

Code of practice for

On-site non-mechanical jointing of plied textile and steel reinforced conveyor belting

ICS 53.040.20

Confirmed December 2009

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The preparation of this British Standard was entrusted by the Rubber Standards Committee (RUM/-) to Technical Committee RUM/16 upon which the following bodies were represented:

Association of Solid Woven Belting Manufacturers
British Rubber Manufacturers' Association
British Steel Corporation
Chief and Assistant Chief Fire Officers' Association
Electricity Supply Industry in England and Wales
Engineering Equipment and Materials Users' Association
Health and Safety Executive
Malaysian Rubber Producers Research Association
Man-made Fibres Producers' Committee
Mechanical Handling Engineers' Association
National Coal Board

This British Standard, having been prepared under the direction of the Rubber Standards Committee, was published under the authority of the Board of BSI

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Published by BSI Standards Limited 2013

The following BSI references relate to the work on this standard:
Committee reference RUM/16
Draft for comment 83/52653 DC

ISBN 978 0 580 83244 4

Amendments/corrigenda issued since publication

Amd. No.	Date	Comments
A1	30 April 2009	See foreword
C1	31 July 2013	In 10.4.7, 150 ± 50 °C changed to 150 ± 5 °C. See foreword

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Foreword

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution.

This code of practice has been prepared under the direction of the Rubber Standards Committee. It is based on work done by the Mechanical Handling Engineers' Association in conjunction with the British Rubber Manufacturers' Association, Rubber and Plastics Research Association, belting manufacturers, belt jointing contractors and conveyor belt users.

BS 6593:1985+A1:2009 supersedes BS 6593:1985, which is withdrawn.

The start and finish of text introduced or altered by Amendment No.1:2009 is indicated in the text by tags **A1** **A1**.

The start and finish of text introduced or altered by Corrigendum No. 1:2013 is indicated in the text by tags **C1** **C1**.

Information from the manufacturers of conveyor belting and from the following publications has been used in the preparation of this code of practice.

BS EN ISO 14890, *Conveyor belting — Specification for rubber or plastics covered conveyor belts of textile construction for general use*.

BS EN ISO 22721, *Conveyor belting — Specification for rubber or plastics covered conveyor belts of textile construction for underground use*.

This code of practice does not necessarily detail all the precautions necessary to meet the requirements of the Health and Safety at Work etc. Act 1974. Attention should be paid to any appropriate safety precautions and the procedures should be carried out under the supervision of trained personnel.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 22, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

0 Introduction

In the manufacture or repair of a conveyor belt it is necessary to join the ends of a length of belting and in many cases it is not possible to do this in the workshop for various reasons, e.g.:

- a) the need to fit the belting accurately to the conveyor structure on site;
- b) the belting has to be threaded on to the structure prior to jointing;
- c) when effecting repairs to a belt by inserting a new section of belting it may not be economic, or safe, to remove the belt from the structure.

This code has therefore been prepared to cover on-site jointing but its recommendations are also applicable to workshop-made joints and may be applied to give added confidence to the quality of such joints.

1 Scope

This code of practice provides guidance on the procedures to be followed when making non-mechanical joints in plied textile and steel reinforced conveyor belting on site. Both hot and cold processes are considered.

This code does not cover mechanical joints in conveyor belting.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Types of belting

2.1 Standard rubber and textile belting

Standard rubber and textile belting comprises belting having rubber covers that are normally black in colour and comply with grades **A**, **H**, **D** or **L** of BS EN ISO 14890 **A1**. The carcass of the belt is usually two or more plies of fabric which may be of cotton, cotton/nylon or cotton/polyester mixture, all-nylon, all-polyester or polyester/nylon mixture. The strength of the belting is 200 kN/m to 2 000 kN/m for 2-ply to 6-ply constructions.

This type of belting represents the most popularly used constructions in general bulk handling operations, the most popular being all-nylon, polyester/nylon mixture and cotton/nylon mixture, in that order.

2.2 Plied PVC belting with PVC covers

Plied PVC belting with PVC covers is included in **A1** BS EN ISO 22721 **A1** but no physical properties are specified for the covers. The carcass construction is generally of cotton/nylon mixture plies but may be all-synthetic fibre.

This type of belting is used on a relatively small scale when fire resistance is necessary and for non-stick properties. The strength range is generally 315 kN/m to 2 000 kN/m.

2.3 Food and package conveyor belting

Two types of food conveyor belting can be identified as follows.

- a) Food conveyor belting generally to **A1** BS EN ISO 14890 **A1** that has food-quality rubber covers (white or coloured) on cotton, cotton/nylon mixture or all-synthetic fibre plied carcasses. The textiles used are frequently of lighter weight than those found in the belts described in 2.1 and the strength range is approximately 100 kN/m to 500 kN/m for 2-ply to 5-ply constructions.
- b) Food conveyor belting with food-quality PVC covers (white or coloured) on all-synthetic or all-cotton plied carcasses which are often of lightweight construction. The strength range is approximately 100 kN/m to 500 kN/m for 2-ply to 4-ply constructions.

NOTE Food conveyor belting often operates over slider beds instead of rollers and may have no back cover of rubber or PVC.

Package conveyor belting is lightweight belting of 2-ply to 4-ply all-synthetic fibre or all-cotton carcass in either rubber or PVC construction. For many applications package conveyor belting has no rubber or PVC covers, or only one cover on the carrying surface. The strength range is usually 100 kN/m to 500 kN/m.

2.4 Steel cord and woven steel reinforced belting

Steel cord belting consists of longitudinal steel cords (normally without any cross members) laid in a matrix of rubber. The diameter of these cords ranges from 2.5 mm to over 12.0 mm depending on the strength of the belting which can range from 500 kN/m to over 6 000 kN/m.

Woven steel belting incorporates a single -ply of woven wire carcass using a plain weave with steel wires along and across the belting. The strength range is 500 kN/m to 1 600 kN/m.

Both of these constructions require specially designed splices for jointing.

2.5 Belting with cover compounds for special purposes

The applications of some commonly used cover materials are as follows:

- a) butyl (polyisobutylene) for heat resistance application;
- b) EPDM (ethylene-propylene diene monomer) for heat resistance and ozone resistance applications;

- c) nitrile (polyacrylonitrile) for oil resistance application;
- d) neoprene (polychloroprene) for flame resistance and, sometimes, oil resistance applications.

These materials are used in conjunction with the textile carcass constructions outlined in 2.1.

2.6 Profiled surface belting

Profiled surface belting normally comprises plied belting having a surface such as chevron or cleated, raised sidewall, vee-tracked (on the underside) or rough-top. The strength range is usually 160 kN/m to 500 kN/m.

3 Safety guidance

3.1 General

The instructions and procedures given in this clause should be observed at all times during the preparation and manufacture of non-mechanical joints in conveyor belting.

3.2 Access and power supplies

Proper means of access should be provided. If scaffolding is needed then this should be erected according to current safety practice and proper access provided. The working area should be adequately lit.

Before work commences, plant should be electrically isolated, and where a permit to work is required this should be obtained from the site supervisor and retained on the job. All portable equipment power supplies and plugs should be compatible with the site supplies.

3.3 Equipment

NOTE Equipment used in the vulcanizing of conveyor belting is subject to statutory requirements, e.g. the Health and Safety at Work etc. Act 1974, the Mines and Quarries Acts 1954 and the Regulations of the  Department for Environment, Food and Rural Affairs (DEFRA).

If mechanical lifting equipment and tackle is needed only such equipment which has a current test certificate should be used.

3.4 Jointing materials

Good housekeeping practices should at all times be observed and the precautions listed in a) to g) below should be taken when handling jointing materials used in the preparation of vulcanized joints.

- a) Do not use in a confined unventilated area.
- b) Avoid breathing the vapours.
- c) Wear protective clothing at all times when handling vulcanizing cements and pastes.

d) Avoid contact with the skin and eyes. In case of accidental contact, treat the affected area with copious quantities of water (or with the reaction agent recommended by the cement/paste manufacturer). For eyes, follow the same treatment and immediately obtain medical aid.

e) Containers of cement/paste should be kept closed at all times except when actually in use and smoking should be prohibited.

f) Accidental spillage should be cleaned immediately. The application of any absorbent dry powder will help to remove stickiness and facilitate the removal of the spillage.

g) After use, all containers should be removed from site.

3.5 Powered tools

When using powered tools such as grinding and buffing and rotary wire brushes, approved eye protection and dust masks should be worn.

4 Site information

4.1 Exchange of information

There should be a free interchange of information between the contractor and the client.

The information to be supplied to the jointing specialist before proceeding to the site should comprise the items listed in a) to d):

- a) general information:
 - 1) date of job;
 - 2) company and site address;
 - 3) company contract;
 - 4) conveyor reference number or name;
 - 5) job description;
 - 6) services available and their location, particularly power supplies;
 - 7) any special safety procedures laid down by the client;
- b) details of belt construction:
 - 1) length of belting;
 - 2) width of belting;
 - 3) number of plies;
 - 4) fabric type and specification;
 - 5) BS grade or quality;
 - 6) thickness of carrying face cover;
 - 7) thickness of back cover;
 - 8) method of jointing;
 - 9) manufacturer's name and belt reference;
 - 10) description of material(s) conveyed;

c) past history of installation: a description of the difficulties experienced should be included, if any, and of the usual cause of belt failure. This should include:

- 1) effect of chemical addition to material being conveyed (see 8.4);
- 2) wet or dry duty belt (see 8.2);
- 3) temperature of conveyed material;
- 4) presence of oil and grease (see 8.3);
- 5) any misalignment of the previous belt;
- 6) any unusual mechanical problems;

d) details of working environment:

- 1) under cover or in the open;
- 2) dusty atmosphere.

The information to be supplied to the client by the contractor or site team prior to starting work should include the following:

- i) date the work is to be done;
- ii) estimated time of arrival of the site team;
- iii) job description;
- iv) any particular hazards likely to arise to client's staff from doing the work;
- v) client's staff required for the job (e.g. fitters to dismantle and reassemble the conveyor fittings in the work area);
- vi) any special instructions to expedite the work (e.g. temporarily fencing off the work area);
- vii) services and power supplies required.

4.2 Procedure on arrival at site

The following procedure should be observed on arrival at a site:

- a) check in at Reception/Security (as per particular site practice);
- b) contact authorized person to be shown job;
- c) check local safety requirements and ensure that these are met;
- d) if required, sign authorization/permit forms;
- e) check list of information provided [see 4.1 a) to d)];
- f) liaise with the client's staff to ensure that belt setting, conveyor preparation and rigging (e.g. removal of rollers and tension systems) and electricity supply is organized to suit the job.

Section 2. Materials and equipment

5 General

5.1 Training

Given that the equipment used in making a joint in belting is in first-class condition, the quality of the joint will ultimately depend upon the skill of the operator. Adequate skill will only be achieved by proper training and on-the-job experience.

All operators should have a period of formal training, both in the workshop and on site, followed by a period of strict on-the-job supervision before they are regarded as being qualified to carry out jointing work on site.

Training records should be kept and should be readily available for inspection.

5.2 Maintenance of equipment

The equipment used in making joints in belting should be regularly maintained. Cutting devices should be kept sharp and any templates used should be regularly checked for dimensional accuracy and damage. Mechanical, electrical, hydraulic and pneumatic equipment should be regularly checked for correct operation and repaired if necessary. It is most important that temperature indicators, pressure gauges and test equipment are accurately calibrated.

The overall safety of the equipment should be regularly reviewed; in particular, the earthing of electrical equipment, the security of guards on presses and soundness of pneumatic and hydraulic hose. All electrical equipment should be fitted with an earth leakage trip and all portable tools should be for 110 V operation.

Records of maintenance and calibration should be kept and should be readily available for inspection.

6 Tools and equipment

6.1 General

All tools, equipment and jointing materials should comply, where appropriate, with British Standards.

NOTE Certain statutory regulations are applicable, e.g. the Health and Safety at Work etc. Act 1974, the Mines and Quarries 1954 and the Regulations of the  Department for Environment, Food and Rural Affairs (DEFRA). 

6.2 Press

The most important piece of equipment required is the press. This has to be capable of exerting the required pressure and of maintaining a controlled temperature to suit the range of belting constructions to be jointed. The platens have to be of suitable design so that, in conjunction with the pressure beams, the load is uniform across the surface of the belting. The press should be checked at regular intervals with a straightedge to ensure platen flatness and also for even temperature distribution. The platens should be at least 100 mm wider than the belting to be jointed and the overlap of the platens on to the portion of the belt outside the jointed area should be a minimum of 50 mm. When vulcanizing belting requiring multiple heats, it is advisable to use platens of a size sufficient to cover the entire joint area with suitable overlaps as above. It is desirable to use mould bars (side bars) that are slightly thinner than the belting to be jointed to constrain the joint width and to prevent spreading of the joint under pressure. A suitable electricity supply is required on site for the press.

It should be ensured that the instructions provided by the press manufacturer cover the operating procedure.

Records should be kept of the checks for flatness and temperature distribution of platens. Spare thermometers should be carried with the equipment to replace any damaged on site.

When jointing PVC belting, it is advantageous to use a press with cooled ends or mould plates. The press should be equipped with platens that can be cooled (e.g. with cold water) to the manufacturer's recommended press opening temperature.

6.3 Ancillary equipment

The equipment listed below should be available for use:

- a) belt clamps;
- b) suitable tensioning devices to enable the belt to be tightened using the clamps in order to remove all the sag;
- c) powered winch for stripping off the covers and plies;
- d) lashings for securing clamps, etc., to the structure;
- e) hand tools, including:
 - 1) steel tape, straightedge and square for setting out the joint;
 - 2) hand knives for cutting; a knife specially ground to cut only through the thickness of one ply is useful to prevent overcutting and damaging other plies;

- 3) 50 mm face hand-roller for rolling down an unvulcanized joint;
- 4) narrow serrated stitch wheel for rolling down along ply ends;
- 5) pincers for stripping off covers and plies;
- 6) scissors for cutting gum;
- 7) V-knives for trimming unvulcanized cover filler strips when laying them in and for removing spew after vulcanization;
- 8) awl for releasing any trapped air;
- 9) industrial stapling machine for use on PVC joints;
- 10) side bars and sash clamps.

7 Jointing materials

7.1 Jointing materials for rubber belting

Jointing materials for rubber belting should be obtained from a reputable supplier and should be suitably matched to the specifications of the particular belt. Care should be taken to ensure that shelf lives are not exceeded. The jointing materials kit should comprise the materials listed in a) to e).

a) *General-purpose vulcanizing cement* (capable of giving good adhesion to cotton, synthetic fibre or cotton/synthetic fibre mixture carcasses). In some cases this will be a two-part solution which should be mixed for use according to the manufacturer's instructions. Care should be taken to ensure that the shelf life of any cement is not exceeded.

NOTE Special vulcanizing solutions should be used for special belting constructions such as heat-resistant, fire-resistant or oil-resistant; these solutions should preferably be obtained from the manufacturer of the belting.

b) *Inside gum or skin gum*, usually provided on glazed holland or polyethylene material to prevent self-adherence of the tacky unvulcanized material. This, as in the case of cement, will be categorized as general purpose and/or special material according to the type of belting to be jointed. This material usually has a thickness of 0.4 mm to 0.5 mm.

c) *Cover fill-in rubber*, which should be of the same compound, grade and thickness as the covers on the belting to be jointed so as to ensure a flush finish to the joint.

d) *Any leno or brattice or other fabric*, for use over the butt joints of fabrics as detailed in the individual instructions.

e) *Suitable solvent*, for cleaning and swabbing. A chlorinated solvent may be preferred on account of its non-flammable properties but for surface work other types of solvents may be more medically acceptable than chlorinated types.

All solvents applied to belting during cleaning should be allowed to evaporate for a period of not less than 30 min as residual solvents can cause bubbles in the joint during the vulcanizing process.

Generally, all belting to BS EN ISO 14890 having cover grade H, D or L can be jointed using general-purpose material.

NOTE Neoprene, nitrile, butyl or EPDM rubber belting should be jointed using skin gum and cover fill-in strips of the same material as the basic belting, together with the appropriate solution.

7.2 Jointing materials for PVC belting

Suitable PVC paste should be used for PVC belting in place of the rubber cement used for rubber belting. Any reinforcing fabric built into the joint should be treated with the same PVC paste.

7.3 Jointing materials for steel cord and woven steel belting

It is important that the materials used for steel cord and woven steel belting are those recommended by the manufacturer of the belting. An indication of the materials required is given in 13.3.1 and 14.2.

7.4 Cement

It should be ensured that the following information is available on containers of cement:

- a) manufacturer's name;
- b) date of manufacture;
- c) material reference number;
- d) shelf life;
- e) instructions for use;
- f) storage instructions;
- g) safety instructions.