production equipment, quality-control equipment, quality-control techniques, and, most important, in an elevation of foundry norms.

The quality-control aspect of the award of the 'mark' is virtually a free service to the foundry by the South African Bureau of Standards. The assurance given to a purchaser by the SABS mark is beyond question the greatest single asset a producer has in negotiations with a purchaser. This is because the purchaser is aware that the producer's quality-control systems have been examined, adjusted, and approved by experts, and that they are under constant review by an independent, expert body.

The purchaser, be he large or small, has the protection of the South African Bureau of Standards if he has a justified complaint against the quality of the product. With the many advantages of the SABS mark, it follows that any sensible purchaser will always purchase from a mark holder in preference to others, since the former group are continually demonstrating, to an independent authority, their ability to control the quality of their production.

(2) *Development of South African National Standards*
Unfortunately, the SABS mark scheme applies only to those products for which there is an SABS specification. Consequently, a large range of castings, for example steels conforming to *British Standard* 3100, cannot be subjected to these controls.

From previous experience, it has been found that foreign specifications cannot always be strictly followed in this country because they obviously do not take local circumstances and supply conditions into account. It is felt that it is the responsibility of South African foundries to initiate the development of specifications for the areas of large usage to which they do not apply at present. If the history of austenitic manganese steel and S.G. (spheroidal graphite) iron is a guide, this process will bring impressive benefits to both producers and users.

(3) *Quality-assurance Audit*
In the past decade, there has been a growing awareness in South African industry that good-quality production can actually reduce production costs, since reject levels are reduced and profitability and sales improved. This realization, coupled with the fact that few organizations can afford to employ a sufficiently large, experienced body to design and implement an efficient quality-control system, has led to the formation of a number of quality-assurance consultants.

Most of these consultants import their technicians and are subsidiaries of similar overseas organizations. They have been operating for a sufficient period to become familiar with local industry and its multifarious problems. One large mining house makes extensive use of these consultants. Purchasers are impressed if suppliers can produce documentation that shows a satisfactory quality-assurance audit has been conducted on the product concerned by such a consulting body.

Typically, two separate audit consultations are necessary: the first to make the audit organization aware of the product's strengths and weaknesses, and the second to ensure that any defects observed during the first audit have been removed. Sandwiched between the two consultations would be the activities necessary to eliminate any problems revealed by the first consultation.

For those familiar with the SABS mark scheme, it will be apparent that this is very similar to the way the scheme is operated. The use of these consultants has the additional advantage that they will, if necessary, design a quality-assurance system unique to the necessities and circumstances of a given producer, and will implement and monitor the system until it is effective.

It is suggested that the foundry industry could benefit from the use of these consultants for the products that have not yet been covered by the SABS mark scheme.

Purchasing Inadequacies

Another major cause of problems to the foundry industry and users of its products is inept purchasing by both middle men and end-users. At times, when operational difficulties have been encountered with castings, investigation has shown that the purchaser had not defined the material or quality requirements adequately, nor had the supplier always made an effort to establish these requirements. This usually results in protracted negotiations; friction between middle men, users, and producers; and, almost invariably, a financial loss to the foundry concerned.

It must be accepted by casting suppliers that many users depend on them for technical guidance. It is in the interests of both parties that foundries should take an active role in determining the specification requirements by investigating the end-use of their products. There have been instances where end-users, in blind ignorance, have specified what they believed to be required, and where suppliers have provided the material without query or in the full knowledge that the product and the end-use are incompatible.

Where a purchaser insists on a requirement despite advice from the supplier, the latter's conscience is clear; his staff have done their duty both to the purchaser

and to their own company since, provided the material quality is adequate, there can be no loss to the supplier. There are some foundries where this type of service to the customer is normal, but there are others where it is not.

Future Action

It is suggested that, if suppliers feel there is substance in any of the statements made in this paper, they should get together to discuss their problems with a view to

(1) extending the range of products covered by SABS standards,

(2) developing a closer association between foundries on quality assurance in general for those products not covered by SABS specifications,

(3) developing a closer association between fundamental research organizations (e.g., the National Institute for Metallurgy, the C S I R, the universities) and the foundry industry, and

(4) developing a closer technical association between end-users and the foundry industry.

Stability in surface mining

The Third International Conference on Stability in Surface Mining is to be held in Vancouver on 1st to 3rd June, 1981.

The theme of the conference will be to provide an up-to-date international review of engineering technology related to stability in surface mining. Special emphasis will be placed on case examples.

The conference will emphasize the following topics:

- Economics of slope stability
- Mechanics of slope failures
- Influence of geology, water, blasting, and earthquakes on stability
- Investigations, monitoring, and analysis
- Stabilization and artificial support
- Research requirements
- Case examples (approximately 20).

Enquiries should be addressed to Coordinator, Surface Mine Stability Conference, P.O. Box 91651, West Vancouver, B.C., Canada V7V 3P3. (Telephone: (604) 922-3717, Telex: 04-352798).

Vacuum metallurgy

The 7th International Conference on Vacuum Metallurgy, sponsored by The Iron and Steel Institute of Japan, will be held in Tokyo from 26th November to 2nd December, 1982. The official language of the conference is English.

The conference will cover advancing technology in special meltings and metallurgical coatings, including new developments in ladle metallurgy (vacuum and/or non-vacuum, cf. VOD, AOD, VAD, RHOB, DH) and the new technology of ESR, vacuum melting, and plasma melting in ferrous as well as non-ferrous metallurgy. Papers will also be accepted on powder making and sintering of powder materials under vacuum or controlled atmosphere. The session on metallurgical coatings will include the presentation of new findings on preparation techniques (vacuum evaporation, sputtering, diffusion coating, plasma processes, etc.), characterization and properties, applications in machine tools, metallization, electronics (epitaxy, passivation, electromigration, superconductor, etc.), energy conversion, and tribology. Presentations in new fields like plasma wall interactions, solar batteries, etc. are also expected.

Papers are invited from prospective speakers. Abstracts of 500 words giving the object, procedure, and results of the work to be described in the papers should be submitted to the Conference Secretariat by 31st January, 1982.

For further information, apply to The Conference Secretariat, 7th ICVM (1982), The Iron and Steel Institute of Japan, Keidanren Kaikan 3rd Floor, Otemachi 1-9-4, Chiyoda-ku, Tokyo 100, Japan (Telephone: 03-279-6021, Telex: 02228153 ISIJTK J).