SOUTH AFRICAN STANDARDS

AND THEIR RELEVANCE TO CONVEYORS

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1. SUMMARY

The paper addresses the general procedures followed by the SABS in the preparation of new standard specifications and codes of practice. It explains the function and membership of the Council and the appointed Technical committees in relation to this new documentation.

The standardisation mark scheme is discussed, together with aspects of quality control giving assurance of compliance of the commodity with the standard.

A brief explanation of the SABS Listing for compliance with the Code of Practice SABS 0157 is given.

Specifically, the contents of the SABS specifications relevant to conveyor belting, idlers and fasteners are briefly discussed. The need for a new specification to cover performance requirements for conveyor idlers in particular is covered.

Finally, mention is made of the fact that the SABS is dependent on manufacturers, suppliers and users of products to request the preparation of new specifications and codes of practice.

2. INTRODUCTION

The purpose of this paper is to give a brief overview of the objectives of the South African Bureau of Standards, the Managerial structure, and the general procedures followed by the Bureau in the upholding of existing standard specifications and the preparation of new standards and new codes of practice.

The Standardization Mark Scheme and Listing Scheme are discussed, particularly insofar as they significantly affect the manufacture and quality of the products relevant to conveyor materials.

The SABS specifications which cover these products will be summarised to show to what extent product quality is controlled. Inadequacies of existing specifications are indicated, and the latest situation regarding the publication of an amended specification for conveyor idlers is given. This latter specification has been drafted to include operational performances in what initially was largely a dimensional and material specification.

3. OBJECTIVES OF THE SABS

a) To promote standardization and to provide information, guidance and instruction in this connection

b) To secure the cooperation of, or give assistance to, the governments of other countries and participate with similar bodies to the SABS internationally to accomplish standardization

c) To obtain the cooperation of State departments, local authorities, representatives of commerce and industry to accomplish standardization with regard to commodities

d) To examine, test or analyse materials

e) To test precision instruments and to calibrate them accordingly

f) To assess and control quality management systems

g) To furnish reports and issue certificates in connection with d) e) & f)

h) To prepare and issue specifications and codes of practice

i) To accredit and control laboratories

j) To control the use of standardization marks

4. ACHIEVEMENT OF OBJECTIVES

4.1 SPECIFICATIONS

In practice, the SABS achieves its objectives mainly by means of specifications and codes of practice.

The object of a specification is to ensure quality and to limit the number of types, sizes and grades of a commodity to an essential minimum.

The method used by the SABS in the preparation of specifications is in accordance with the procedure applied by standards bodies in overseas countries. Each specification is a well-considered document embracing the latest knowledge on a particular subject or commodity plus the combined views of interested manufacturers and consumers and is, therefore, a practical, acceptable standard in every respect.

4.2 CO-ORDINATING (CKS) SPECIFICATIONS

CKS specifications are designed to standardize and co-ordinate the bulk purchases of government and semi-government bodies. They are prepared by the

SABS in consultation with manufacturers and consumers when there is an urgent need for a specification and no standard specification is available.

4.3 PRIVATE SPECIFICATIONS

A private specification is prepared by the SABS at the request of a client. The desired characteristics of the commodity are stipulated by the client, whose property the specification subsequently becomes. The commodity covered by such a specification is usually of use only to the client.

4.4 CODES OF PRACTICE

A code of practice describes the method to be applied or the procedure to be followed in connection with the performance for any act in an orderly, systematic, practical, efficient, safe or effective manner to achieve a stated purpose (be it the construction, installation, testing, operation or use of any article, apparatus, process, etc.). It is prepared in the same manner as a specification.

4.5 STANDARD METHODS

A standard method describes the equipment, material or substance to be used, or the procedure to be followed, to determine the nature, purity, composition, dimensions, performance or other characteristics of an article, or any other material or substance.

4.6 MARK SCHEME

Closely connected with the issue of standards is the voluntary Standardization Mark Scheme. Up to now,

four marks have been established as standardization marks. The best known of these marks is undoubtedly the standardization mark for general commodities, which indicates optimum quality for price and performance of the commodity as well as compliance with a national standard.

If a manufacturer is prepared to manufacture commodities in accordance with the requirements of a standard specification and to apply the required quality control measures in his factory, he may apply to the Council to use the applicable standardization mark on his commodity.

The SABS then subjects the commodity to strict tests. After a permit to use the standardization mark has been issued to the manufacturer, inspections are carried out regularly at the factory in order to ensure that factory control is applied thoroughly and accurately and that the final product will always comply with the requirements of the specification. This factory control is of paramount importance to the consumer.

The SABS is one of the pioneers of this particular system of certification marking involving quality control testing and inspection, which has been adopted by standards organizations in many parts of the world.

4.6.1 SABS QUALITY MARK

The SABS quality mark is applied to a commodity which complies with a standard specification which is comprehensive and covers all the known characteristic requirements to ensure that the product is fit for its purpose.

4.6.2 SABS DIAMOND MARK

The SABS diamond mark is applied to a commodity which complies with a standard specification which covers only one or more specifically selected characteristics of a commodity and is always qualified by specifying such characteristics in wording below the diamond mark.

4.6.3 SABS PACKAGING MARK

The SABS packaging mark is similarly applied to a package (carton, etc.) which complies with a comprehensive standard specification covering the requirements for the package only and not the contents.

4.6.4 SPRINGBOK HEAD MARK

The springbok head mark is applied to an article made of gold or silver and covers the precious metal content only and not the design or workmanship of the article.

4.7 LISTING SCHEME

In its constant quest for the improvement of product and service quality, the SABS in 1979 published the now well-known code of practice SABS 0157 'Quality systems' as a guide to manufacturers and suppliers who wish to improve their management systems for controlling quality, as well as to purchasers who require parameters for judging the effectiveness of such systems. This scheme is supplementary to the effective SABS Standardization Mark Scheme and is also applicable to services or to commodities that are not or cannot be covered by standard specifications.

Suppliers whos quality systems comply with the relevant part of SABS 0157, and who are listed accordingly, are accepted by purchasers as being reliable in terms of the quality of their products. This obviates the need for purchasers to conduct their own quality assessments.

4.8 CONSIGNMENT INSPECTION SCHEME

The SABS also operates a consignment inspection scheme to safeguard the interests of organizations that buy on a large scale, for example regional authorities, municipalities, government departments and mining groups.

The scheme provides for the inspection of commodities before consignment to the purchasers and comes into operation after tenders have been accepted. Suppliers, instructed by purchasers, notify the SABS when commodities are ready for inspection. SABS inspectors then visit the factory, where the commodities are inspected and certified as complying with the relevant requirements. These facilities are not used exclusively by South African buyers, but are also available to African States and overseas countries, many of whom have already availed themselves of this service.

4.9 TESTING FACILITIES FOR INDUSTRIALISTS

The scientific laboratory staff and testing equipment of the SABS are at all times available to industrialists for the development of commodities, comparative testing of locally manufactured and imported commodities, qualitative and quantitative testing of raw materials, and the testing of manufactured commodities in general.

4.10 TRAINING COURSES

The SABS offers training courses to assist industry with specialized training of staff in cases where training facilities are not available elsewhere.

Attendance of these courses is encouraged by the SABS, especially in technical fields for which no training is provided at any university or technikon in the Republic.

4.11 LIAISON WITH OVERSEAS COUNTRIES

The SABS maintains close relations with the standards bodies of many overseas countries, and full information about their specifications can be obtained from the SABS. It also represents South Africa in the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

All ISO and IEC documents dealing with international standardization are distributed by the SABS among industries in the Republic. The SABS participates in the work of ISO and IEC and their numerous technical committees.

The SABS is also the South African contact address for the receipt, distribution and handling of all documentation relating to the international standardization of processed foods under the control of the Codex Alimentarius Commission, with its head office in Rome.

4.12 LIAISON WITHIN THE REPUBLIC

Liaison within the Republic is accomplished by:

the appointment of special liaison committees such as the Agricultural Liaison Committee, and the Industrial Liaison Committee in which the Federated Chamber of Industries, the Afrikaanse Handelsinstituut, and the Steel and Engineering Industries Federation of SA are represented;

interested persons serving on technical committees;

direct contact with government departments and reciprocal representation on committees.

4.13 SERVICES TO EXPORTERS

The SABS offers the following services to exporters:

quality definition - standards reference library and international participation;
quality assessment - testing facilities for comparison of products with those offered on foreign markets and with any nominated specification;
quality verification - standardization mark scheme, consignment inspection scheme;
packaging - testing facilities for containers and packages;

design - assistance in developing an export image and in designing products that measure up to competitive standards on international markets.

5. **MANAGEMENT STRUCTURE** (See Organogram attached)

The Standards Bureau is an autonomous organization with a Director General as Chief Executive. Control of the Bureau is vested in a Council consisting of eight members; the Chairman and six members are appointed by the Minister of Trade & Industry &

Tourism for a period not exceeding three years. The Director General is member and vice-chairman ex officiï. The Council normally meets quarterly.

The Bureau comprises three main Directorates, Corporate Functions, Engineering Departments and Chemical Departments, each with a Chief Director. The Directorates are divided into individual Departments, controlled by a Director, and again into Divisions and Sections.

Conveyor idlers, steel for idlers and conveyor belt fasteners are monitored and tested by General Mechanical Engineering Division, and the belting itself by Rubber and Plastics Division.

6. STANDARD SPECIFICATIONS AND CODES OF PRACTICE

One of the most important aspects of standardization with which the SABS is entrusted is the preparation of specifications, codes of practice and standard methods generically grouped and referred to as standards. These standards deal respectively with commodities (specifications) and procedures or methods (codes of practice and standard methods).

As far as commodities are concerned the procedure followed by the SABS in regard to the preparation of a standard and the declaration of a mark, is as follows:

On being approached with a request for the preparation of a standard, the Council, if satisfied that it is in the national interest that such a standard be prepared, appoints a technical committee representative of manufacturers, distributors, purchasers, government departments, independent

bodies and experts to proceed with the preparation of the standard.

In collaboration with the standards officers of the SABS, the technical committee drafts a proposed standard for the commodity concerned. The draft is then circulated widely in South Africa and is sent to standards organizations overseas for comment. After a lapse of about three months the committee reviews its proposed standard in the light of the comments received and then only is the standard placed before the Council for approval, the declaration of the applicable standardization mark and publication.

This standardization mark may be applied by the permit holder to the commodity as evidence to the purchaser that the commodity is being made in accordance with the standard specification.

In commerce and industry the three groups mainly concerned are the producers, the distributors and the purchasers.

7. EXISTING SABS SPECIFICATIONS

7.1 CONVEYOR BELTING. Three specifications are currently available, viz. SABS 1173:1977, General Purpose Textile-Reinforced Conveyor Belting;SABS 971:1980, Fire-Resistant Textile-Reinforced Conveyor Belting (for use in fiery mines) and SABS 1366:1982, Steel-Cord- Reinforced Conveyor Belting.

The specifications are very comprehensive and therefore cannot be discussed in detail here, but it may be of interest to review the requirements in respect of materials, dimensional and tensile testing, construc- tion, and performance.

7.1.1 SABS 1173:1977 is for general purpose belting, but does not cover speciality belting such as heat resistant, oil resistant, or belting suitable for use on elevators and food conveyors. Definitions are given as to acceptability, breaking strength, construction, maximum working tension, and standard conditions for testing.

The class of belt is numbered in accordance with the minimum full thickness breaking strength in a longitudinal direction in kilonewtons per metre of width. The minimum breaking strength in a transverse direction is also specified, being normally approximately 40 % of the longitudinal minimum.

Type of belting is defined by the cover required in terms of the abrasiveness of the materials to be conveyed, and the severity of the working conditions. The various covers, which may be rubber or PVC are tested for tensile strength and elongation at break against specified minima.

Materials used include textile reinforcement and belt covers, and the requirements for both are stated.

Construction includes single-ply and multi-ply types and edge protection against ingress of moisture. Carcasses are defined in terms of construction, ie full-width, stepped or reverse stepped construction.

The belting must also comply with the distances between joints in plies in longitudinal and transverse directions, and the number of joints per ply longitudinally.

Workmanship must be in accordance with accepted manufacturing procedure, and the belting must be free from defects which would impair its long-term serviceability.

The mass of carcass and covers, in kilogrammes per square metre, minimum, for the classes of belt are specified separately.

Dimensional requirements include cover thickness with maximum negative tolerances, width in accordance with purchasers' requirements, but preferably as quoted in the specification, and length as specified by the purchaser within certain tolerance limits.

Troughability, that is measured deflection divided by length of specimen, is specified as a minimum against various troughing angles.

Adhesion between components, carcass and cover, and adjacent plies, in newtons per millimetre of width is measured in accordance with a standard SABS method. The minimum requirement is specified.

Acceptable standards for packing and marking are defined.

The correct sampling procedure is given for determining whether or not a "lot" (a length of belting greater than 30 metres) complies with the relevant requirements of the specification.

The final section of the specification describes the apparatus used and the methods adopted for measuring breaking strength, elongation, troughability, mass per unit areas, adhesion and thickness of covers.

In conclusion, applicable standards are referred to, there are notes to purchasers on the requirements for tender invitations, and data for designers, comprising recommended minimum pulley diameters for all classes of belting, and for multi-ply and single-ply carcasses.

7.1.2 SABS 971:1980 is the standard specification for fire-resistant belting for use in fiery mines, so that the only basic differences between this specification and the previous one are related to obviating, or at least reducing, the risk of belting-associated fires.

The covers shall be made of fire-resistant rubber, or polyvinyl chloride (these are referred to as polyvinyl chloride impregnated solid woven covers) is one of the requirements.

Electrical resistance shall not exceed 3 x 10^8 ohms, determined in accordance with ISO 284. This limit is set to ensure that the belt is sufficiently conductive to dissipate charges of electricity which may build up during operation. The test method and apparatus used are described in detail in ISO 284, as are the temperature and humidity conditions, both of which may have a significant effect on electrical resistance of the belt.

SABS 971 describes a resistance to drum friction test, during which the belt shall not show any sign of flame or glow.

Flame resistance is also covered, whereby the maximum duration of flame and glow is specified, the testing to be in accordance with ISO 340, which again gives the test method, the apparatus, and a description and operating conditions of the burner to be used.

The remainder of SABS 971 is very similar in all respects to the general purpose specification, SABS 1173, with the exception of a table giving minimum belt modulus in kilonewtons per metre per class of belt.

7.1.3 SABS 1366:1982 is the standard specification for steel-cord-reinforced conveyor belting, which shows some variations from SABS 1173 and SABS 971'.

Type of belt, in addition to suitability for abrasive materials under severe and average working conditions, addresses a rubber cover that has both fire-resistant and antistatic properties.

Components include inspection and testing of reinforcing cords, in terms of diameter, breaking strength, direction of lay of the steel wires, pull-out strength and ability to withstand the effects of flexing.

Constructional requirements define the belting as a single layer of longitudinal cords moulded into a rubber matrix, possibly with secondary reinforcement.

The required breaking strength, and the spacing and lay of cords, vertical location of cords and joints in cords permissible are specified.

Electrical resistance, resistance to drum friction, and flame resistance are defined and tested for as in SABS 971.

Test methods and equipment, including those already mentioned, cater for cover thickness and location of cords, cord breaking strength, pull-out strength and adhesion of secondary belting reinforcement.

An appendix gives the suggested number of cords for preferred classes and widths of belting.

7.2 CONVEYORS

Three specifications exist for conveyors, SABS 962:1978, Fasteners for Belt Conveyors, SABS 1313:1980, Conveyor Belt Idlers and Rollers (in process of revision), and SABS 657 Part III:1980, Steel Tubes for Rolls for Conveyor Belt Idlers.

7.2.1 SABS 962:1978 is for heavy duty plate-and-bolt type conveyor belt fasteners, for industrial applications where special abrasion or corrosion-resistant properties are not required.

The bolts and nuts shall be of steels that comply with the relevant requirements of SABS 135, namely ISO metric black bolts, screws and nuts (hexagon and square).

All other fastener components shall be of steel of commercial quality.

The design and dimensions of the fastener components are defined such that the bolt heads do not foul the

belting, and the nuts have a minimum protrusion of 0,5 mm above the top surface of the top plate, and the specification makes provision for this.

Nominal sizes of fasteners, according to purchasers' requirements are tabulated against other relevant dimensions to ensure uniformity.

Strength tests required, and the test methods and equipment/tools used are described. The tests include a torque test simulating actual operational fixing, and the use of a bolt breaker to determine the characteristics of the broken bolt, which must reflect the specification requirement.

Sampling procedures and number of samples required per lot for inspection and testing are indicated. The number of samples depends on the lot size, which is not less than 50 and not more than 35 000.

One appendix states the nominal fastener size for a range of recommended belt thicknesses.

7.2.2 SABS 1313:1980 specifies the dimensions and construction of conveyor belt idlers and tools, using steel tubes as defined in SABS 657 Part III:1980.

In addition to definitions of, for instance, in-line and offset rills, overlap of offset rolls, and roll bracket ends, only types of idlers and fixings, their construction and dimensions, and the formula for assessing peripheral runout are defined.

Specific requirements for troughing and impact idlers include number and gauge length, inclination angles, gaps, overlaps, spacing and roll height above base, all

of which are defined or tabulated. Similar requirements are stated for flat belt carrying and flat return idlers, and for two-roll V-form return idlers.

It is unfortunate that this specification, and amendments introduced in 1983, 1988 and 1989 did not include any requirements for performance. This is in the process of being rectified, and the new draft specification addresses, inter alia:-

a) Shafts-tolerances, parallelism of locking planes, axial movements, assembly resistance;

b) Bearings - housing alignment, location, assembly, type, static load requirement, rating life, design life, seals and outer cover (to prevent ingress of dirt or water), lubrication (for life), corrosion protection and friction force.

c) Quality control provisions - suppliers quality management systems shall comply with SABS 0157.

d) Inspection and tests - resistance against pressing out, tightness, effectiveness of lubrication, resistance to ingress of dust and water, running behaviour, running force, friction force, life test, (20 000 hours or 4 years).

Much of the performance part of this specification has been extracted from the German DIN 22112 Parts 1,2 and 3 - 1987. Apart from British Coal test methods, DIN 22112 was the only specification available internationally which included performance requirements as summarised above.

7.2.3 SABS 657 Part III:1980 covers the requirements for welded steel tubes for use in the manufacture of rolls for conveyor belt idlers.

Requirements include the type - electrically welded; the grade - yield stress; the material - chemical composition, maximum carbon, sulphur and phosphorus content.

Dimensions are specified in terms of outside diameter and wall thickness, and are as per purchaser requirements, but within certain limits of outside diameter, and the wall thickness to be at least equal to the nominal value given for the various outside diameters.

Tube lengths can be specified by the purchaser as "mill cut", or in random lengths from 5,5 to 8 metres.

Straightness and ovality limits are defined, and a requirement for scarfing is included.

Inspection and methods of test are given for tensile testing, flattening, and drift expanding with a conical drift.

8. OVERSEAS VISIT TO DNT ESSEN

In June this year, Mr Martin Kellermann, Chief Director of Engineering, visited DNT Essen, which was originally an off-shoot of the German Chamber of Mines laboratories, but has now been privatised. It has become a testing laboratory for machine safety, and is mainly engaged in research for the German mining industry, but does not carry out routine testing. Quality is checked, and control effected in accordance with the relevant DIN specification, by users and manufacturers, not by DNT.

The reason for mentioning this visit to DNT Essen is that some interesting opinions and findings were

voiced. The mining industry in Germany has requested high quality conveyor idlers, which will last for many years, with minimal maintenance and inspection. DNT claim to have proved that this approach is not feasible, because whatever the quality of a bearing, there will always be 2 - 3 % below specification. Therefore regular inspections of conveyors, and the associated maintenance and replacements are still necessary.

Roller bearings in Germany are manufactured cheaply, with fairly wide tolerances, that is , bearings with a design life of about 20 000 hours. The average cost of an idler was quoted as being DM16 (around R30).

Bearing cages and labyrinth seals are made of plastic. Industry in Germany insists apparently on the use of plastic in preference to metal, since when a metal bearing cage fails, almost invariably the bearing will seize solid, creating frictional heat and a hazardous situation. When plastic cages fail, the idler will normally continue to turn.

Costs are held down partly by limiting idler diameters to three sizes, and lengths to four. The lengths used are according to the lengths supplied by the steel mills, and there is no waste therefore in the form of off-cuts.

Equipment in use by DNT for research work includes a continuous belt tester for idler wear under load, and apparatus to test for water and dust ingress. It is considered that the combined effect of dust, water and applied load is no more serious than the effect individually.

It is also considered, and probably correctly, that erratic loading of a belt, (a normal operational phenomenon), is the main cause of idler bearing problems and failures, more so than the problems associated with water or dust ingress.

The SABS is at present equipping itself to carry out similar tests to those in use at DNT, and will therefore be in a position to cover the requirements of the revised specification SABS 1313:1991.

9. CONCLUSION

The Bureau is an organisation dedicated to quality, and to monitoring the control systems, and the inspection, sampling and testing procedures that ensure that guaranteed quality products are available to the discerning consumer. The Bureau relies on feedback from manufacturers, distributors and consumers to inform the relevant Departments should products be suspect in any way.

Concurrently, the Bureau also relies on feedback to request new specifications and codes of practice which are demonstrably required on a national basis to improve the quality of marketed products, and to enhance the safety of work methods and operation of equipment.

The gradual lifting of sanctions will improve the potential for export of South African made commodities, and compliance with SABS 0157 Code of Practice, which is directly equivalent to ISO 9000, may well be a pre-requisite. SABS permit to apply the mark to products will also be beneficial, as the SABS standards can often be equated to those of ISO, BS, DIN, ANSI etc.

The Bureau's main purpose is to maintain the quality of marketed products, increase the efficiency, and thereby improve the cost effectiveness of suppliers, and ensure the satisfaction of the consumer, which in turn leads to the profitability of manufacturers.

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van **1 Julie 1991**

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This organigram applies with effect from **1 July 1991**

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