Ministry of Defence

Defence Standard 81-041 Part 5

Issue 9 **Date: 14 August 2018**

Packaging of Defence Materiel

Part: 5 : Packaging Processes

Section 1

Foreword

Defence Standard Structure

Section 1 (Generated by the StanMIS toolset)

- Revision Note
- Historical Record
- Warning
- Standard Clauses

Section 2 (Technical information provided by Subject Matter Expert)

- Title
- Scope
- Introduction (optional)
- Table of Contents
- Technical Information to include Tables and Figures
- Annexes (as required)

Section 3 (Generated by StanMIS toolset)

- Normative References
- Definitions
- Abbreviation

REVISION NOTE

Formatting issues fixed. Withdrawn standards removed from references.

HISTORICAL RECORD

This standard supersedes the following:

Def Stan 81-041 Part 5 Issue 8

WARNING

The Ministry of Defence (MOD), like its contractors, is subject to both United Kingdom and European laws regarding Health and Safety at Work. Many Defence Standards set out processes and procedures that could be injurious to health if adequate precautions are not taken. Adherence to those processes and procedures in no way absolves users from complying with legal requirements relating to Health and Safety at Work.

STANDARD CLAUSES

a) This standard has been published on behalf of the Ministry of Defence (MOD) by UK Defence Standardization (DStan).

b) This standard has been reached following broad consensus amongst the authorities concerned with its use and is intended to be used whenever relevant in all future designs, contracts, orders etc. and whenever practicable by amendment to those already in existence. If any difficulty arises which prevents application of the Defence Standard, DStan shall be informed so that a remedy may be sought.

c) Please address any enquiries regarding the use of this standard in relation to an invitation to tender or to a contract in which it is incorporated, to the responsible technical or supervising authority named in the invitation to tender or contract.

d) Compliance with this Defence Standard shall not in itself relieve any person from any legal obligations imposed upon them.

e) This standard has been devised solely for the use of the MOD and its contractors in the execution of contracts for the MOD. To the extent permitted by law, the MOD hereby excludes all liability whatsoever and howsoever arising (including, but without limitation, liability resulting from negligence) for any loss or damage however caused when the standard is used for any other purpose.

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Section 2

Packaging of Defence Materials. Part 5 Packaging Process

Scope

This Part of Defence Standard 81-041 relates to production processes applicable to the packaging of Defence Materiel. It includes preservation and packing processes appropriate to Military Packaging Levels.

Introduction

Def Stan 81-041 is in six parts. More than one part may apply to any one packaging requirement. It is essential that all parts be considered and used where appropriate.

The arrangement of the complete series of Def Stan 81-041 is given below:

Part 1 – Introduction to Defence Packaging Requirements

Part 2 – Design

Part 3 – Environmental Testing

Part 4 – Service Packaging Instruction Sheet (SPIS)

Part 5 – Production Processes

Part 6 – Package Markings

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Figures

Tables

General Requirements for Preservation Process

1 Climatic Protection Requirements

1.1 Continuity of Processing.

The climatic protection cycle of cleaning, drying and preservation shall be continuous in the sequence chosen.

1.2 Handling.

Care must be taken to protect materiel from physical and climatic damage during the protection cycle. Materiel shall not be handled with bare hands if deterioration might occur, and clean gloves shall be worn and replaced when soiled. Equipment used for handling shall be clean.

1.3 Plant Requirements

General.

1.3.1 Air in the cleaning and preservation areas shall be extracted and replaced continuously to maintain an acceptable level of cleanliness. Ventilating air shall be drawn from a clean source or filtered to the required level of cleanliness.

Drying Ovens.

1.3.2 The air shall be circulated and replaced at the rate of at least twenty changes per hour.

1.4 Plant Maintenance

Fluid Containers.

1.4.1 Baths, tanks, and other containers of fluids shall be tightly covered when not in use to prevent the ingress of contaminants or losses by evaporation.

Compressed Air Systems.

1.4.2 The air shall leave no visible trace of moisture, oil, or dirt when blown on a glass or polished metal surface. Moisture traps shall be placed at the lowest point of the air delivery pipe as close to the nozzle as practicable. The traps shall be drained daily before the system is used and frequently during operation.

Spraying Equipment.

1.4.3 Prior to using the equipment, the nozzles shall be examined to ensure freedom from clogging. Screens and filters shall be cleaned or replaced daily when equipment is in continuous use. Spraying equipment shall be cleaned after use.

Cleaning, Degreasing and Drying Processes

2 Process C1 – Vacant

3 Process C2 – Metallic, Material, Solvent Cleaning and Degreasing using Inhibited Trichloroethylene or its Alternatives

3.1 General.

3.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

3.1.2 Inhibited Trichloroethylene is physically/chemically suitable for this process but similar (in operation) and safer formulations should be used (see Note 1).

Note 1: This process used to specify Inhibited Trichloroethylene (ITCE) alone, but there has been increasing restriction on its use because of Health and other concerns; its use was restricted from April 2016

Note 2: Commercial ITCE replacement formulations are available so solvent cleaning and degreasing can continue where ITCE can no longer be used. These should be checked for compatibility with materials / materiel to be cleaned

Note 3: It should also be confirmed that the ITCE alternatives can be used with the method selected.

3.2 Material

Trichloroethylene, inhibited	Commercial grade

ITCE Alternatives	Commercial grades

3.3 Pre-treatment.

The materiel shall be free from heavy deposits of grease, oil, dirt, or foreign matter. All particles of metal such as swarf, filings, or dross shall be removed; particularly from aluminium, magnesium and titanium metal and their respective alloys.

3.4 Method

Note: The following processes shall be carried out in and with equipment/safety equipment that has been designed/approved for the purpose.

Immersion Process.

3.4.1 The materiel shall be immersed in a bath of solvent until all oil, grease and dirt has been removed. Small items may be placed in baskets or trays. After immersion, the materiel shall be rinsed in a bath of clean hot solvent and then passed through a vapour zone (see 3.4.2) so that it is dry as it leaves the plant.

Vapour Process.

3.4.2 The materiel at ambient temperature shall be passed through or suspended in the solvent vapour within a heated bath until no further condensation occurs. Small items may be placed in baskets or trays. If necessary the operations shall be repeated (after allowing the items to cool) until all oil, grease and dirt has been removed and the items are dry as they leave the plant.

Jetting Process.

3.4.3 Materiel with obstinate dirt deposits that cannot be removed by immersion may require jetting. The hot solvent shall be high pressure jetted so that all surfaces are covered and until all oil, grease and dirt has been removed. Small items may be placed in baskets or trays. After treatment, the materiel shall be passed through a vapour zone (see 3.4.2) so that it is dry as it leaves the plant.

Ultrasonic Cleaning Process.

3.4.4 The materiel shall be immersed in a tank of solvent at room temperature to which an ultrasonic transducer has been fitted and activated at the resonant frequency recommended by the manufacturer of the equipment until all oil, grease and dirt has been removed. Small items may be placed in baskets or trays. After treatment, the materiel shall be passed through a vapour zone (see 3.4.2) so that it is dry as it leaves the plant.

Note: ITCE and alternatives may produce corrosion on light alloy items. Adverse conditions exist when; the solvent becomes depleted in inhibitor, the temperature exceeds 120 °C (due to build-up of insoluble material etc.), when items are in contact with either each other or the tank walls, and are left in the solvent for long periods of time. (Only a few minutes are required for efficient cleaning).

3.5 Plant Maintenance

3.5.1 Cleaning baths shall be installed and maintained in accordance with the manufacturer's recommended instructions.

3.5.2 The notices provided by the manufacturer regarding the methods of operation, and the precautions to be taken, shall be exhibited near the plant.

3.5.3 The use and maintenance of the bath(s) shall be in accordance with best practice, for example;

3.5.4 Water and water vapour shall be excluded from the bath,

a) The control of acidity shall be carried out at intervals, not exceeding one month for ITCE

Records of check tests shall be maintained.

4 Process C3 – Metallic Materiel, Solvent Cleaning and Degreasing with Hydrocarbon Solvent, Kerosene or White Spirit

4.1 General.

4.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

4.2 Materials

Hydrocarbon solvent	Commercial (see note 1)

Kerosene	BS 2869, Class C2
Turbine fuel, aviation, kerosene type, jet A-1, NATO Code No: F-35	see Note 2
Joint Service Designation: AVTUR	
White spirit	BSI BS 245, Type A

Note 1: Shall be a solvent suitable for cleaning electrical and aerospace equipment with no deleterious effects.

Note 2: See associated Def Stan in Section 3

4.3 Method

Immersion Process.

4.3.1 The materiel shall be immersed in a bath containing one of the solvents for not less than one minute (to allow for the removal of contaminants). Small items may be placed in baskets or trays. The items shall be agitated, tilted, or inverted to allow trapped air to escape and ensure complete coverage of all surfaces (internal and external). Brushing and/or scrubbing shall be used when necessary. Items with cavities shall be removed from the bath at an angle to ensure that the holes are emptied. The process may be repeated.

After cleaning, the excess solvent shall be drained and the item shall be rinsed in a bath of clean solvent for a period of at least one minute (to remove contaminated solvent remaining after the first dipping). A further rinse in clean solvent may be given. The item shall then be removed from the solvent and allowed to drain.

Jet or Spray Process.

4.3.2 The materiel shall be suspended in or passed through the spraying zone for sufficient time to ensure thorough cleaning. The spray pumping system shall have adequate pressure with nozzles placed so that all surfaces of the item are sprayed. Small items may be placed in baskets or trays. After cleaning the materiel shall be removed from the plant and allowed to drain.

Brushing Process.

4.3.3 The materiel shall be brushed until all contamination has been removed.

4.4 Plant Maintenance

4.4.1 The solvent shall be checked periodically for residues and renewed when contamination either causes unsatisfactory cleaning or reaches 2 % of the solvent by mass or volume. The residue content may be determined by evaporating a measured volume of the solvent only until the oily and/ or solid residues remain and the mass/volume determined. Records of check tests shall be maintained.

5 Process C4 - Metallic Materiel, Cleaning and Degreasing with Detergent Solution

5.1 General.

5.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

5.2 Material

Detergent solution	Commercial

Note: The concentration of the detergent solution, and the detergent itself, will be determined by the nature of the contamination to be removed and the material from which the materiel has been constructed.

5.3 Method

Immersion process.

5.3.1 The materiel shall be immersed in a bath containing the detergent solution for not less than one minute (to allow for the removal of contaminants). Small items may be placed in baskets or trays. The items shall be agitated, tilted, or inverted to allow trapped air to escape and ensure complete coverage of all surfaces (internal and external). Brushing and/or scrubbing shall be used when necessary. Items with cavities shall be removed from the bath at an angle to ensure that the holes are emptied. The process may be repeated.

5.3.2 After cleaning, the excess detergent solution shall be drained and the item shall be rinsed in a bath of clean detergent solution for a period of at least one minute (to remove contaminated detergent solution remaining after the first dipping). A further rinse in clean detergent solution may be given. The item shall be removed from the rinse solution and allowed to drain.

5.3.3 After rinsing, the item shall be drained and rinsed twice in baths of clean hot water and then be subjected immediately to process C11 (See 12).

Jet or spray process.

5.3.4 The materiel shall be suspended in or passed through the spraying zone for sufficient time to ensure thorough cleaning. The spray pumping system shall have adequate pressure with nozzles placed so that all surfaces of the item are sprayed. Small items may be placed in baskets or trays. After cleaning the materiel shall be removed from the plant and allowed to drain.

5.3.5 After cleaning and draining, the item shall be rinsed twice in baths of clean hot water and then be subjected immediately to process C11 (See 12).

6 Process C5 – Vacant

7 Process C6 – Vacant

8 Process C7 – Vacant

9 Process C8 – Vacant

10 Process C9 – Vacant

11 Process C10 - Non-Metallic and Composite Materiel: Cleaning and Drying by Air Blow, Vacuum Cleaner, Wiping or Washing

11.1 General.

11.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

11.2 Method

11.2.1 Clean dry air blow or vacuum cleaning. Dust, dirt, and moisture shall be removed by blowing with clean dry air or by suction using a vacuum cleaner.

Note: The air pressure or vacuum used shall be such that no damage is caused to the item.

Wiping.

11.2.2 The materiel shall be wiped with a cloth until all dirt, dust, and moisture have been removed. The cloth shall be clean, dry, and free from residues of laundering chemicals.

Washing.

11.2.3 The materiel shall be washed with water, or dilute detergent solution until all dirt and dust have been removed. After washing, the materiel shall be rinsed in de-mineralized water and dried by one of the methods in 11.2.1 or 11.2.2.

12 Process C11 - Drying of Metallic Materiel: Drying by Hot Air Oven, Infra-Red Heating, Air Blow or Wiping

12.1 General

12.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

12.1.2 The hot air oven and infra-red radiation methods shall not be used for materiel that is adversely affected by heat.

12.2 Method

12.2.1 Items shall be drained of water or detergent solution prior to drying.

Hot air oven.

12.2.2 The materiel shall be placed in the oven until dry. The oven shall be controlled at (65 ± 3) or (110 ± 10) °C depending on the type of materiel to be dried (see 1.4.2).

Infra-red radiation.

12.2.3 The materiel shall be exposed to infra-red heating until dry. The drying lamps or elements shall be arranged to suit the particular item. The heater shall be controlled so that the temperature on the surface of the item is (65 ± 3) or (110 ± 10) °C depending on the type of materiel to be dried.

Clean dry air blow.

12.2.4 The materiel shall be dried by blowing with clean dry air at a pressure not exceeding 0.6 MPa (6 bar).

Wiping.

12.2.5 The materiel shall be wiped with a cloth until all surfaces are dry. The cloth shall be clean, dry, and free from residues of laundering chemicals.

12.3 Records

12.3.1 Shall be maintained of the hot air oven or infra-red heater temperature and of the condition of the air filters and moisture traps.

Protection and Preservation Processes

13 Process C12 – Temporary Protection of Metallic Materiel with Antifreeze

13.1 General.

13.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

Note 1: This is temporary, when the inhibition ceases to operate corrosion will again be a possibility. It should not be used for periods beyond the antifreeze and or article supplier/manufacturers recommended coolant system renew period.

Note 2: The antifreeze's compatibility with the metallic material(s) to be protected should be confirmed before use.

13.2 Material

Antifreeze, Inhibited Ethanediol, AL-399	See Note 1
Antifreeze, Inhibited	Commercial

Note 1: See associated Def Stan in Section 3

13.3 Method

Dipping.

13.3.1 Materiel shall be immersed in a bath of antifreeze solution for sufficient time to ensure complete wetting. Small items may be placed in baskets or trays. The items shall be agitated, tilted, or inverted to allow trapped air to escape and ensure complete coverage of all surfaces both internal and external. After immersion, the items shall be removed and surplus antifreeze drained. Items with cavities that may retain the antifreeze shall be removed from the bath at an angle to ensure that any cavities are emptied.

Flushing.

13.3.2 The materiel shall be flushed with antifreeze so that all internal passages are filled. The surplus shall be drained. The items shall be tilted or rotated during and after flushing.

14 Process C13 – Vacant

15 Process C14 – Vacant

16 Process C15 – Vacant

17 Process C16 - Application of Temporary Protective to Metallic Materiel: Hard-Film, Solvent Deposited

17.1 General.

17.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

Note 1: PX-32 may incorporate aromatic solvents that are toxic and flammable, and should be handled only in well ventilated areas. Regular, prolonged, or major skin contact must be avoided.

Note 2: PX-32 is unsuitable for internal use in; engines, sub-assemblies with moving parts or parts with inaccessible recesses. PX-32 may not be suitable for painted surfaces.

Note 3: Dries within 24 hours at ambient, above 10 °C

Note 4: PX-32 replaces PX-31 (itself in place of PX-2) which was made obsolete, a test on a representative sample is recommended before use to confirm suitability.

17.2 Material

Corrosion preventive compound, PX-32 — See Note 1

Note 1: See associated Def Stan in Section 3

17.3 Method

17.3.1 PX-32 shall be applied at ambient temperature and allowed to set before handling.

Dipping.

17.3.2 Items shall be immersed in a bath of PX-32 for sufficient time to ensure complete wetting. The items shall be agitated, tilted, or inverted to allow trapped air to escape and ensure complete coverage of all surfaces (internal and external). Small items may be placed in baskets or trays for dipping (separated from each other to prevent blocking). Large items may be dipped in two stages to ensure complete coverage. After immersion, the items shall be removed from the bath and surplus PX-32 drained. If necessary, the process may be repeated (or method 17.3.4 followed) after the first coating has set to ensure complete coverage of areas that may have been in contact with the basket or tray.

Spraying.

17.3.3 The items shall be sprayed so that an even coating of PX-32 is applied to all surfaces both internal and external. Small items may be placed in baskets or trays for spraying (separated from each other to prevent blocking). If necessary, the process may be repeated (or method 17.3.4 followed) after the first coating has set to ensure complete coverage of areas that may have been in contact with the basket or tray.

Brushing.

17.3.4 The PX-32 shall be applied using a brush to give an even coat on all surfaces. The brush shall be clean and of a quality that will allow coverage of the item without leaving deep brush marks.

18 Process C17 – Application of Temporary Protective to Metallic Materiel: Soft-Film, Solvent Deposited

18.1 General.

18.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

18.2 Materials

Corrosion Preventive Compound: Soft Film, — See Note 1

Cold Application NATO Code: C-614 JSD: PX-1

Note 1: See associated Def Stan in Section 3

18.3 Method

18.3.1 PX-1 shall be applied at ambient temperature and allowed to set before handling.

Note: When a new drum is opened, or a bath is first brought into commission, the density shall be determined in accordance with BSI BS 718, Appendix E using a BS M50 hydrometer. The hydrometer reading (g/ml and temperature) shall be recorded as the reference standard. Check tests shall be carried out to ensure that the density is maintained within (± 0.01) of the reference standard. If this tolerance is exceeded the PX-1 shall be diluted with white spirit, BSI BS 245, Type A until the density of the diluted blend is within (± 0.003) of the reference standard.

Spraying.

18.3.2 The item shall be sprayed so that an even coating of protective is applied to all surfaces both internal and external. Small items may be placed in baskets or trays for spraying (separated from each other to prevent blocking). If necessary, the process may be repeated (or method 18.3.3 followed) after the first coating has set to ensure complete coverage of areas that may have been in contact with the basket or tray.

Brushing.

18.3.3 The protective shall be applied using a brush to give an even coating on all surfaces. The brush shall be clean and of a quality that will allow coverage of the item without leaving deep brush marks.

Dipping.

18.3.4 Materiel shall be immersed in a bath of protective for sufficient time to ensure complete wetting. The items shall be agitated, tilted, or inverted to allow trapped air to escape and ensure complete coverage of all surfaces (internal and external). Small items may be placed in baskets or trays for dipping (separated from each other to prevent blocking). Large items may be dipped in two stages to ensure complete coverage. After immersion, the items shall be removed from the bath and surplus protective drained. If necessary, the process may be repeated (or method 18.3.3 followed) after the first coating has set to ensure complete coverage of areas that may have been in contact with the basket or tray.

19 Process C18 - Application of Temporary Protective to Metallic Materiel: Soft-Film, Grease

19.1 General.

19.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

19.2 Materials

Grease, XG-291	See Note 1
Grease, XG-279	See Note 1
Petrolatum, technical protective, PX-7	See Note 1

Note 1: See associated Def Stan in Section 3

19.3 Method

19.3.1 Application of the protective shall be at ambient temperature.

Brushing.

19.3.2 The temporary protective shall be applied using a brush to give an even coating on all surfaces. The brush shall be clean and of a quality that will allow coverage of the item without leaving deep brush marks.

Smearing.

19.3.3 The temporary protective shall be applied so that an even coating is obtained on all surfaces using clean cloth or swabs which are free from residues of laundering chemicals, or clean tools of a material that does not damage the item.

20 Process C19 - Application of Silicone Compound / Grease to Ferrous Metal Components Containing Rubber

20.1 General.

20.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

20.2 Material

Silicone compound, XG-250	See Note 1
Or Commercial	(Para 20.2.1 to 20.2.7)

Note 1: See associated Def Stan in Section 3

A protective silicone compound for use as a coating material on ferrous based articles with or without rubber based components; it should be suitable for use over the product temperature range, nominally -50 to +200 °C. The silicone compound shall be prepared from silicone fluid and a gelling agent. Its primary purpose in this application is as a temporary protective against; water / water vapour, corrosion, and contaminants.

Appearance

20.2.1 By visual examination; Homogeneous, translucent, white to light grey in colour, smooth in texture and free from visible impurities

Freedom from abrasive particles

20.2.2 When tested to ASTM D1404 there should be no scratching

Freedom from corrosive action on Ferrous alloys

20.2.3 In a typical corrosion test (e.g., Coat test panels heat at 100 ± 1°C for 70 hours, remove coating, & examine for evidence of corrosion) there should be no pitting, etching, or discolouration.

Low temperature stability

20.2.4 At -50°C for 24 Hours the appearance of the Compound should exhibit no hardening or cracking.

Rubber Swelling (Volume change)

20.2.5 This should not occur. However, it is acceptable if the Rubber Swell Volume change is limited to - 2 to + 10 % (Test pieces immersed in the sample for 14 days at 70 ± 1°C) where the method below is adapted accordingly.

Consistency

20.2.6 At 25 °C (test method IP50/88) Un-worked penetration units, 190 – 250 and Worked penetration units Max 310

Storage stability

20.2.7 (Def Stan 05-50 Part 33 - 6 months at 38 ± 2 °C) Un-worked penetration, penetration units; 190 – 250 and change in Worked Penetration max 310.

20.3 Method

20.3.1 The compound shall be at ambient temperature. Contact between the compound, if 20.2.5 applies, and rubber shall be kept to a minimum. If contact is unavoidable the compound shall be cleaned from the rubber with a clean dry cloth that is free from residues of laundering chemicals.

Brushing.

20.3.2 The Compound shall be applied using a brush to give an even coating on all surfaces. The brush shall be clean and of a quality that will allow coverage of the item without leaving deep brush marks.

Smearing.

20.3.3 The Compound shall be applied so that an even coating is obtained on all surfaces using a clean cloth or swabs which are free from residues of laundering chemicals, or clean tools of a material that does not damage the item.

21 Process C20 - Application of Corrosion Preventive Compound PX-11 to Metallic Materiel

21.1 General

21.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

21.2 Material

Corrosion preventive compound (PX-11, AEROSHELL COMPOUND 05)

Note: The products approximate composition should be 90% mass High melting point mineral jelly and 10% mass Beeswax.

21.3 Method

21.3.1 The compound shall be applied at (85 ± 5) °C and allowed to set before handling.

Dipping.

21.3.2 Materiel shall be immersed in a bath of the compound for sufficient time to ensure complete wetting. The items may be pre-heated to avoid local chilling. The items shall be agitated, tilted, or inverted to allow trapped air to escape and ensure complete coverage of all surfaces (internal and external). Small items may be placed in baskets or trays for dipping (separated from each other to prevent blocking). Large items may be dipped in two stages to ensure complete coverage. After immersion, the items shall be removed from the bath and surplus compound drained. If necessary, the process may be repeated (or method 24.3.3 followed) after the first coating has set to ensure complete coverage of areas that may have been in contact with the basket or tray.

Brushing.

21.3.3 The compound coat shall be applied using a brush. This brush shall be clean and of a quality that will allow coverage of the item without leaving deep brush marks. The coating made shall be even on all surfaces.

22 Process C21 - Application of Temporary Protective to Metallic Materiel: Oil Film

22.1 General.

22.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

22.2 Materials

Corrosion preventive compound, PX-4 See Note 1

Note 1: See associated Def Stan in Section 3.

22.3 Method

22.3.1 The protective shall be applied at ambient temperature.

Dipping.

22.3.2 Materiel shall be immersed in a bath of protective for sufficient time to ensure complete wetting. The items shall be agitated, tilted, or inverted to allow trapped air to escape and ensure complete coverage of all surfaces (internal and external). Small items may be placed in baskets or trays for dipping. Large items may be dipped in two stages to ensure complete coverage. After immersion, the items shall be removed from the bath and surplus protective drained.

Spraying.

22.3.3 The items shall be sprayed so that an even coating of protective is applied to all surfaces both internal and external. Small items may be placed in baskets or trays for spraying.

Brushing.

22.3.4 The protective shall be applied using a brush to give an even coating on all surfaces. The brush shall be clean and of a quality that will allow coverage of the item without leaving deep brush marks.

Smearing.

22.3.5 The protective shall be applied so that an even coating is obtained on all surfaces using a clean cloth or swabs which are free from residues of laundering chemicals.

23 Process C22 – Vacant

24 Process C23 – Vacant

25 Process C24 – Vacant

26 Process C25 – Vacant

27 Process C26 – Vacant

28 Process C27 – Vacant

29 Process C28 – Vacant

30 Process C29 – Vacant

31 Process C30 – Vacant

32 Process C31 – Vacant

33 Process C32 – Vacant

34 Process C33 - Protection of Woollen Materiel against Moths

34.1 General.

34.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

Note 1: Storage, packing and unpacking shall be carried out in a well-ventilated area.

Note 2: Naphthalene in the physical form of; flakes, crystals or powder shall not be used.

Note 3: Where the textile material is already impregnated with a similar functioning agent this process may not be relevant.

34.2 Material

Naphthalene, grade 1	BSI BS 5962

34.3 Method.

34.3.1 The naphthalene shall be used within marked dust proof sachets in ball or ovoid form (see Supply and Carriage of Dangerous Goods Regulations) at a rate of 160 g of naphthalene per cubic metre of the package. The sachets shall be evenly distributed within the package.

34.4 Marking of containers

34.4.1 The exterior of the container shall be marked or labelled with the following:

Contains Naphthalene (Moth Balls)

Harmful by inhalation and if swallowed

Avoid contact with skin and eyes

35 Process C34 - Vacant

36 Process C35 - Treatment of Rubber Materiel with Dusting Powder

36.1 General.

36.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

36.2 Material

French chalk powder	Commercial

36.3 Method.

36.3.1 The powder shall be evenly disposed by dusting over all rubber surfaces.

37 Process C36 – Vacant

38 Process C37 – Vacant

39 Process C38 - Vacant

40 Process C39 – Vacant

41 Process C40 – Vacant

Wrapping Applications

42 Process C41 – Application of Primary Wrapping Materials

42.1 General.

42.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

42.2 Materials

Non-grease-resisting

Paper, wrapping; (Types 1, 2 or 3)	See Note 4
Polyethylene, bubble film for packaging	See Note 4
Paper, Kraft, creped, wet strengthened or Anti-Bleed	See Note 4
Paper, tissue	Commercial
Polyethylene film, black electrically conductive	See Note 4
Polyethylene film (low density) natural colour	Type 1, See Note 4
Polyethylene film (low density) black, opaque	Type 2, See Note 4
Grease-resisting	
Paper, wrapping, grease-resisting and Bags, Paper, grease-resisting	See Note 4
Wrapping, mouldable, waxed, grease-resisting	See Note 4

Note 1: Paper, wrapping, grease-resisting shall not be used in contact with paint or rubber.

Note 2: Polyethylene film (125 µm minimum thicknesses), may be used as a grease-resisting wrap for materiel coated with PX-1.

Note 3: When polyethylene bubble film is used for wrapping an item, the bubbles shall be innermost.

Note 4: See associated Def Stan in Section 3

42.3 Methods of Application

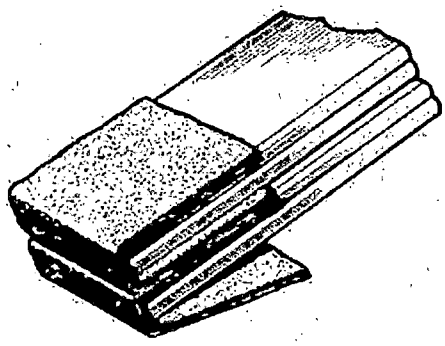
Bandage wrapping.

42.3.1 The ends of the item shall be padded and the wrapping applied as shown in Figure 1. Each succeeding turn of the wrap shall overlap the previous turn by one half of the width or by 25 mm whichever is less. The first and last turns (minimum) shall be secured in position.

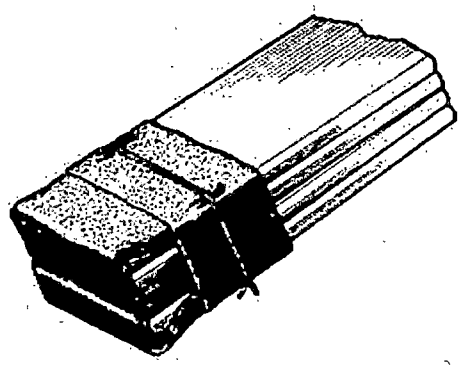
Non-bandage wrapping.

42.3.2 Wrapping shall be in accordance with Figure 2. Overlapping material may be left as a 25 mm overlap (minimum). If the wrapping material is polyethylene film, heat-sealing may be used to secure/close the wrap. The wrapping shall be drawn as close to the item surfaces as possible without exerting pressure that will disturb the protective (if any). If grease-resisting material is used the grease-resistant surface shall be in contact with the temporary protective. Sheets, bags, or envelopes may be used.

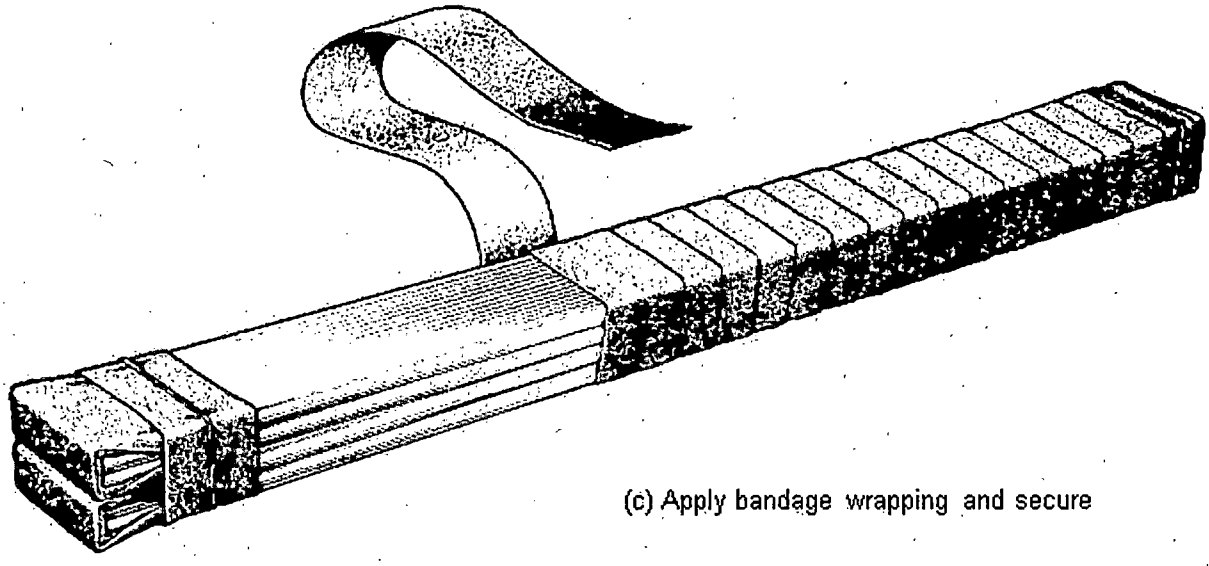
42.3.3 When textiles, that are subsequently to be baled, are wrapped (with Type 3), an overlap of not less than 150 mm shall be used.



(a) Form two pads of wrapping material of triple thickness and slightly wider than the bundle. Locate a pad over each end of the items by folding in half, tucking in between the items, and carrying loose ends over the items as shown.



(b) Wind single strip of wrapping material around the pad and secure in position.



(c) Apply bandage wrapping and secure

Figure 1 - Bandage Wrapping

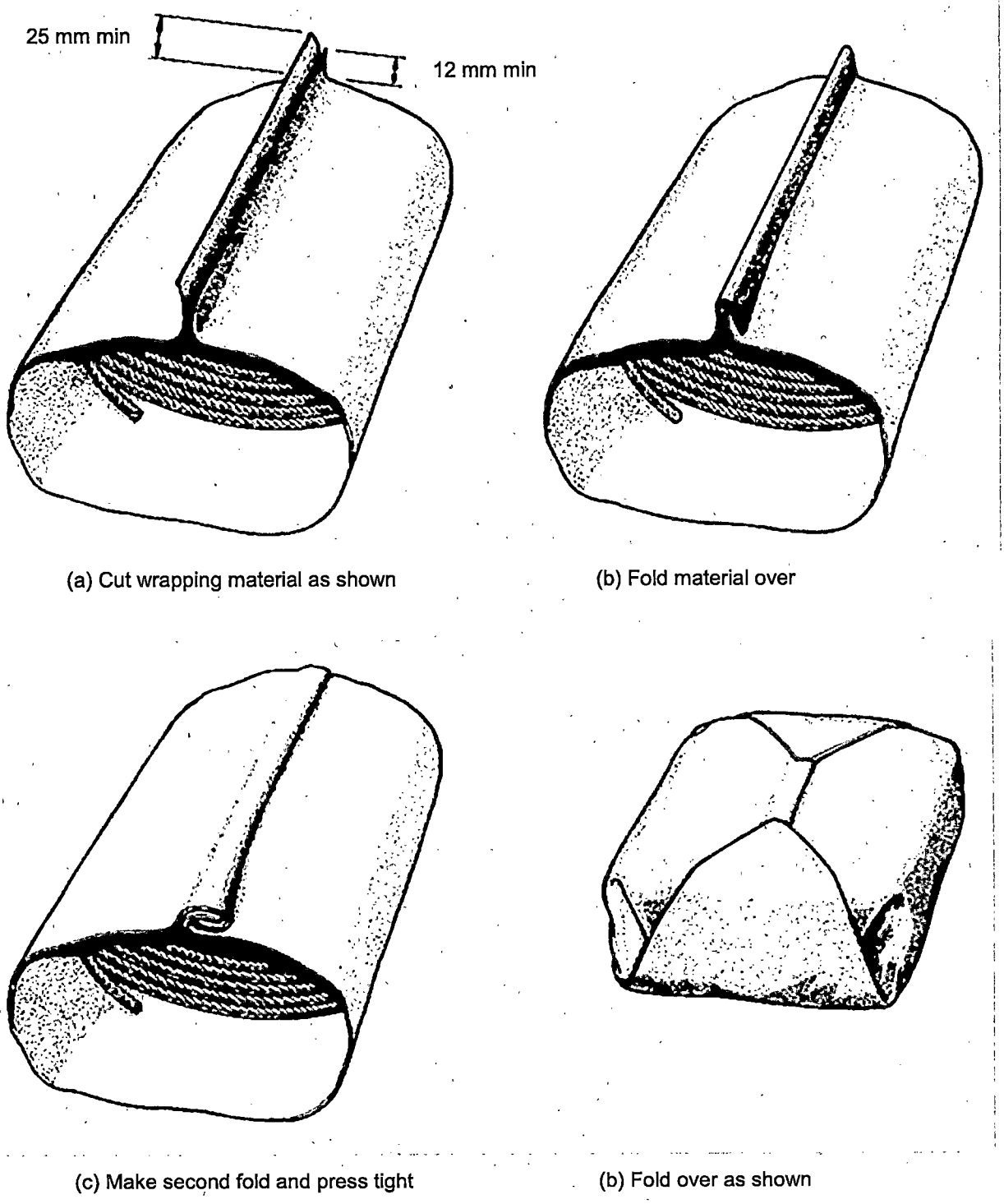


Figure 2 - Primary Wrapping Employing a Lock Fold Seam

43 Process C42 - Application of Outer Wrappings

43.1 General.

43.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

43.2 Material

Paper, Kraft Union (PKU) and Paper, Creped, Kraft Union Reinforced (PCKUR)	See Note 1
Polyethylene (low density) film, natural colour	Type 1, See Note 1
Polyethylene (low density) film, black opaque	Type 2, See Note 1
Paper, wrapping, Kraft 90 g/m^2	Commercial
Tubing, woven polypropylene	Commercial

Note 1: See associated Def Stan in Section 3

43.3 Methods of Application

Bundle wrapping.

43.3.1 Bundles shall be wrapped as shown in Figure 3 and secured using tensional steel strapping, BSI BS EN 13246, non-metallic tensional strapping, BSI BS EN 13394 (with strapping joints made by a suitable tensioning machine) or round, oval or flat tensional steel wire, (commercial).

a) The flat, tensional steel strapping shall have a minimum tensile strength of 620 MPa and chosen from Table 1.

b) The non-metallic tensional strapping shall be in accordance with BSI BS EN 13394, Polypropylene Type 1. The sizes shall be as shown in Table 2

c) The round, oval or flat tensional steel wire shall be galvanized and chosen from Table 3.

Table 1 Application of Outer Wrappings – Flat Tensional Steel Strapping

GROSS MASS (kg)	WIDTH OF STRAPPING (mm)	THICKNESS OF STRAPPING (mm)
up to 40	10	0.40
40 to 90	13	0.50
90 to 225	16	0.50
225 to 1000	19	0.60
over 1000	25	0.60

Table 2 Application of Outer Wrappings – Non-metallic Tensional Strapping

GROSS MASS (kg)	NOMINAL WIDTH OF STRAPPING (mm)	Minimum Break Strength (N)
up to 40	12	2500
40 to 90	16	5000
90 to 225	19	6000

Table 3 Application of Outer Wrappings – Round, Oval or Flat Tensional Steel Wire

GROSS MASS (kg)	CROSS-SECTIONAL AREA OF WIRE (mm^2)
up to 4	0.70
4 to 20	1.88
20 to 65	2.40

Bandage wrapping.

43.3.2 The ends of the item shall be padded as shown in Figure 1(a) and (b). The wrapping material shall be cut to size and applied as shown in Figure 1(c) with each succeeding turn of the wrap overlapping the previous turn by 50% of the width or by 25 mm (whichever is less). The first and last turns shall be secured in position with fastening material (see Table 4).

Wrapping of fibreboard containers (cartons and boxes)

43.3.3 Cut the wrapping material to size and place around the container as shown in Figure 4(a). The overlapping material may be left as a simple overlap (provided a minimum 25 mm overlap is used), or formed into a lock fold seam in accordance with Figure 5(a), (b) and (c).

43.3.4 Fold in the bottom and sides as shown in Figure 4(b) or 5(d).

43.3.5 Fold in the top and sides as shown in Figure 4(c) or 5(e).

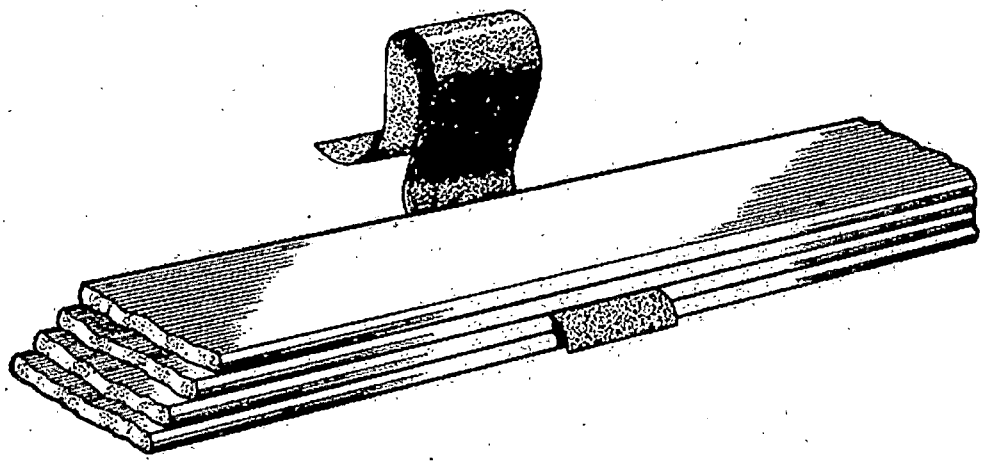
43.3.6 Fold the flaps against the ends or sides as shown in Figure 4(d) or 5(f) and press all seams and joints firmly against the container.

43.3.7 Secure the flaps and seams as shown in Figure 4(e) using the appropriate material (see Table 4).

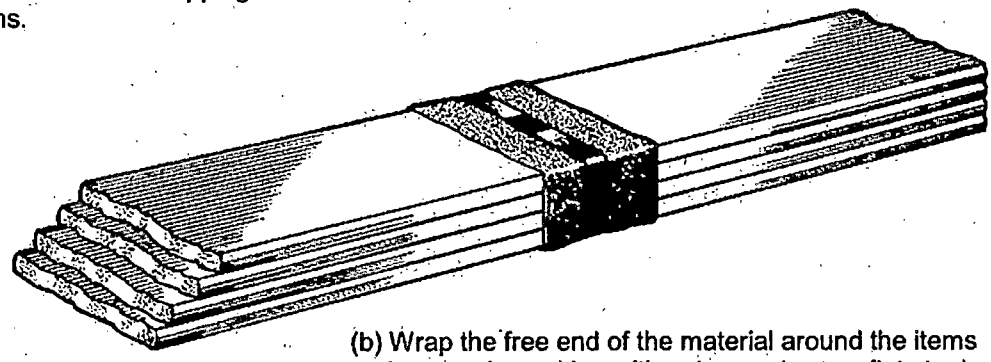
Note: The wrapping material shall be drawn as close as possible to the surfaces of the container being wrapped at all stages.

Table 4 Application of Outer Wrappings – Fastening Materials

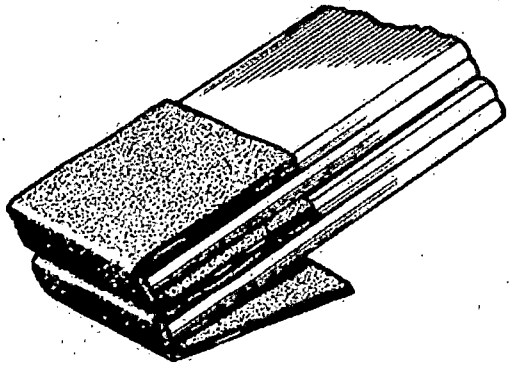
WRAPPING MATERIALS	FASTENING MATERIALS	REMARKS
Tubing, woven polypropylene	BSI BS EN 13394, Non-metallic strapping Twine (40 kg force minimum breaking load) BSI BS EN 13246, Tensional steel strapping	
Kraft Wrapping Paper, 90 g/m^2	Type 2, Tape, pressure-sensitive adhesive (fabric) Type 4, Tape, pressure-sensitive adhesive (water-resistant film)	Levels N and P
Paper, Kraft Union (PKU) and Paper, Creped, Kraft Union Reinforced (PCKUR)	Def Stan 81-145 Type 2a, Tape, pressure-sensitive adhesive (water resistant fabric)	Level J only



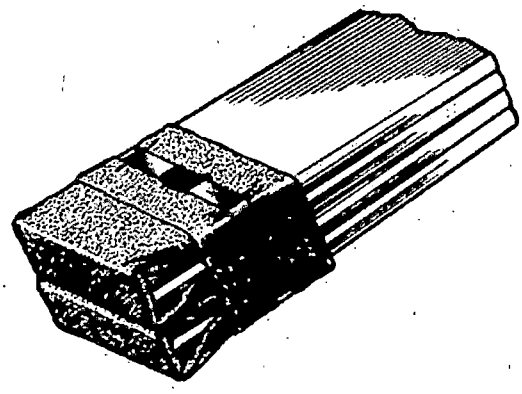
(a) At central point along the length of the bundle, place an end of the wrapping material between the items.



(b) Wrap the free end of the material around the items and secure in position with polypropylene or flat steel strapping or wire



(c) Form two pads of wrapping material of triple thickness and slightly wider than the bundle. Locate a pad over each end of the items by folding in half, tucking in between the items, and carrying loose ends over the items as shown



(d) Wind single strip of wrapping material around the pad and secure in position with polypropylene or flat steel strapping or wire.

Figure 3 - Bundle Wrapping

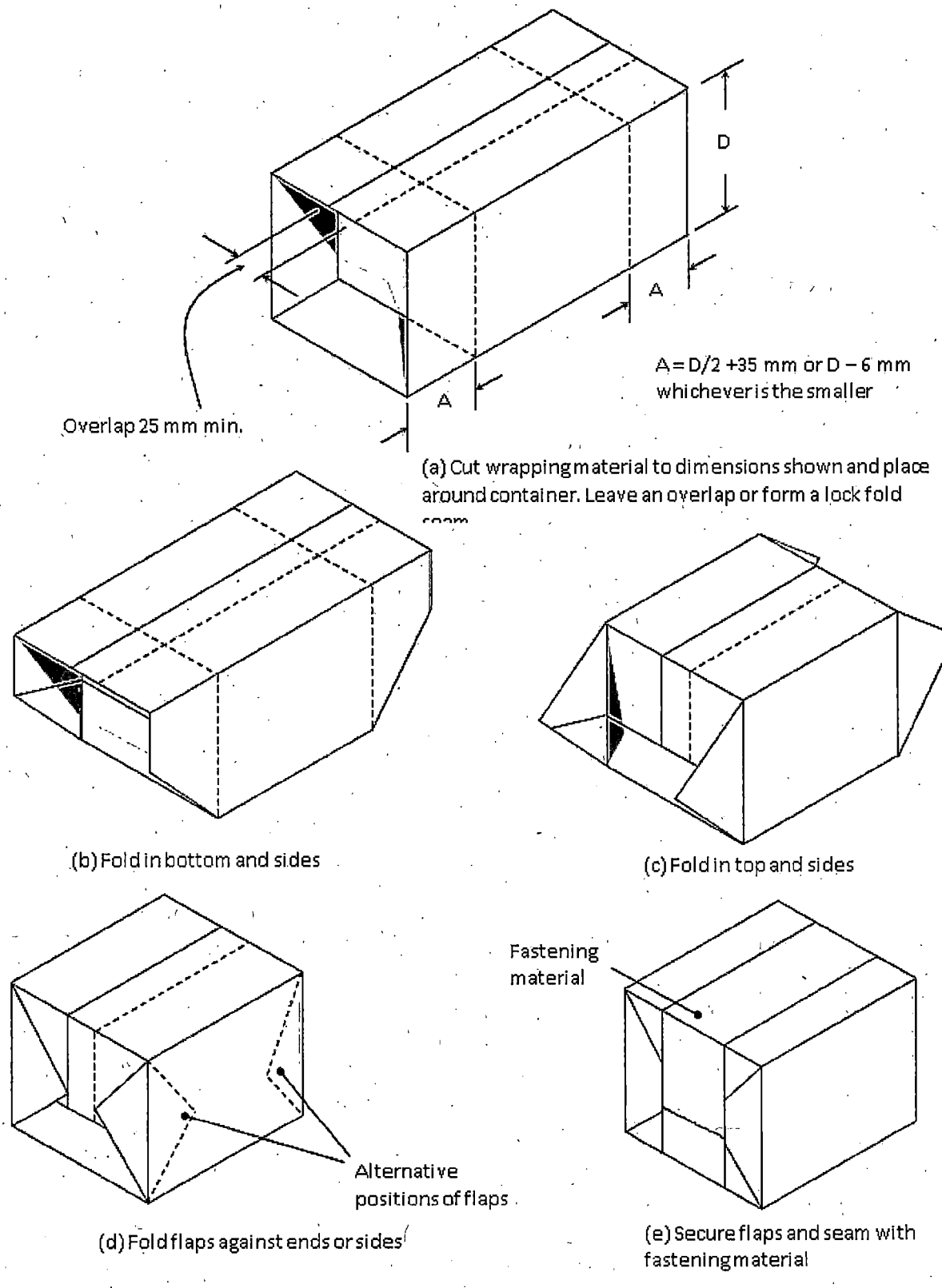


Figure 4 - Container Outer Wrapping

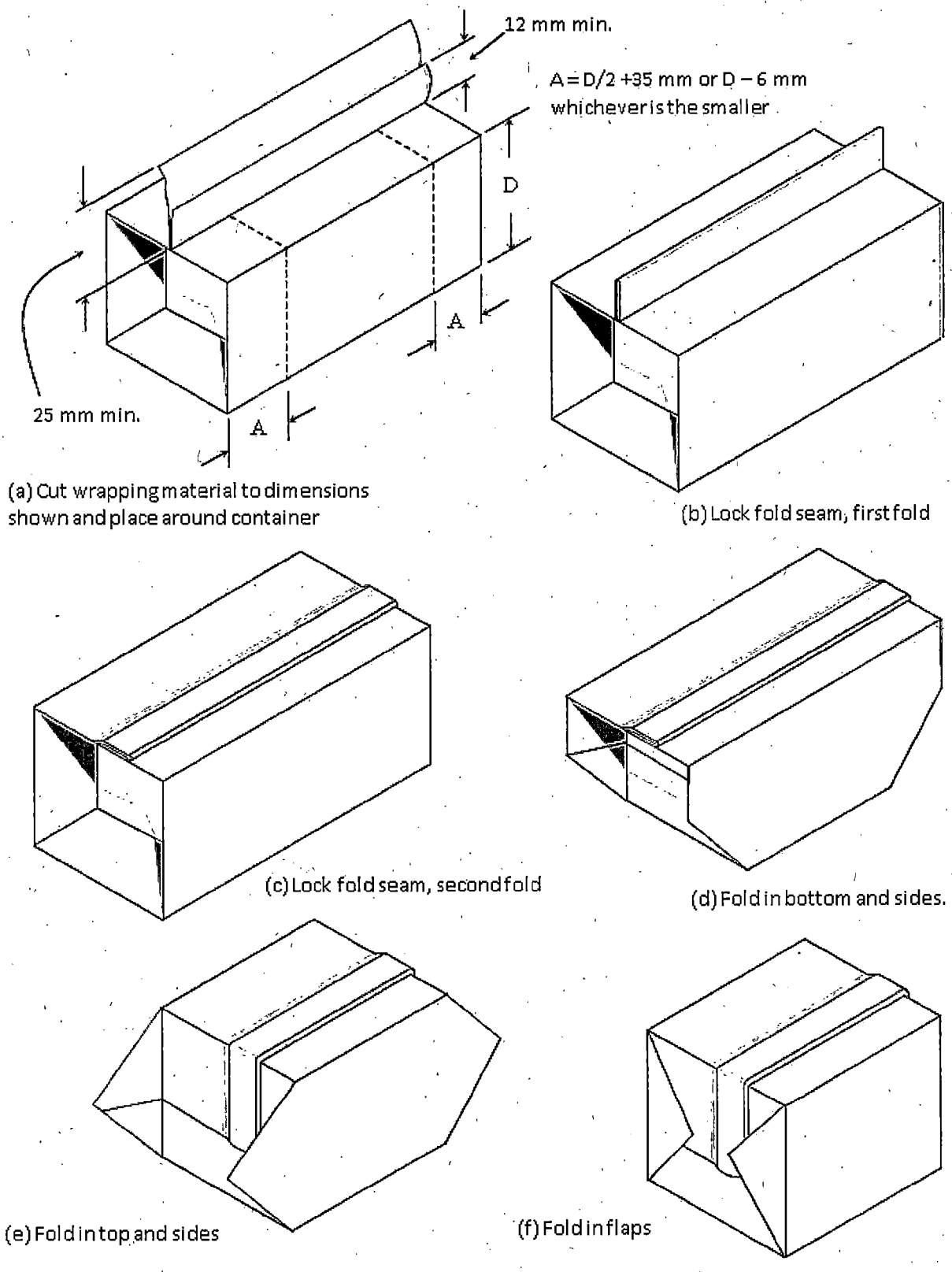


Figure 5 - Container Outer Wrapping

44 Process C43 - Application of Waterproof Paper as a Waterproof Barrier

44.1 General.

44.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

44.1.2 This process details the method of applying the materials listed below to construct waterproof barriers in the form of envelopes, bags, loose container liners and fitted container liners.

44.2 Materials

Paper, Kraft Union (PKU) and Paper, Creped, Kraft Union Reinforced (PCKUR) See Note 2

Note 1: PKU is water-proof and PCKUR is water resistant, use as appropriate.

Note 1: See associated Def Stan in Section 3

44.3 Method of Construction

General.

44.3.1 The securing and waterproofing adhesive shall be Rubber-resin No. 7.

Bags and envelopes.

44.3.2 These shall be sufficiently large to avoid stressing the paper or seams. Bags shall be constructed by folding a sheet of the barrier material in the centre and sealing the two sides or by placing two sheets of the barrier material together and sealing the sides and bottom. After the item has been inserted in the bag, the opening shall be sealed in a similar manner or by a turnover flap. All joints, seams and flap shall be a minimum of 10 mm width and be made waterproof by the application of adhesive (see Figure 6).

Fitted container liners.

44.3.3 The waterproof barrier lining material shall be applied during the build-up of the sides, ends, base, and lid of a container. Construction members shall be utilized to secure the lining material, e.g. between framing and sheathing of a sheathed container.

44.3.4 The lining material shall be applied to the inner faces of side and end panels and shall be carried over the panel edges to the full thickness of the panel and be secured to the panel edges with adhesive. On bases and lids the lining material shall be applied to the inner face only and shall be secured around the periphery with adhesive.

44.3.5 Any joints in the liner shall have a minimum 75 mm overlap and shall be waterproofed by the application of adhesive.

44.3.6 Completion of the liner as a waterproof barrier shall be accomplished by the application of adhesive to the butting faces of the panels during container assembly.

44.3.7 If a container has no internal framing in its construction or the container panel surfaces are relatively large, the lining material shall be secured at intervals by nailed or stapled timber laths (see Figure 7). Liners shall not be secured by nails or staples only.

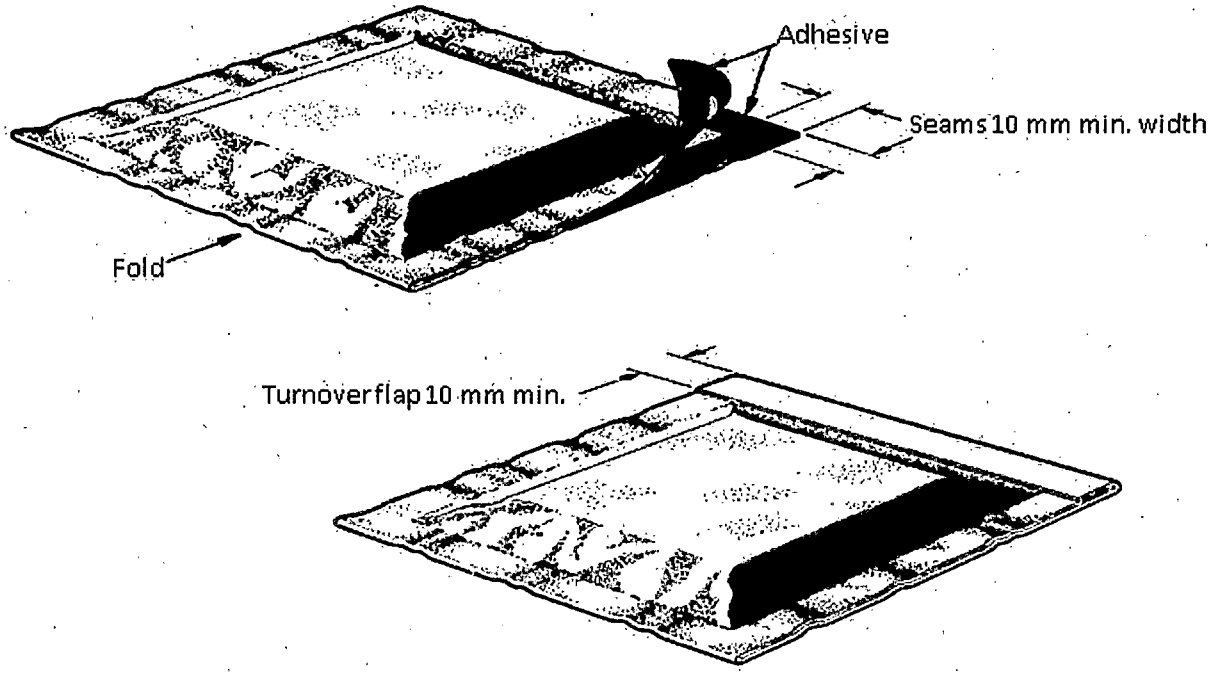


Figure 6 - Construction of Bags

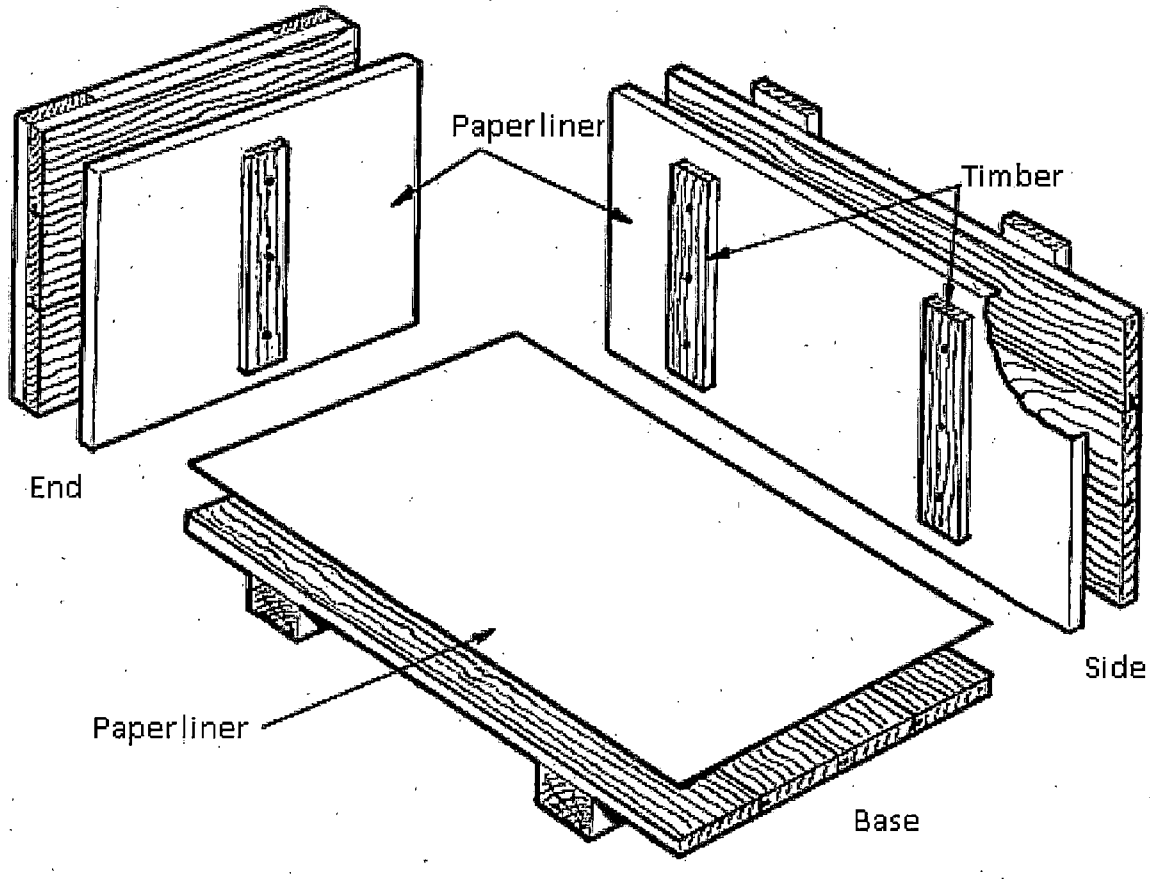


Figure 7 - Fitted Container Liners

45 Process C44 - Application of Polyethylene Film and Polyethylene-Coated Paper as a Waterproof, Water Vapour-Resistant or Water Vapour-Proof Barrier

45.1 General.

45.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

45.2 Materials

Polyethylene (low density) film, natural colour	Type 1, See Note 1
Polyethylene (low density) film, black opaque	Type 2, See Note 1
Paper, Kraft, polyethylene coated (heat sealable)	See Note 1
Tape, Adhesive	Type 3, See Note 1

Note 1: See associated Def Stan in Section 3

45.3 Method of Construction

45.3.1 Water vapour-proof barriers shall be constructed from 500 µm polyethylene film, Type 1 or 2. This may consist of many films each not less than 125 µm thick.

45.3.2 Water vapour-resistant barriers shall be constructed from 250 µm polyethylene film, Type 1 or 2. This may consist of two 125 µm thick films.

45.3.3 Waterproof barriers shall be constructed from a minimum thickness of 65 µm polyethylene film, Type 1 or 2, or paper, Kraft.

45.3.4 Barriers shall be constructed from sheets or envelopes, or layflat tubing (polyethylene film) (see Figure 8). The barrier shall be sufficiently large to avoid stressing the enclosed items and sufficient material shall be allowed so that the final seal may be broken and remade.

45.3.5 All seams and closures shall be heat-sealed using a suitable machine or tool. Air shall be extracted or expelled from within the barrier before completing the final seal. Care shall be taken not to damage the barrier material. Care must be taken not to impose undue stress on items that may be liable to damage by air pressure variations (such as instruments incorporating capsules).

Note: Care shall be taken to verify that the sealing of a corner used for air exclusion connects up with the initial sealing and a continuous weld is obtained.

45.3.6 The barrier shall be folded after sealing to conform to the shape of the item and secured with tape, Type 3.

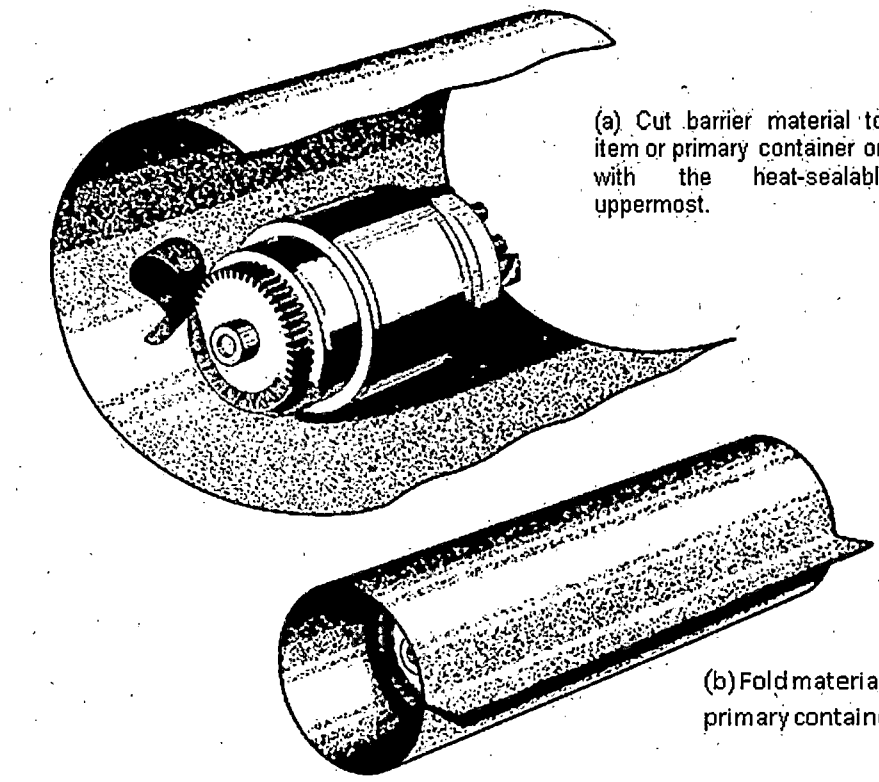
45.4 Visual Examination of Barriers

45.4.1 All barriers shall be examined to verify that:

a) All seams have been satisfactorily sealed and form a continuous weld.

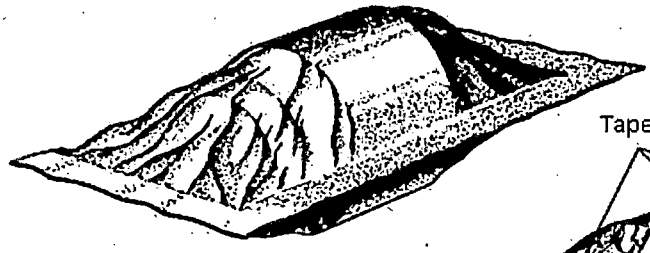
b) The seams are flat and the material has not bunched during sealing.

c) The seams show no sign of damage by burning. A satisfactory seal of polyethylene film is indicated by an unbroken translucent band or beaded edge.

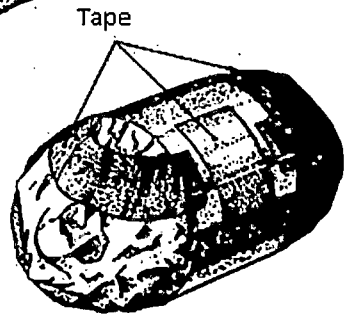


(a) Cut barrier material to size. Place item or primary container on the material with the heat-sealable surface uppermost.

(b) Fold material over the item or primary container



(c) Heat seal to complete barrier



(d) Fold complete barrier to shape of item or primary container and secure with tape

Figure 8 - Application of Barrier

46 Process C45 – Application of Wrapping, Mouldable, Waxed, Grease-Resisting, Def Stan 81-129, as a Waterproof Barrier

46.1 General.

46.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

46.2 Material

Wrapping, mouldable, waxed, grease-resisting	See Note 1

Note 1: See associated Def Stan in Section 3

46.3 Method of Application

General.

46.3.1 The wrapping shall be drawn as close as possible to the surface of the container or item being wrapped. A lock fold seam shall be used to make the closure.

Container wrapping.

46.3.2 Cartons and boxes shall be wrapped as follows:

a) Cut the wrapping material to size, place around the container and wrap using a lock fold seam as shown in Figs 5(a) to 5(f).

Wrapping items directly.

46.3.3 The wrapping shall be cut to size and applied in accordance with Figure 2. The wrapping material shall conform as closely as possible to the contours of the item so that a minimum of air is enclosed. All seams and joints shall be pressed down firmly.

46.4 Overwrapping

46.4.1 The wrapped item shall be overwrapped with paper, wrapping Kraft 90 g/m^2 as follows:

a) Cut the paper to size and place around the wrapped item as shown in Figure 4(a). The overlapping material may be left as a simple overlap provided a minimum 25 mm overlap is allowed, or formed into a lock fold seam in accordance with Figure 5(a) to 5(c).

b) Fold in the bottom and sides as shown in Figure 4(b) or 5(d).

c) Fold in the top and sides as shown in Figure 4(c) or 5(e).

d) Fold the flaps against the ends or sides as shown in Figure 4(d) or 5(f) and press all seams and joints firmly against the container.

e) Secure the flaps and seams as shown in Figure 4(e) using tape Def Stan 81-145 Type 2a (military packaging level J) or Type 4 (military packaging levels N and P).

47 Process C46 – Vacant

48 Process C47 - Application of Metal Foil Laminated Sheet as a Water Vapour-Proof Barrier

48.1 General.

48.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

48.2 Material

Barrier material, aluminium foil laminate, flexible, heat sealable, water-vapour resistant	See Note 1
Tape, Adhesive	Type 4, See Note 1

Note 1: See associated Def Stan in Section 3

48.3 Method of Construction

48.3.1 The barrier shall be sufficiently large to avoid stressing the material when the item is enclosed and sufficient material shall be allowed to enable the final seal to be broken and remade (see Figure 8).

48.3.2 All seams and closures shall be heat-sealed using a suitable machine or tool. Air shall be extracted or expelled from within the barrier. Care shall be taken not to damage the barrier material. Care must be taken not to impose undue stress on items that may be liable to damage by air pressure variations (such as instruments incorporating capsules).

48.3.3 Care shall be taken to verify that the sealing of a corner used for air exclusion connects up with the initial sealing and a continuous weld is obtained.

48.3.4 The barrier shall be folded after sealing to conform to the shape of the item and secured with tape, Type 1 or Type 4.

48.4 Visual Examination of Barriers

48.4.1 All barriers shall be examined to verify that:

a) All seams have been satisfactorily sealed and form a continuous weld.

b) The seams are flat and the material has not bunched during sealing.

The barrier has no holes, lesions or other defects that may affect performance adversely.

49 Process C48 - Application of Metal Foil Laminated Sheet or Polyethylene Film as Water Vapour-Proof or Water Vapour-Resistant Barriers in the Form of Floating Bags

49.1 General.

49.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

49.2 Materials

Barrier material, aluminium foil laminate, flexible, heat sealable, water-vapour resistant	See Note 1
Polyethylene (low density) film, natural colour	Type 1, See Note 1
Polyethylene (low density) film, black opaque	Type 2, See Note 1
Tape, Adhesive	Type 3, See Note 1
Tape, Adhesive	Type 4, See Note 1

Note 1: See associated Def Stan in Section 3

49.3 Methods of Construction

49.3.1 Water vapour-proof barriers shall be constructed from, barrier material, or 500 µm polyethylene film, Type 1 or 2 (may consist of a number of films each not less than 125 µm thick).

49.3.2 Water vapour-resistant barriers shall be constructed from 250 µm polyethylene film, Type 1 or 2 (may consist of two 125 µm films).

49.3.3 The barrier shall be sufficiently large to avoid stressing the material when the items are enclosed and sufficient material shall be allowed so that the final seal may be broken and remade.

49.3.4 Where bolts or studs pass through the barrier material (used for securing the item) the holes shall be reinforced with suitable gaskets. The gaskets shall be placed either side of the barrier to make a water vapour-proof seal and held in position with rubber resin No 7, applied in accordance with Process D32 (Paragraph 94).

49.3.5 Two methods of construction are as follows:

Single-wrap method.

a) Affix gaskets over the mounting bolts or studs and stick in position (see Figure 9(a)).

b) Locate the sheet of barrier material centrally on the base board with the mounting bolts or studs protruding through.

c) Affix a second set of gaskets over the mounting bolts or studs and stick in position (see Figs 9(b) and (c)).

d) Locate the item in position and secure.

Note: Care must be taken when tightening securing devices to create an air-tight seal without rupturing the barrier material.

e) Apply padding (Process C49 Paragraph 50) to the item if specified (see Figure 9(d)).

f) Form the floating bag by drawing the barrier material up around the item and sealing the edges (refers to Figure 9(e) and paragraph 49.3.6).

Top hat method.

a) The base of the item shall be placed on a sheet of barrier material and under a prefabricated 'top hat' section that shall be sealed to the bottom sheet. The operations are as follows:

b) As paragraph 49.3.5 a).

c) Locate a sheet of barrier material centrally on the base board to which the 'top hat' section can be sealed with the mounting bolts or studs protruding through.

d) As paragraphs 49.3.5 c) to 49.3.5 e).

e) Form the floating bag by placing the 'top hat' section over the item and seal to the sheet of barrier material that forms the base (see Figure 9(f) and paragraph 49.3.6).

49.3.6 Seams and closures shall be heat-sealed using a suitable machine or tool. Air shall be removed from within the barrier before completing the final seal. Care shall be taken not to damage the barrier material. Care shall also be taken not to impose undue stress on items that may be liable to damage by air pressure variations (such as instruments incorporating capsules).

49.3.7 The barrier shall be folded after sealing to conform to the shape of the item or primary container and secured with tape, Type 3 or Type 4.

49.4 Visual Examination of Barriers

49.4.1 All barriers shall be examined to verify that:

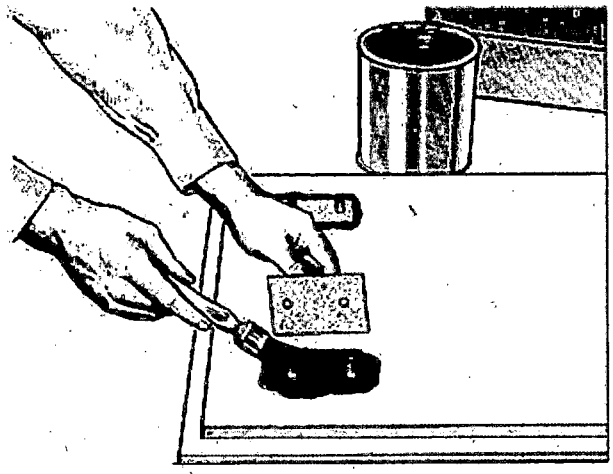
a) All seams have been satisfactorily sealed and form a continuous weld.

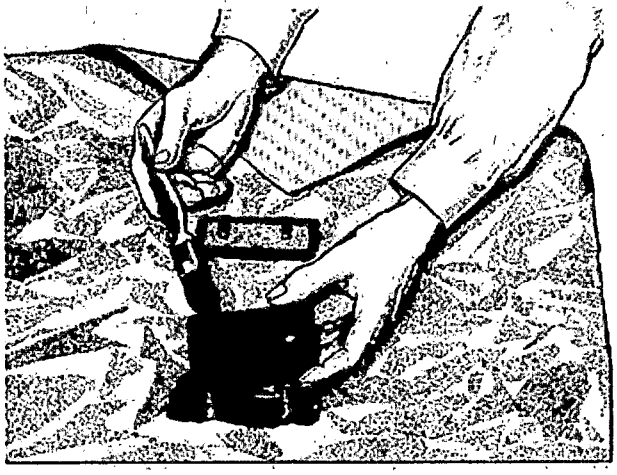
Note: Care shall be taken to verify that the sealing of a corner used for air exclusion connects up with the initial sealing and a continuous weld is obtained.

b) The seams are flat and the material has not bunched during sealing.

c) The seams show no sign of damage by burning. A satisfactory seal of polyethylene film is indicated by an unbroken band or beaded edge

(a) Fit gaskets in position on the mounting board with adhesive. Apply adhesive to the top surface of the gaskets





(b) Place barrier material on the mounting board over the gaskets. Apply adhesive to barrier and underside of the second set of gaskets. Press gaskets firmly in position.

(c) Barrier with gaskets in position. Apply adhesive around studs to complete water vapour-proof seal.

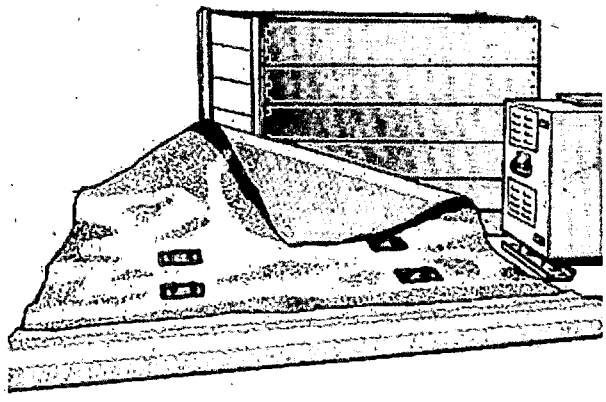
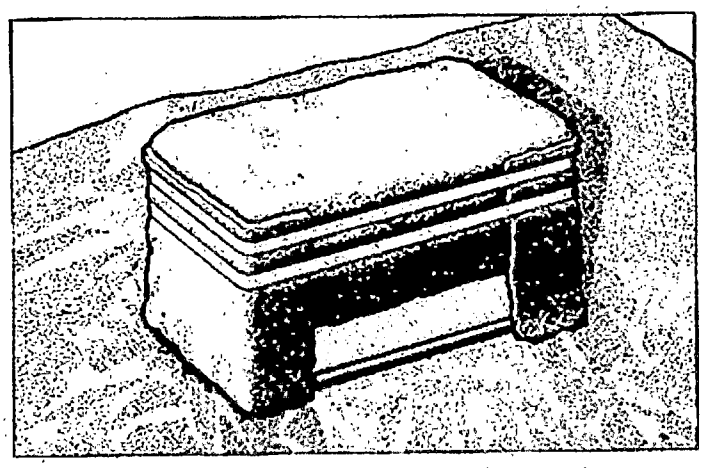
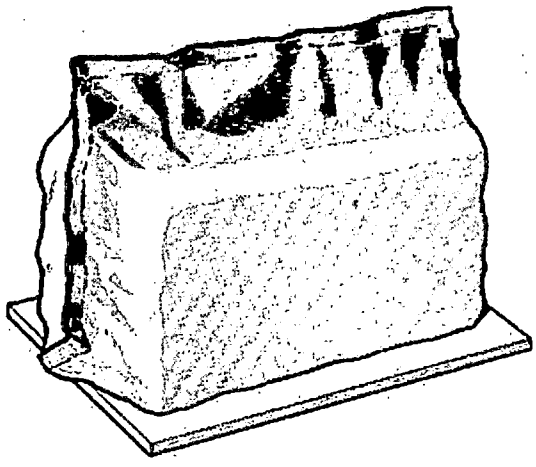


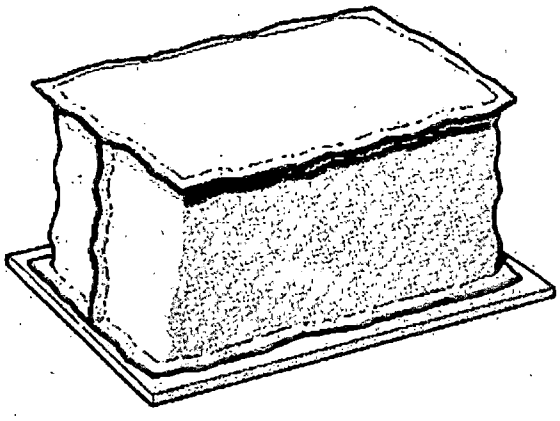
Figure 9 - Construction of Floating Bags



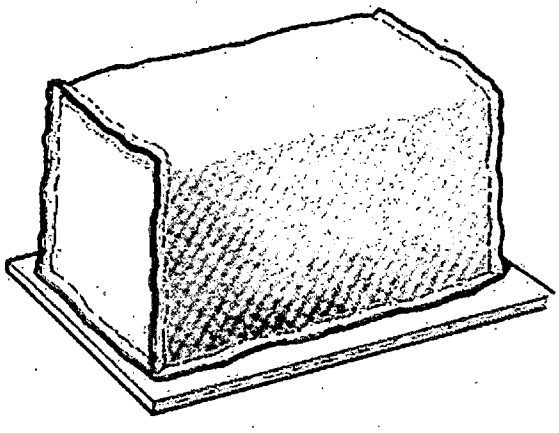
(d) Apply padding to all sharp edges and projections as specified



(e) Completed single wrap barrier



(f)(1) Completed "Top Hat" barrier manufactured from three pieces of material



(f)(2) Completed "Top Hat" barrier manufactured from four pieces of material

Figure 9 - Construction of Floating Bags (Concluded)

50 Process C49 - Protection of Wrapping and Barrier Materials from Sharp Edges, Corners and Projections

50.1 General.

50.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

50.2 Materials

Paper, Wrapping, Location	(single-faced, corrugated)	Type 1, See Note 1
Paper, Wrapping, Location	(Kraft, four-ply)	Type 2, See Note 1
Paper, wrapping, Type 1 (waxed)		See Note 1
Tape, Adhesive		Type 2, See Note 1
Synthetic-fibre Needlefelts		BSI BS 7200
Wadding, cellulose		See Note 1
Wrapping, mouldable, waxed, grease-resisting		See Note 1
Expanded polyethylene skin		Commercial

Note 1: See associated Def Stan in Section 3

50.3 Methods of Application

50.3.1 Sharp edges, corners, and projections on materiel shall be padded so that they cannot puncture or damage wrapping or barrier materials using one of the following methods:

a) Cover all sharp edges, corners and projections with wrapping, mouldable, waxed, grease resisting conforming as closely as possible to the contours of the item. If necessary several thicknesses shall be employed.

b) Cover all sharp edges, corners and projections with paper corrugated, single faced coarse flute, Type 1 and secure with tape, Type 2.

c) Pad all sharp edges, corners, and projections with expanded polyethylene skin, cut to size and shape, and secure with tape, Type 2.

d) Pad all sharp edges, corners, and projections with wadding, cellulose, cut to size and shape, and secure in position with tape, Type 2.

e) Pad all sharp edges, corners and projections with paper, Kraft, embossed, four-ply Type 2, cut to size and shape, and secure with tape, Type 2.

f) Pad all sharp edges, corners and projections with a suitable quantity of shredded paper enclosed in a bag; the material used for both shall be Type 1. The pads shall be secured with tape, Type 2.

g) Pad all sharp edges, corners, and projections with synthetic-fibre needle-felt, (BSI BS 7200), cut to size and shape, interposing Paper, wrapping, Type 1 (waxed) between the item and the pad. The pads shall be secured in position with tape, Type 2.

h) Cover all sharp edges, corners, and projections with tape, Type 2, interposing a primary wrap between the item and the covering. If necessary several thicknesses shall be employed.

51 Process C50 – Vacant

52 Process C51 – Vacant

53 Process C52 – Vacant

54 Process C53 – Vacant

55 Process C54 – Vacant

56 Process C55 – Vacant

57 Process C56 – Vacant

58 Process C57 – Vacant

59 Process C58 – Vacant

60 Process C59 – Vacant

Desiccation

61 Process C60 - The Use of Desiccant

61.1 General.

61.1.1 This process shall be read in conjunction with **Section 1 Warnings**, paragraph 1 and Def Stan 81-041 (Part 2).

61.1.2 All preliminary packaging operations shall be completed so that the barrier may be sealed with minimum delay after desiccant has been inserted and secured in position.

Desiccant bags or sachets shall not be opened.

61.1.3 Loose desiccant shall not be used.

61.1.4 Containers of desiccant shall not be placed adjacent to hygrometers or paper humidity indicators used within the sealed barrier.

61.2 Material

Bags filled with silica gel and bags filled with activated clay	See Note 1
Tape, Adhesive	See Note 2

Note 1: See associated Def Stan in Section 3

Note 2: A suitable Def Stan (see section 3) adhesive tape shall be used when securing the desiccant bags within the packaging.

61.3 Method.

61.3.1 The requisite number of bags or sachets holding the total quantity of desiccant required shall be disposed evenly within the barrier and secured in position with Def Stan tape, using the seams of the bags only. After insertion of the desiccant the barrier shall be sealed without delay.

62 Process C61 – Vacant

Packing and Location of an Item in Containers

63 Process D1 - Packing an Item in a Container using a Space-Filling Material

63.1 General.

63.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

63.2 Materials

Sawdust	Commercial
Vermiculite	Commercial
Wood wool	BSI BS 2548
Expandable corrugated fibreboard lattice	Type 3, See Note 1 or Commercial
Crimped multi-ply, Kraft sheet	Type 2, See Note 1 or Commercial
Loose-fill expanded polystyrene (EPS)	Commercial
Loose-fill Chipped/peanuts of fibreboard	Type 4, See Note 1

Note 1: See associated Def Stan in Section 3

Note 2: Loose-fill EPS shall not be used for Military Level packages designed for the Navy. It should not be used where there is the opportunity for it to become; foreign object damage (FOD) material, e.g., Airfields, or a hazard to farm or other animals.

Note 3: In meeting its environmental and waste responsibilities, the MOD discourages the use of EPS in favour of more Eco-friendly materials. Selectors should also consider the movement of packages to or through other Nations where other regulations apply that may not be as favourable as in the UK.

63.3 Procedure

63.3.1 The item shall be located centrally within the container by filling all the space between the item and container with sufficient material to prevent contact between adjacent items or groups of items. The material shall be compacted to an even density so that the item is firmly held and movement controlled. There shall be no undue deformation of the container resulting from the use of excessive material.

63.3.2 When using either; loose-fill expanded polystyrene, loose-fill fibreboard chips/peanuts, Type 4, or crimped multi-ply Kraft sheet, Type 2, a depth or thickness of 75 mm of material shall surround the item being packed and care shall be taken to overfill the container to a level 15 mm before closure.

64 Process D2 – Vacant

65 Process D3 - Packing an Item in a Container using Corrugated Paper, Embossed Kraft Paper, Polyethylene Bubble Film, Cellulose Wadding or Crimped Multi-Ply Kraft Sheet

65.1 General

65.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

65.2 Materials

Paper, Wrapping Location (single-faced, course flute)	Type 1, See Note 1
Paper, Wrapping Location (four-ply)	Type 2, See Note 1
Polyethylene, bubble film for packaging	See Note 1
Wadding, cellulose	See Note 1
Tape, Adhesive	Type 3, See Note 1
Crimped multi-ply, Kraft sheet	Commercial

Note 1: See associated Def Stan in Section 3

65.2.1 When paper, corrugated is used for wrapping an item or lining a container, the corrugations shall be innermost and folded with the direction of the fluting.

65.2.2 When polyethylene bubble film is used for wrapping an item or lining a container, the bubbles shall be innermost.

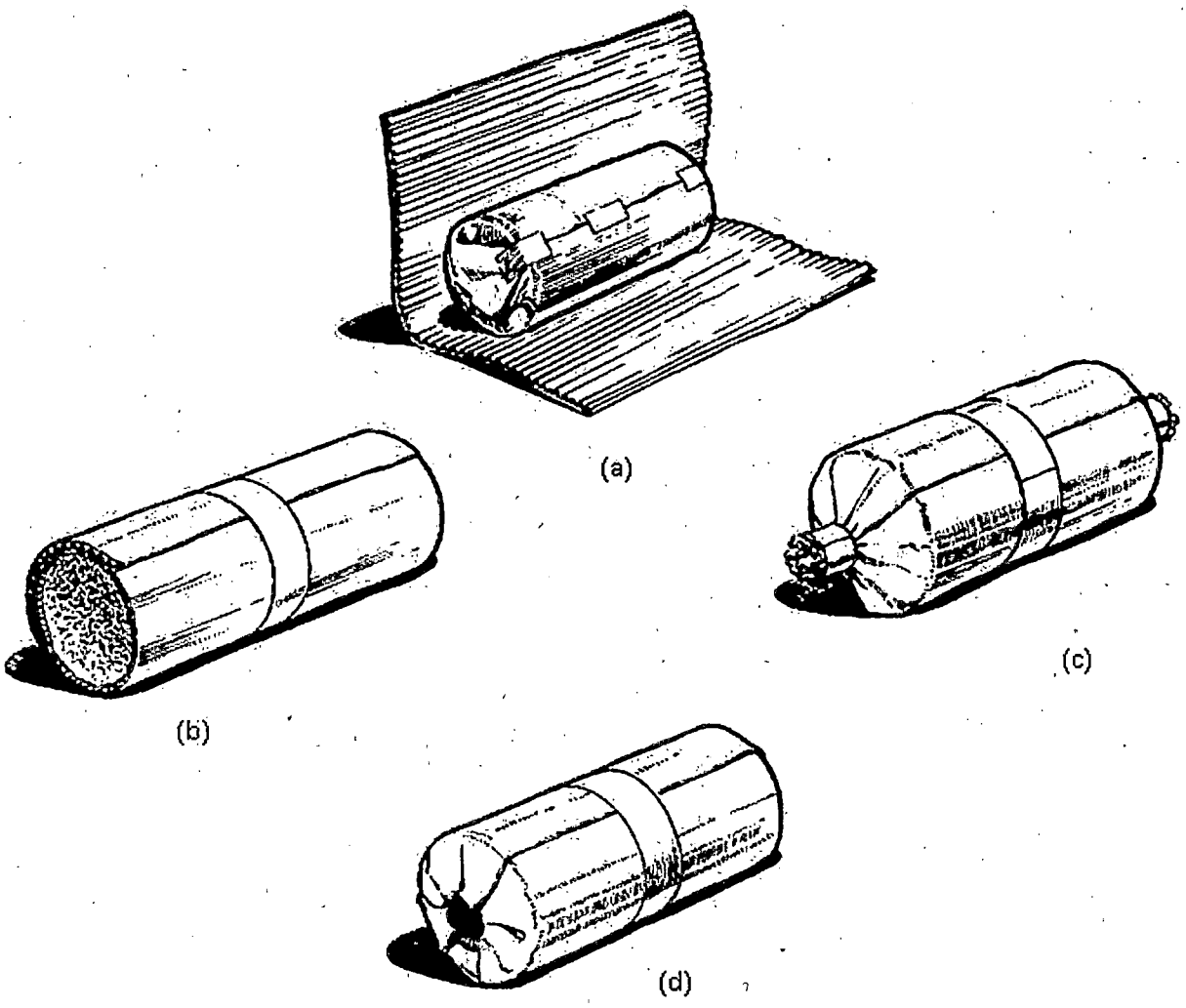
65.3 Procedure

65.3.1 The item shall be located centrally in the container, using one of the materials listed above, to prevent contact between the item and the container and, where appropriate, between adjacent items or groups of items. Sufficient material shall be used to hold the item firmly and control movement within the container during transit of the package. There shall be no undue deformation of the container resulting from the use of excessive material. One of the following methods shall be used.

a) The material shall be applied in the form of a wrap around the item, with a minimum overlap of 50 mm, to obtain an adequate thickness. The wrap shall be secured with tape Type 3 (see Figs 10(a) to (d)). The wrapped item shall then be in the container using additional material as required.

b) The material shall be applied in the form of two wraps around the item, each with a minimum overlap of 50 mm, applied at right-angles to enclose the item totally. The outer wrap shall be secured with tape Type 3 (see Figure 10(e)). The wrapped item shall then be in the container using additional material as required.

c) The material shall be inserted into the container in the form of two strips at right-angles, the inner strip ends shall butt together when folded over the item and the outer strip ends overlap by a minimum 50 mm. The widths of the strips shall correspond to the internal dimensions of the container. The item shall be in the container using additional material as required, prior to the strip ends being folded over (see Figure 10(f)).



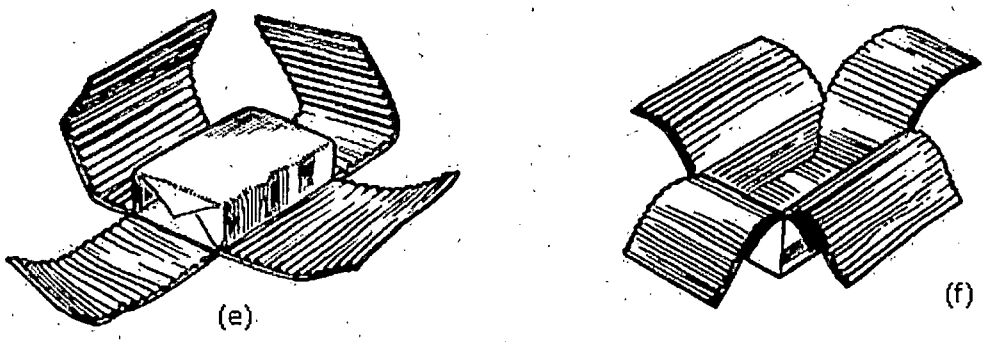


Figure 10 - Methods of Wrapping

66 Process D4 - Location of an Item in a Container using Expanded Polystyrene Fitments

66.1 General.

66.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

66.2 Materials

Expanded polystyrene boards	BSI BS 3837-1
Expanded polystyrene mouldings Types GP and QX	See Note 3
Expanded polystyrene sheet and blocks, reconstituted	Commercial
Tape, adhesive	BSI BS 7116
Tape, adhesive, masking	BSI BS 4J11

Note 1: Expanded polystyrene (EPS) shall not be used in Military Level packages designed for the Navy Department.

Note 2: In meeting its environmental responsibilities, the MOD in general discourages the use of polystyrene products in favour of other Eco-friendlier materials.

Note 3: See associated Def Stan in Section 3

66.3 Fabrication of fitments

66.3.1 The EPS fitments shall be produced by cutting or machining and, where necessary, laminating using synthetic rubber/ resin adhesive No 7, applied in accordance with Process D32 (Paragraph 94), or using tape, BSI BS 7116, or masking tape, BSI BS 4J11.

66.4 Procedure.

66.4.1 The item shall be in the fitments taking care to ensure the correct orientation of the item in relation to the fitments. There shall be no appreciable movement of the item when located or when the assembly is placed in a container. Space between the fitments and the container shall be filled in accordance with Process D5 (Paragraph 67).

67 Process D5 - Location of an Item in a Container using Fabricated Paper Fitments

67.1 General.

67.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

67.2 Materials

Board, corrugated, double-faced (Types A, B, C)	See Note 1
Board, corrugated, (two-flute, three-liner) Types 1 and 2	See Note 1
Board, corrugated, (three-flute, four-liner)	See Note 1
Board, corrugated, (three-flute, four-liner) medium grade	See Note 1
Fibreboard, solid, Kraft lined chipboard	See Note 1
Fibreboard, corrugated, double faced 'E' flute	See Note 1
Paper, Wrapping, Location, (single-faced, coarse flute)	Type 1, See Note 1
Paper, Wrapping, Location (Kraft, four-ply)	Type 2, See Note 1
Tape, Adhesive	Type 4, See Note 1
Crimped multi-ply, Kraft sheet	Commercial
Moulded fibre pulp packaging	Commercial

Note 1: See associated Def Stan in Section 3

67.3 Fabrication of fitments

67.3.1 The fitments shall be fabricated using one of the following methods:

67.3.2 Die cut pads shall be fabricated from boards, corrugated, or fibreboard, that shall be cut to size and die-cut to the required shape. The pieces shall be laminated to obtain the required thickness using a suitable adhesive (see Figure 11).

67.3.3 Rolls and tubes shall be fabricated as follows:

a) Rolls. Paper, corrugated or crimped multi-ply shall be cut to the required width and rolled to form a cylindrical or flat pad of the required dimensions. The ends shall be secured, if necessary, using tape Type 4. When paper, corrugated is used the corrugations shall be innermost and rolled with the direction of the fluting (see Figure 16).

b) Tubes. Corrugated paper, board, or fibreboard shall be cut to the required width and wound to form a cylindrical or rectangular tube of the required dimensions. The ends shall be secured using tape Type 4 or using a suitable adhesive. When paper, corrugated is used the corrugations shall be innermost and the material wound with the direction of the fluting (see Figure 16).

67.3.4 Pads shall be fabricated from corrugated paper, board, or fibreboard or crimped multi-ply cut to size, creased, and folded to obtain a pad of the required shape and dimensions (see Figure 12).

67.3.5 Cells shall be fabricated from board, corrugated or fibreboard, cut to size, creased, and folded to obtain a cell or multi-cell form of the required type, shape, and dimensions. The ends shall be secured using strips of Type 4, passing through the cell and overlapping on the outside face, or using a suitable adhesive (see Figure 13). A combination of pads and cells may be used (see Figure 14).

67.3.6 Blocks shall be constructed from boards, corrugated or fibreboard, which shall be cut to size. The pieces shall be laminated using a suitable adhesive to obtain the required thickness.

67.3.7 Moulded fibre pulp packaging pieces shall be constructed from vacuum moulded recycled fibre pulp to suit the item of supply. They are suitable for protecting items up to 15 kg mass packaged to Military Packaging Level N requirements.

Note: This material may contain chemical impurities and the moulded fibre pieces shall always be exterior to the barrier.

67.4 Procedure

67.4.1 The item shall be located centrally in the container using the fitments, to prevent contact between the item and the container and between adjacent items or groups of items. Space between the fitments and the container shall be filled with material detailed in 67.2.

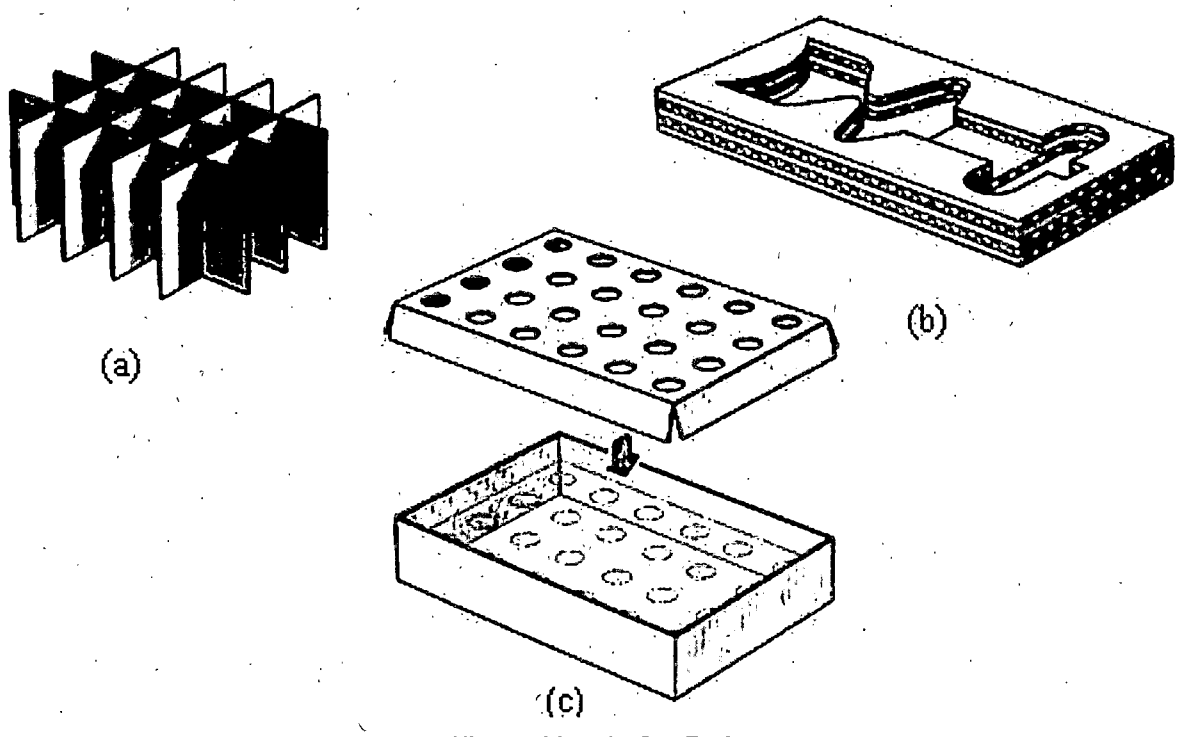


Figure 11 - Die Cut Pads

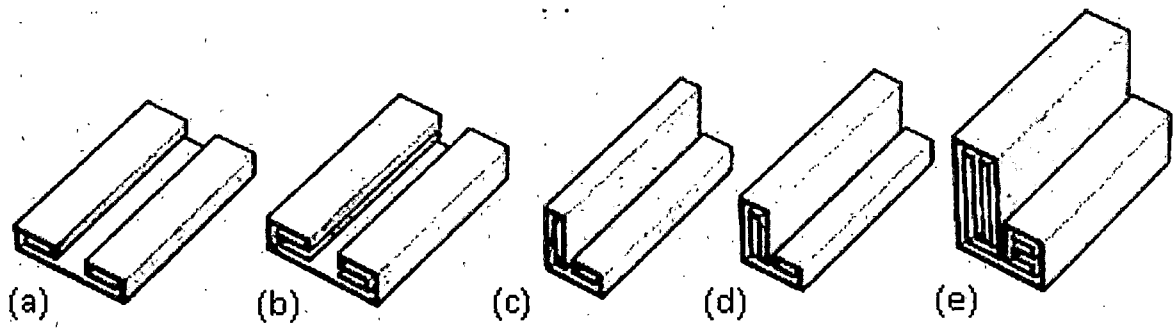


Figure 12 - Pads

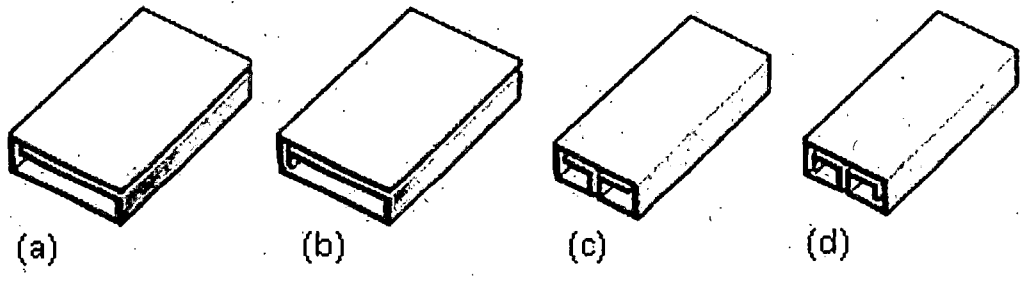


Figure 13 – Cells

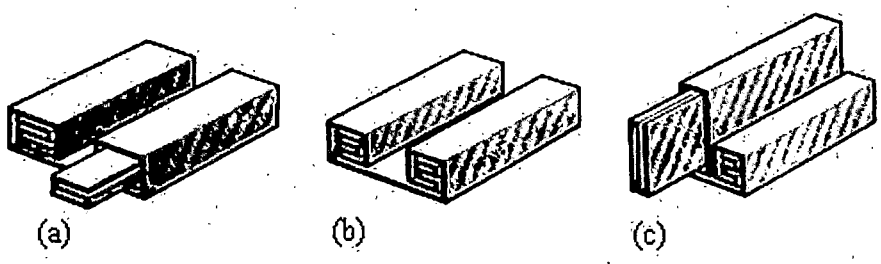


Figure 14 - Pads and Cells

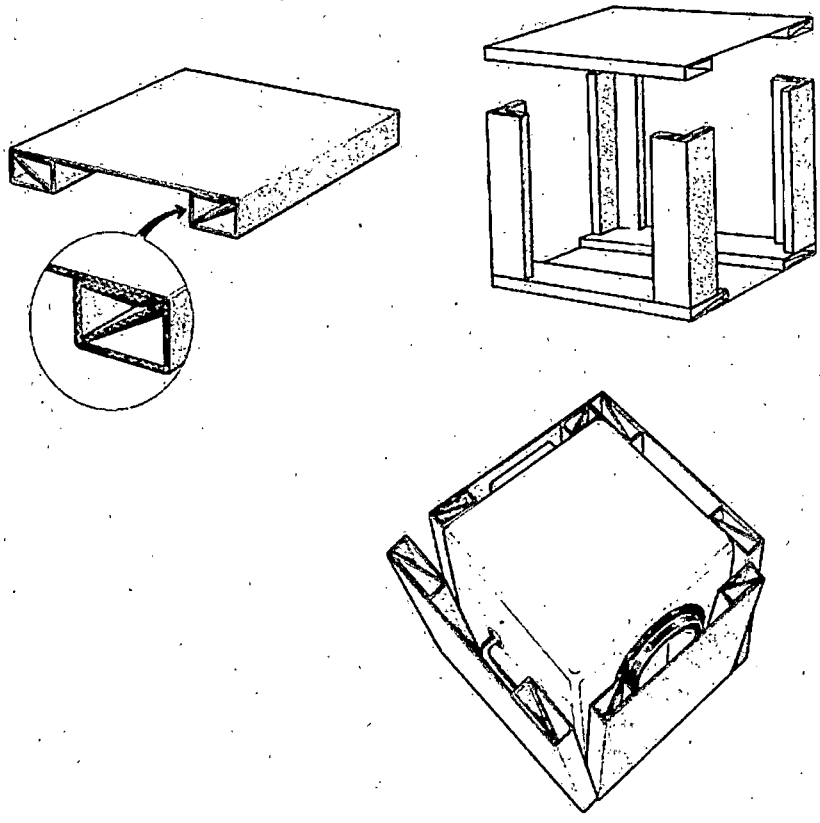


Figure 15 - Typical Examples of Paper Fitments

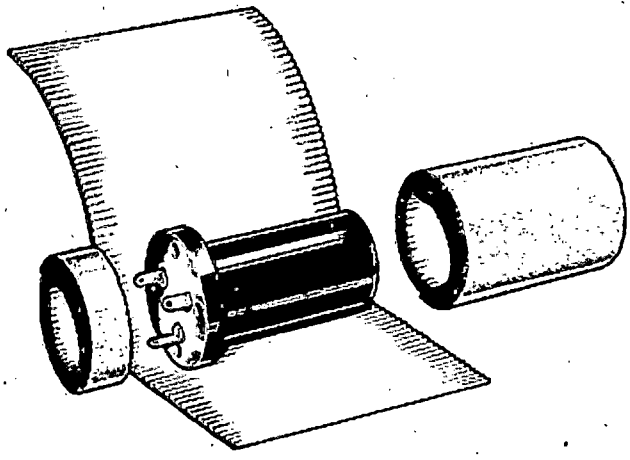


Figure 16 - Rolls and Tubes

68 Process D6 - Location of an Item in a Container using Blocking and Bracing

68.1 General.

68.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

68.2 Materials

Plywood for general purpose packaging	See Note 3
Medium density fibreboard (MDF) for packaging applications	See Note 3
Oriented Strand-board (OSB)	BSI BS EN 300
Synthetic-fibre Needlefelts	BSI BS 7200
Expanded polyethylene sheet	Type GP, grade C, See Note 3
Synthetic rubber/resin No. 7	See Note 3
Any species of temperate coniferous softwood timber	
Any species of temperate hardwood timber (except elm or oak)	

Note 1: All timber shall be fine sawn or planed, sound and free from shakes, splits, dead knots, bark, or other defects likely to impair its strength.

Note 2: All timber should be obtained from a sustainable source and meet ISPM-15 requirements; and be so marked.

Note 3: See associated Def Stan in Section 3

68.3 Procedure

68.3.1 The item shall be located by means of the fitments taking care to ensure the correct orientation of the item in relation to the fitments (see Figs 17(a) to (m)). Slackness or gaps at bearing areas shall be eliminated by local padding with synthetic-fibre Needlefelts, BSI BS 7200 or expanded polyethylene sheet, type GP, grade C. These shall be secured to the fitments using synthetic rubber/resin No 7, applied in accordance with Process D32 (Paragraph 94) (see Figs 17 (a) to (f)).

68.3.2 Loose fitments such as cradles or formers shall be a sliding fit in the positioning guides or cleats that shall be adjusted if necessary to obtain this condition. All fitments shall be secured (see Figs 17 (g) to (m)).

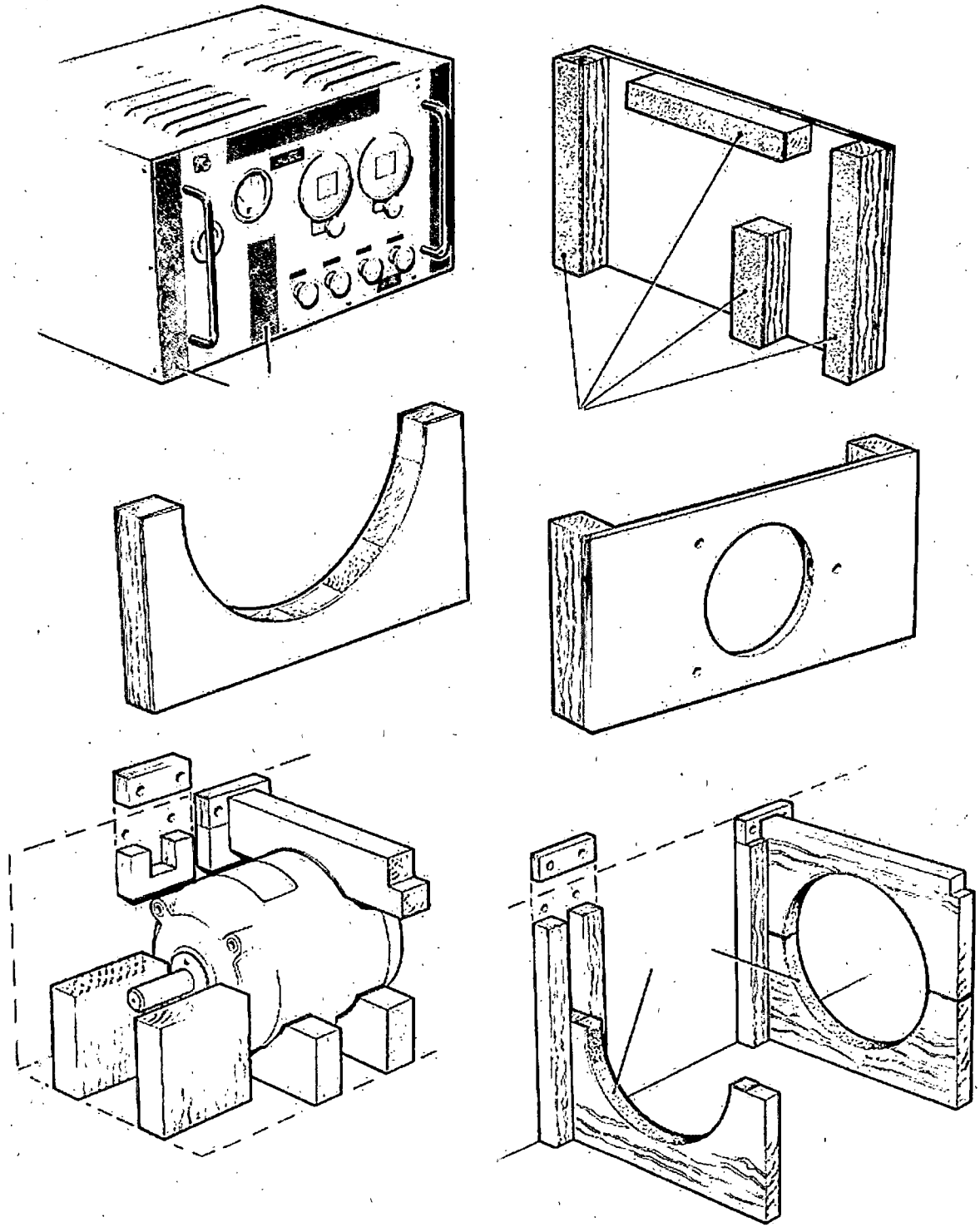


Figure 17 - Blocking and Bracing

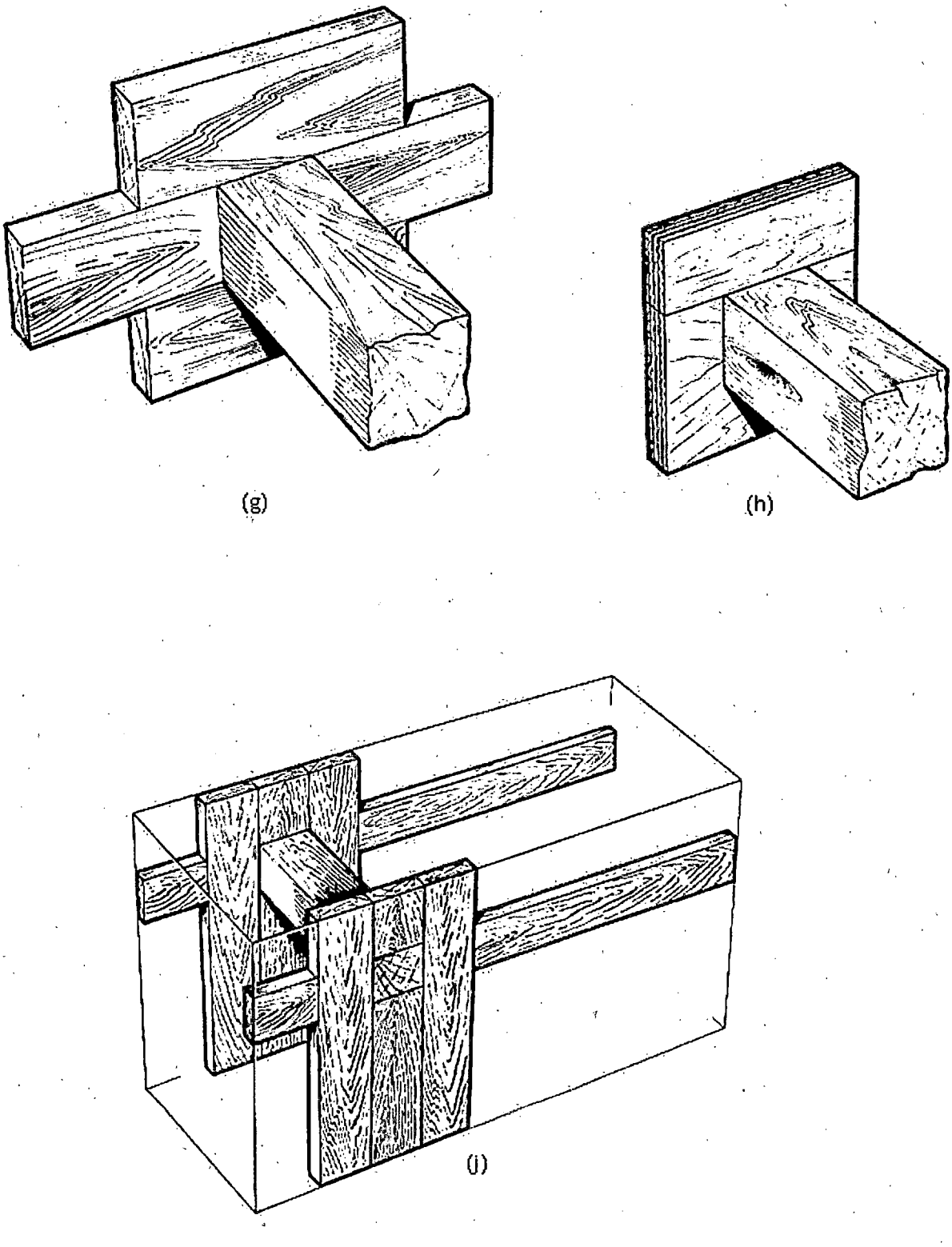


Figure 17 - Blocking and Bracing (Continued)

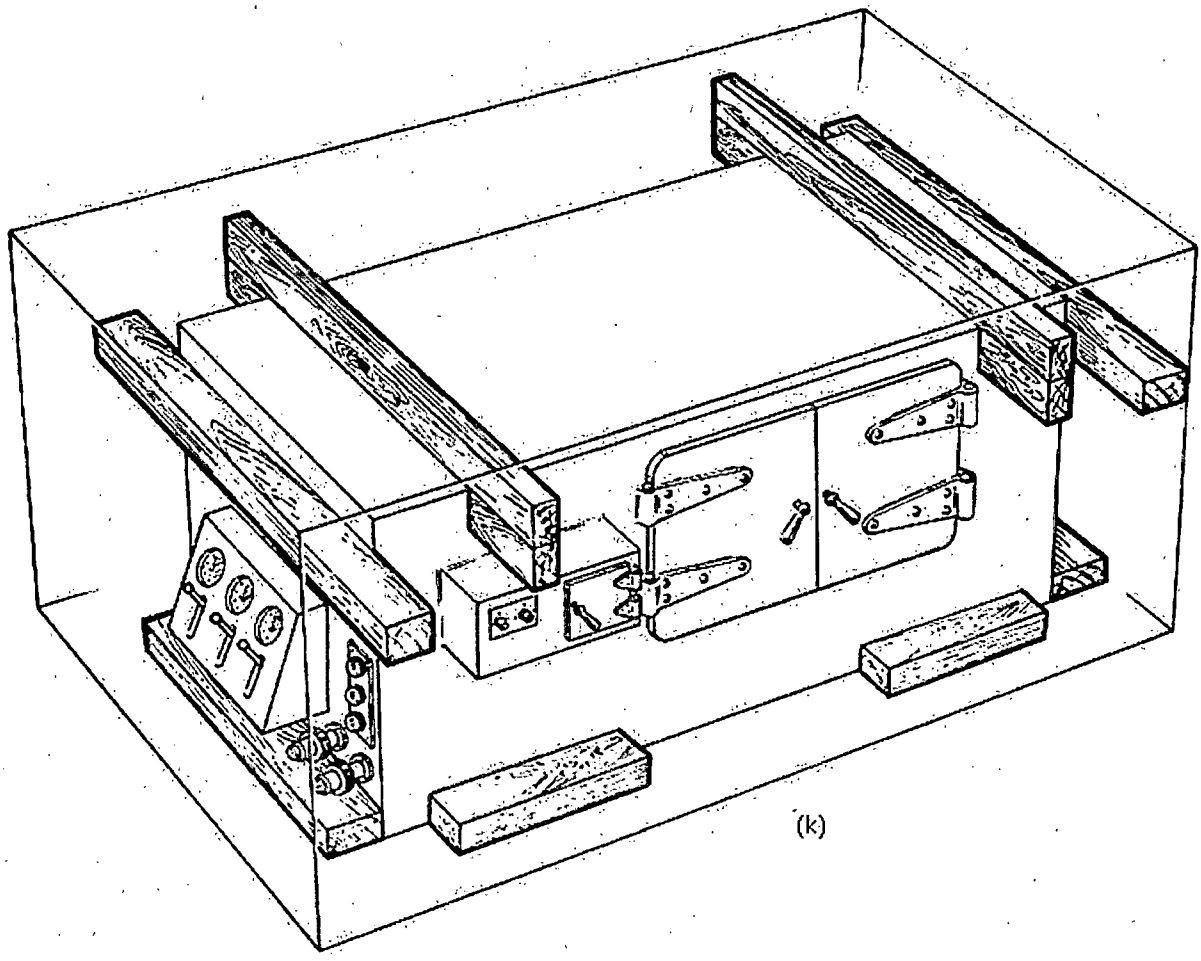
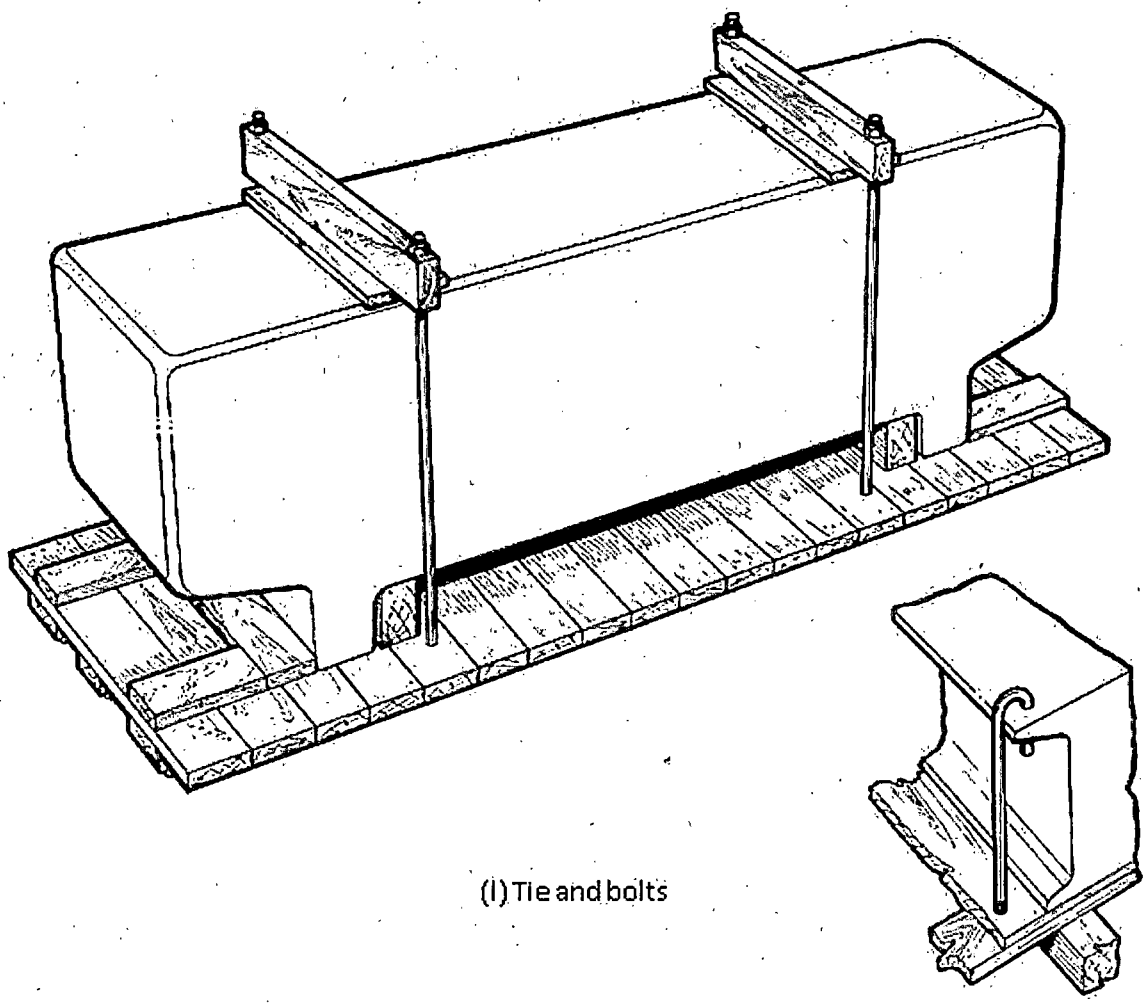
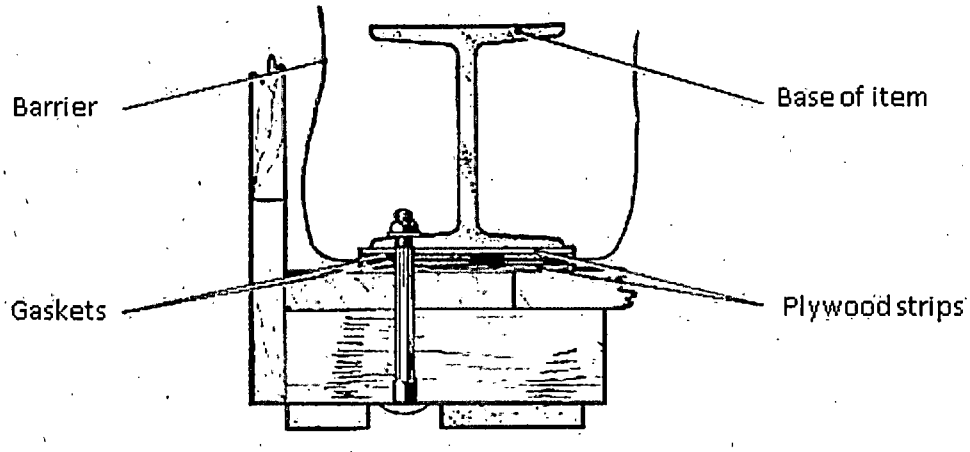


Figure 17 - Blocking and Bracing (Continued)



(l) Tie and bolts



(m) Sealing the barrier at attachment bolts

Figure 17 - Blocking and Bracing (Concluded)

69 Process D7 - Packing an Item in a Container using Resilient Pads

69.1 General.

69.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

69.2 Materials

Bonded Polyurethane Chipfoam	See Note 2
Cross-linked expanded ethylene-vinyl acetate sheets and mouldings	See Note 2
Expanded polyethylene sheet and mouldings	See Note 2
Flexible Polyurethane foam for load bearing applications	BSI BS 3379
Rubber, sheet cellular, closed cell	Commercial Oil / Fuel resistant
Tape	BSI BS 7116

Note 1: Where the above cushioning materials are preferred, alternative materials may be used where the cushioning performance data is known and is either equivalent or suitable for the application; given relevant material compatibility.

Note 2: See associated Def Stan in Section 3

69.3 Procedure

69.3.1 The item shall be "squared up" and located in an inner framework or container. It shall then be located centrally in a second (outer) container using one of the above listed cushioning materials. Unless the cushions are automatically located by the contents, or by each other (see Figs 18 (a), (e) and (f)), they shall be secured to the inner faces (except to the top face) of the outer container using the appropriate adhesive applied in accordance with Process D32 (Paragraph 94), or with tape, BSI BS 7116 if suitable.

Note: Conductive foam sheet is not included in the materials listed above as it is specifically for use in accordance with BSI BS EN 61340-5-1.

69.3.2 Cushion performance data for cushions of the material noted in 69.2 is shown in Def Stan 81-041 (Part 2) Table 13 and Guidance on cushion design is given in DR/4. Performance data for other cushioning materials is obtainable from the supplier / manufacturer

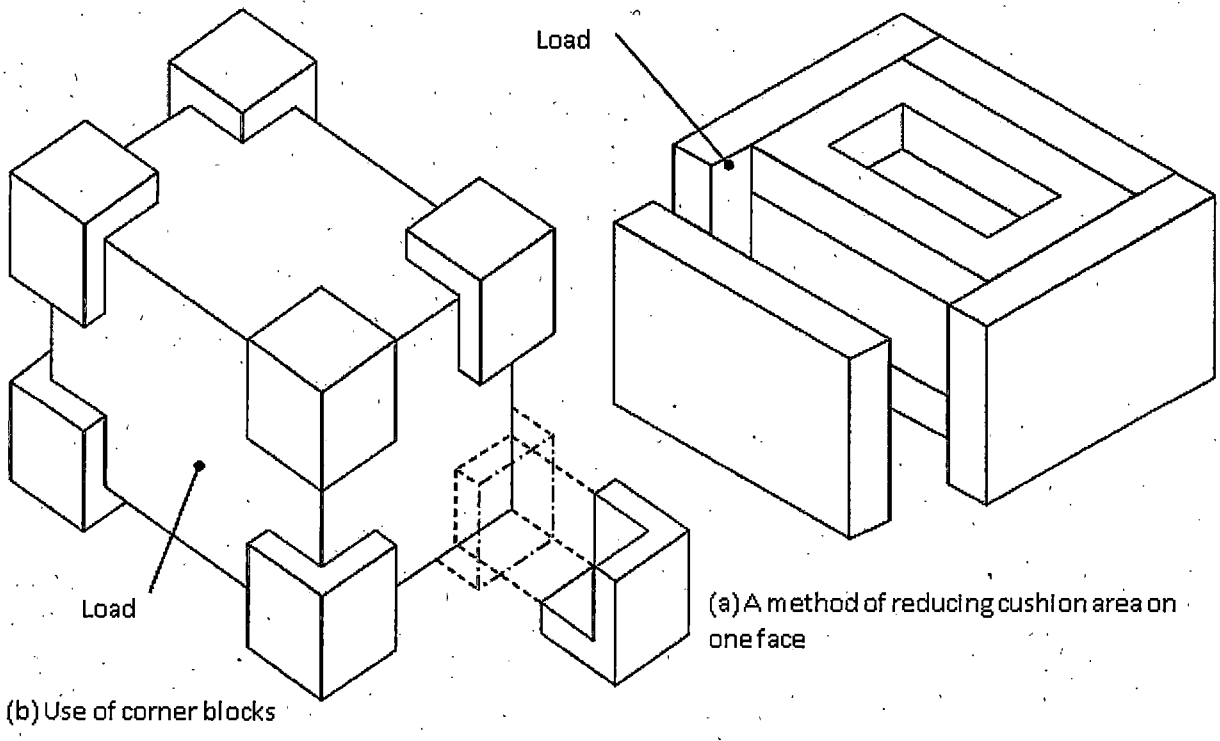
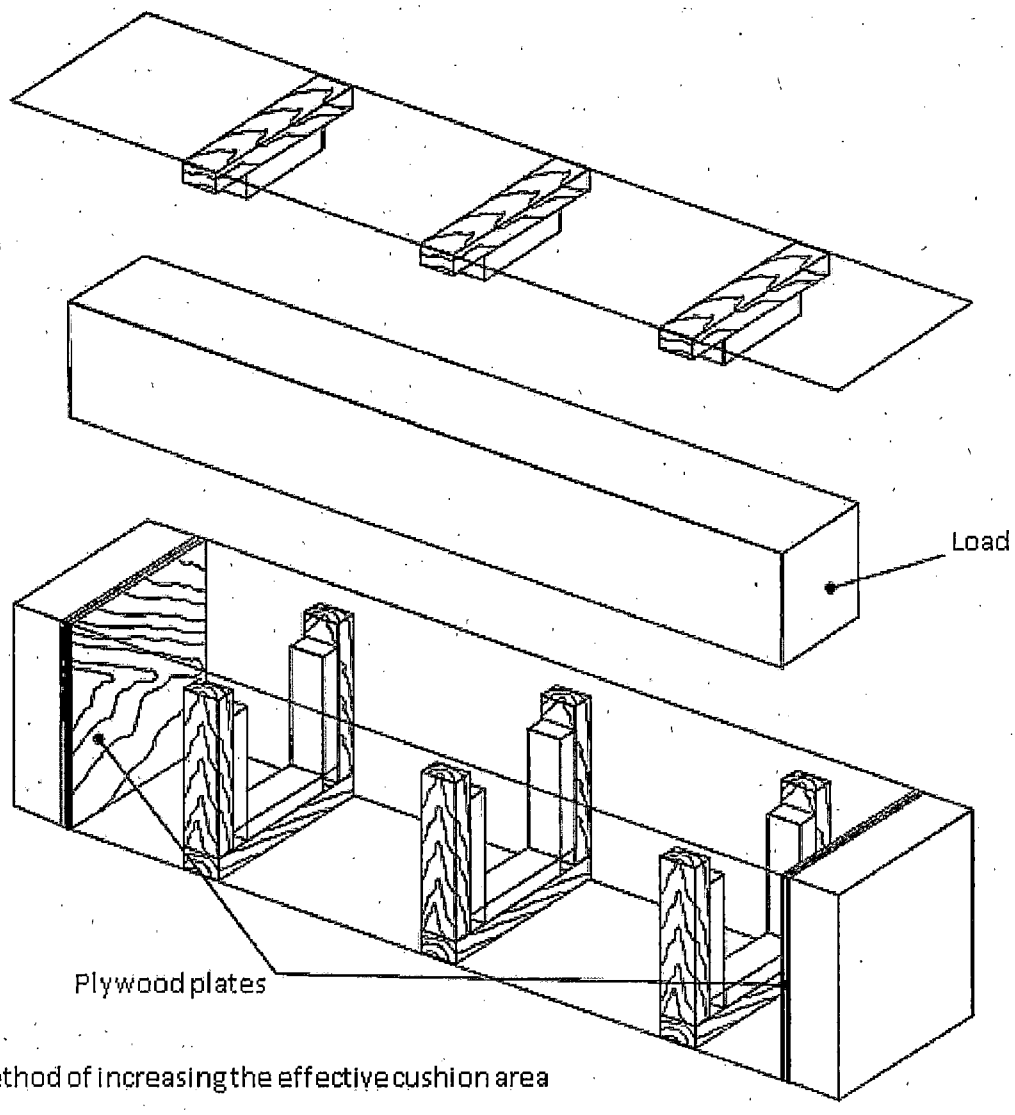
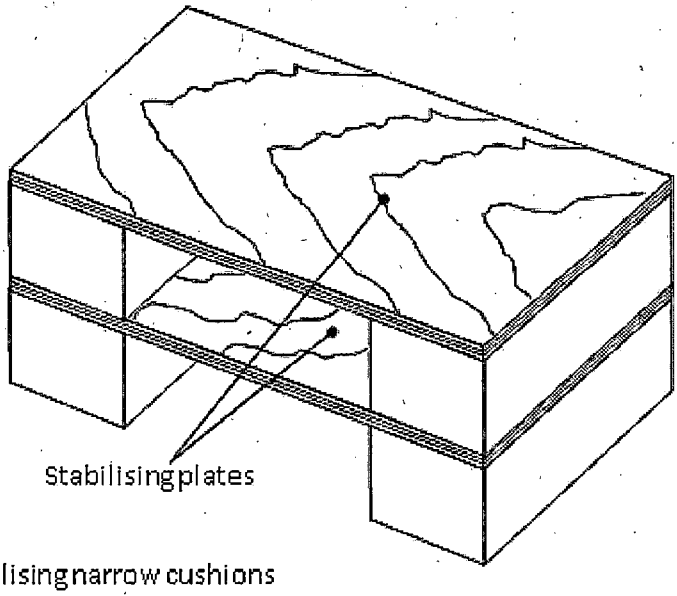


Figure 18 - The Use of Resilient Pads



(c) A method of increasing the effective cushion area



(d) Method of stabilising narrow cushions

Figure 18 - Use of Resilient Pads (Continued)

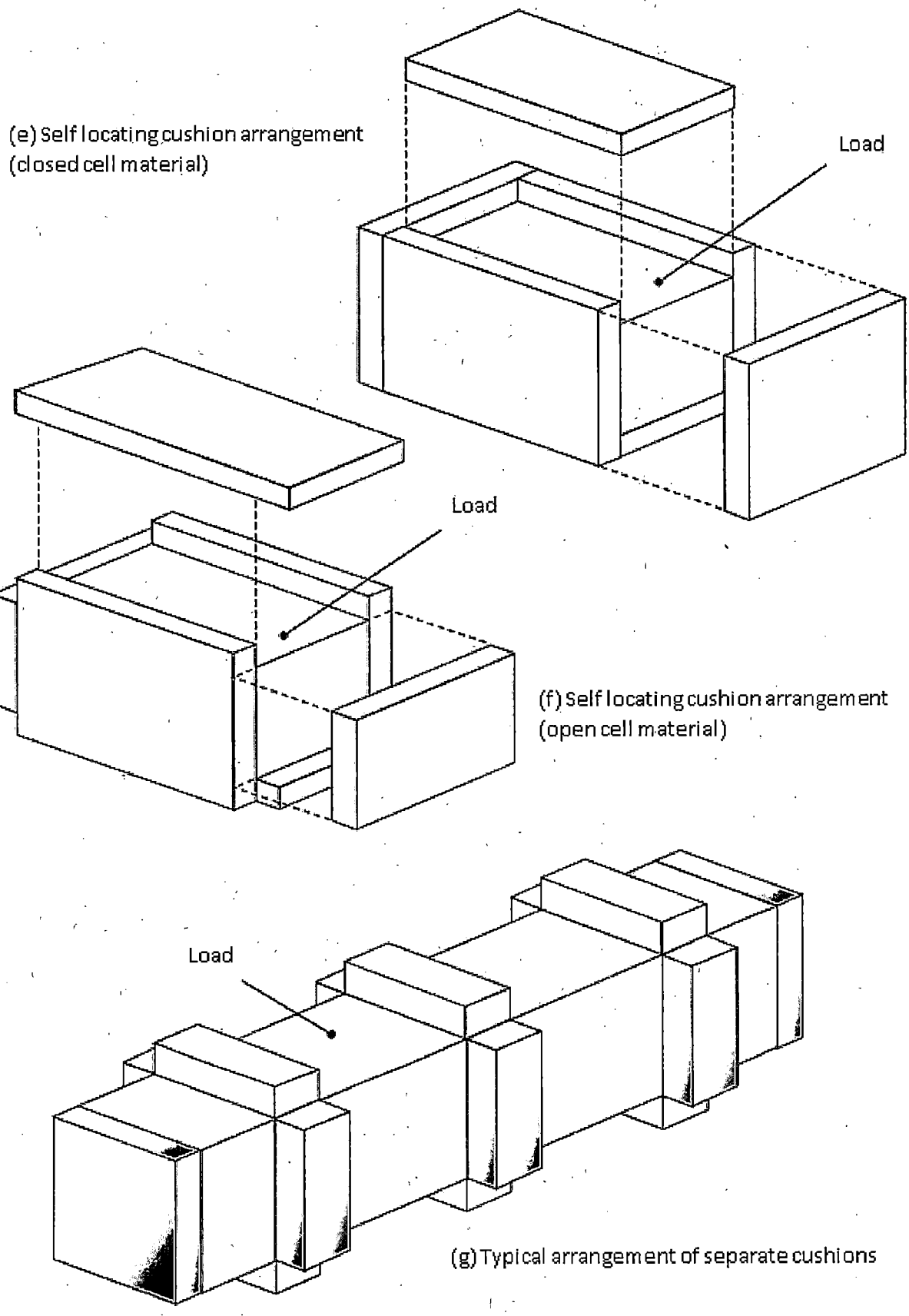


Figure 18 - Use of Resilient Pads (Concluded)

70 Process D8 - Packing an Item in a Container using a Spring Device

70.1.1 The sprung mass is supported in the outer container by springs. In the simplest form either metallic helical springs or rubber cords or straps are attached to the sprung mass and to the outer container (see Figure 19). Alternatively, the support may be provided by resilient rubber mounts held in compression or shear (see Figs 20 and 21).

70.1.2 Adequate provision for damping of spring systems must be made where this property is not inherent in the mountings.

70.1.3 Reference should be made to Def Stan 81-041 (Part 2) and BSI BS 1726 Part 2 for the design or selection of helical extension springs.

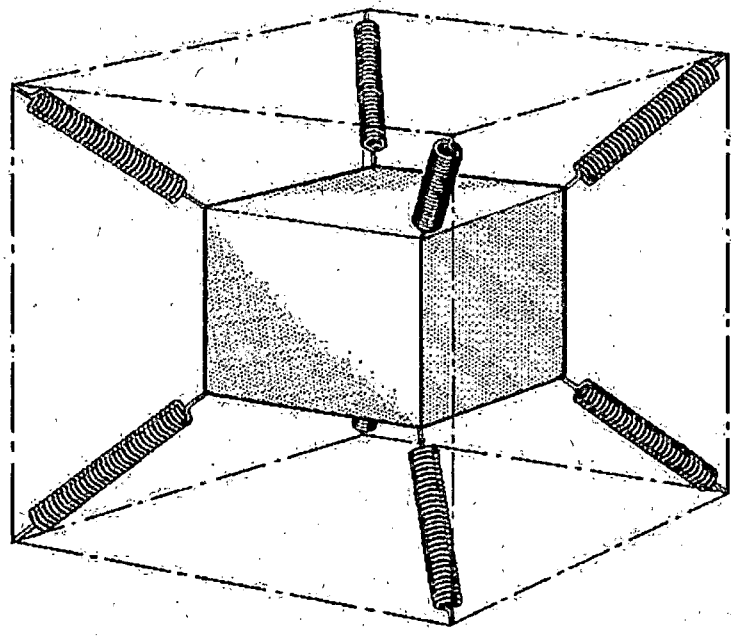


Figure 19 - A Simple Suspension System for a Light Fragile Item

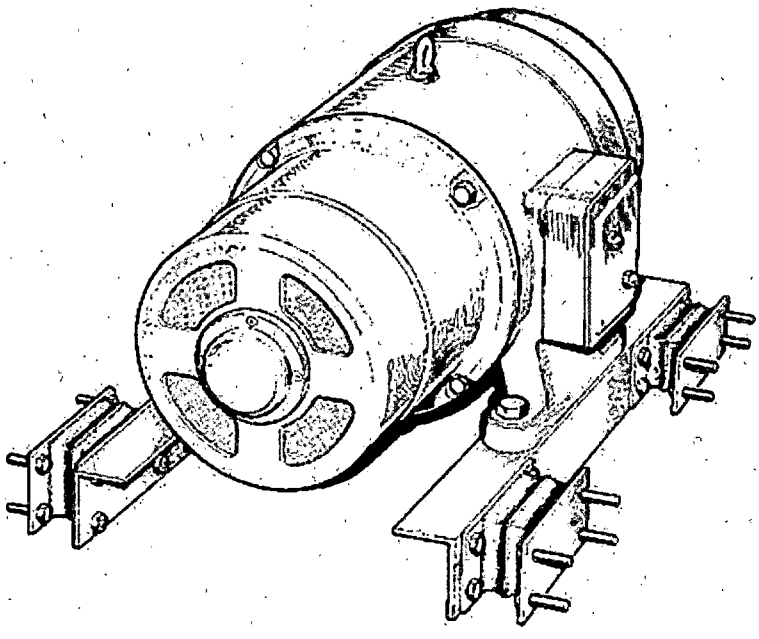


Figure 20 - Heavy Fragile Items Mounted on Solid Rubber Shear Mountings

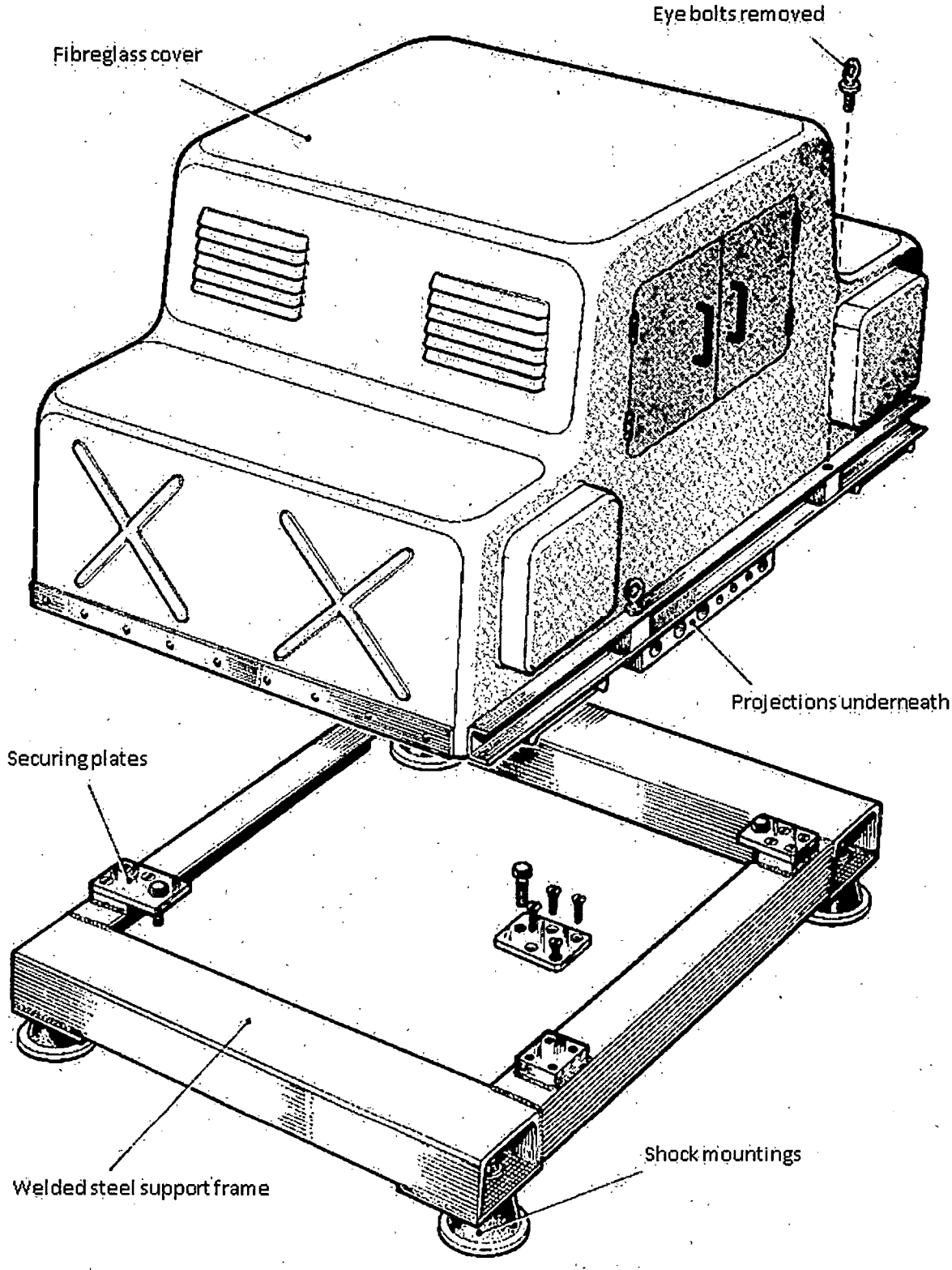


Figure 21 - A Method of Locating a Heavy Fragile Item and Supporting on Shock Mountings

71 Process D9 - Vacant

72 Process D10 – Vacant

Container Closure and Reinforcement Processes

73 Process D11 Closure of Containers using Steel Wire Nails

73.1 General.

73.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

73.1.2 When the item is classed as being of a magnetically sensitive nature it shall be packaged in accordance with Def Stan 81-130.

73.2 Materials

Steel Nails	BSI BS 1202 Part 1
Steel Wire Nails Part 1: Loose nails for general applications	BSI BS EN 10230

73.3 Methods

Closure of timber and/or plywood cases and crates by vertical nailing

73.3.1 The nails shall be galvanized plain head (for boards, battens, and slats) or galvanized clout (for un-battened plywood). Phosphate treated D-head nails may be used for machine driven applications.

73.3.2 The nails shall be driven through the lid into the sides and ends so that they enter along the centre line of the edge receiving them. The nails shall be driven so that the heads do not project beyond the surface of the timber/ plywood (and shall not be overdriven more than 12.5 % of the thickness timber/ plywood).

73.3.3 One nail shall be driven into position approximately 20 mm from each corner of each board, batten, or slat of the lid or from each corner of the lid panel, with additional nails driven into position between them so that the spacing does not exceed 75 mm

73.3.4 Nailing through spaces between slats or within 10 mm of the edge of timbers or the joint between receiving timbers shall be avoided.

73.3.5 Wooden cases, in which the lid is not supported by the end timbers, shall be closed by nailing horizontally through the end into the lid.

73.3.6 Plywood cases with battened lids shall be closed by nailing horizontally through the sides and ends of the case into the lid battens.

73.3.7 Plywood drums shall be closed by nailing with clout nails, with a minimum clinch of 9 mm, through closing hoops, the body, and the body band of the drum.

74 Process D12 - Closure of Containers using Wood Screws

74.1 General.

74.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

74.2 Material

Wood screws	BSI BS EN 14592
Timber structures - Dowel-type fasteners – Requirements	BSI BS EN 14592

74.2.1 Wood screws shall have a corrosion resistant surface layer; that is an electroplated finish or a phosphate treatment. Alternatively, be made from a corrosion resistant material (stainless steel etc.). They shall meet the requirements of BSI BS EN 14592, slotted type countersunk steel screws.

a) The driving type may be other than slotted-type such as cross-point or Pozi-drive™ if specified in the contract or order.

Note 1: Care should be taken to establish that other driver types than "slotted" are usable by the end-user.

Note 2: Cadmium (Cd) is not acceptable for a corrosion resistant layer.

Note 3: When the item is classed as being of a magnetically sensitive nature it shall be packaged in accordance with Def Stan 81-130; no ferromagnetic closures shall be used.

Note 4: Care should be taken with all fasteners to ensure that the material being fastened is in fact thick enough for the fastener.

74.3 Methods

Closure of timber and/or plywood cases and crates by horizontal screwing

74.3.1 Wooden cases in which the lid is not supported by the end timbers shall be closed by screwing horizontally through the end into the lid.

74.3.2 Plywood cases with battened lids shall be closed by screwing horizontally through the sides and ends of the case into the lid battens.

Closure of timber and/or plywood cases and crates by vertical screwing

74.3.3 Timber and plywood shall be pre-drilled to receive the screws and countersunk to a depth sufficient to ensure that screw heads do not protrude above the surface.

74.3.4 Screws shall be driven through the lid into the sides and ends so that they enter along the centre line of the edge receiving them.

74.3.5 Screwing through spaces between slats or within 10 mm of the edge of timbers or the joint between receiving timbers shall be avoided.

74.3.6 Screws used for closure of comb-jointed inner containers shall be in accordance with Table 5.

Table 5 Size of Screws - Comb-jointed Inner Containers

THICKNESS OF PLYWOOD (mm)	SIZE OF SCREWS (mm)
6	19.1 x No 6 gauge
9	25.4 x No 6 gauge
12	31.8 x No 6 gauge

74.3.7 Other containers shall be closed in accordance with Table 6 and shall be of such a length that they penetrate a minimum of 30 mm into the receiving member (except that screws driven horizontally into lid battens shall not pass completely through the battens).

Table 6 Size of Screws - Other Containers

SIZE OF SCREWS (mm)	
19.1 x No 8 gauge	44.5 x No 8 gauge
22.2 x No 8 gauge	50.8 x No 8 gauge
25.4 x No 8 gauge	63.5 x No 10 gauge
31.8 x No 8 gauge	76.2 x No 10 gauge
38.1 x No 8 gauge	101.6 x No 12 gauge

74.3.8 Lids made up of boards or slats shall be secured to case and crate ends by one screw positioned approximately centrally in each end of each board or slat and to the sides by one screw positioned approximately 100 mm from each end of the board or slat with additional screws positioned so that the spacing does not exceed 200 mm.

74.3.9 Lids consisting of single panels shall have each side and end secured by screws positioned approximately 100 mm from the corner of the lid with additional screws positioned so that the spacing does not exceed 200 mm. Lids with sides and/or ends not exceeding 200 mm in length shall be secured by two screws positioned approximately 33% of the distance from each end.

75 Process D13 - Vacant

76 Process D14 - Closure of Containers using Wire Staples or Tenterhooks

76.1 General.

76.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

Note 1: When an article is classed as having a magnetically sensitive nature it shall be packaged in accordance with Def Stan 81-130.

Note 2: Care should be taken with all fasteners to ensure that the material being fastened is in fact thick enough for the fastener.

76.2 Materials

Wire staples of round or flat section steel wire	Commercial
Tenterhooks of round section steel wire	Commercial

Note: Staples and tenterhooks shall be rust-proofed by phosphate treatment or electroplate finish.

76.3 Method

General.

76.3.1 Staples and tenterhooks shall be spaced at intervals not exceeding 75 mm.

Closure of plywood cases (metal-edged).

76.3.2 The metal-edge shall be folded on to the lid and secured by applying staples or tenterhooks with 12 mm legs and a cross-sectional area of not less than 1.5 mm^2 so that the loop spans the folded or beaded edge. The long leg of a tenterhook shall be driven into the wood of the lid as near as possible to the edge of the metal strip.

79.3.3 Closure of plywood drums.

76.3.3 Staples with a minimum cross-sectional area of 1 mm^2 and crowns of a minimum 19 mm shall be used. They shall be driven through the closing hoop(s), the body, and the body band and clinched so that the ends of the legs are a maximum of 2 mm apart.

77 Process D15 – Vacant

78 Process D16 - Closure of Containers using Adhesive Tapes

78.1 General.

78.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

78.2 Materials

Tape, pressure-sensitive adhesive (water-resistant, conformable)	Type 1, See Note 1
Tape, pressure-sensitive adhesive (water-resistant fabric)	Type 2a, See Note 1
Tape, pressure-sensitive adhesive (water-resistant film)	Type 4, See Note 1
Tape, Kraft Gummed (Not to be used where a water-resistant tape is needed)	Type 5a, See Note 1
Tape, Kraft, Gummed, Reinforced (Not to be used where a water-resistant tape is needed)	Type 5b, See Note 1

Note 1: See associated Def Stan in Section 3

78.3 Method

Closure of containers, fibreboard, Def Stan 81-015

78.3.1 A container shall be closed with one of the tapes of minimum width 48 mm unless the container is small when the widest practicable tape shall be used.

78.3.2 If the container is to be over-wrapped / over-packed the tape shall be positioned across the joints between the lid or closure flap(s) and the body. Whenever possible each strip of tape shall extend a minimum of 50 mm across each face adjacent to the joint line.

78.3.3 Containers (excluding style J) up to 150 mm long shall have the tape applied centrally across the length (see Figure 22(a)). Containers over 150 mm long shall have two or more strips of tape applied across the length and spaced equidistantly along the length so that the space between them shall not exceed twice the width of the tape (see Figure 22(b)).

78.3.4 Style J containers shall have the tape applied centrally across the joint at each end (see Figure 22(c)).

78.3.5 If the container is not to be overwrapped or over-packed the tape shall be applied centrally along the complete length of the joints between the lid or closure flap(s) and the body (see Figs 23(a), (b) and (c)).

Closure of containers, fibreboard, Def Stan 81-015 Range B & C

78.3.6 Containers shall be closed with one of the tapes of minimum width 48 mm. The tape shall be applied to the joints between the outer flaps and between the outer flaps and the body of the container. The tape shall be placed centrally along the complete length of the joint lines with a minimum overlap of 50 mm at each end (see Figure 24(a)). When additional closure reinforcement is required the methods detailed in Process D19 (Paragraph 81) shall be followed.

78.3.7 Containers fitted with a sleeve shall be closed with one of the tapes of minimum width 48 mm. The tape shall be applied along the longitudinal joints on the top and bottom of the container and shall have a minimum overlap of 50 mm on the ends of the container (see Figure 24(b) (i)). The sleeve shall be secured by tape placed centrally along the joints between the sleeve and the container to seal all gaps between the sleeve and the container (see Figure 24(b) (ii)). When additional closure reinforcement is required the methods detailed in Process D19 (Paragraph 81) shall be followed.

Closure of cylindrical containers

78.3.8 Cylindrical containers shall be closed with end pieces supplemented by one of the tapes of minimum width 24 mm. For tubes, and for other containers not provided with end pieces, either a 25 mm thick disc of expanded polystyrene (EPS), shall be inserted in each end, or the ends shall be covered with discs of fibreboard.

Note 1: Expanded polystyrene is not acceptable in Military Level packages designed for the Navy Department.

Note 2: Commercial Packing Tubes can be acquired with push fit plastic end-caps, internal or external fitting, a material other than EPS, (e.g. PE or PP) are preferred, see Figures 25 & 26.

Containers having butt joint (sleeve) lids or slip lids more than 12 mm deep

78.3.9 The tape shall be applied centrally over the joint line between the lid and the container body or, if the width of the tape is more than double the depth of the lid, over the full depth of the lid with the remainder of the tape applied to the container body. The tape ends shall overlap by a minimum of 25 mm (see Figure 25(a)).

Containers having lids less than 12 mm deep, internal fitting end pieces or end discs

78.3.10 The tape shall be applied across the diameter of the end cap and extending at each end a minimum of 65 mm down the outside wall of the container. The position and number of tape strips shall be as in Table 7.

Table 7 Tape Application - Containers

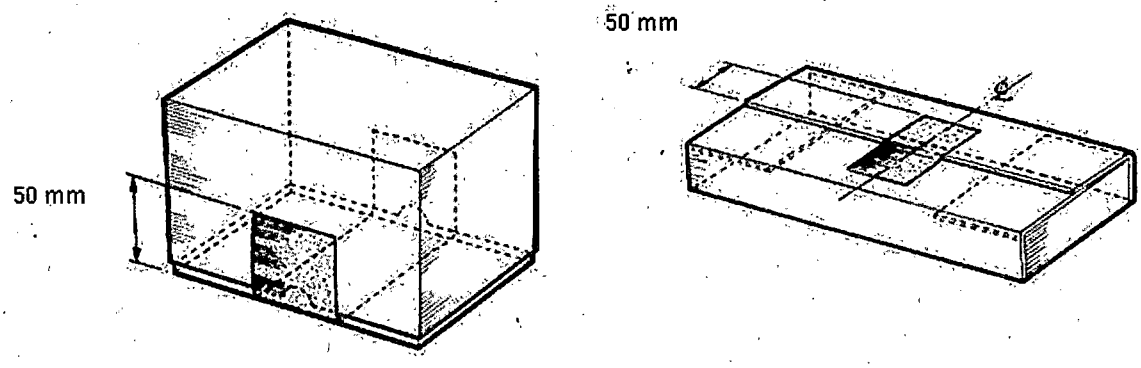
OUTSIDE DIAMETER OF CONTAINER (mm)	NUMBER AND LOCATION OF STRIPS
Up to 30	1 strip (see **Figure 25(b)**)
30 to 75	2 strips at right-angles to each other (see **Figure 25(c)**)
75 to 150	3 strips equidistantly spaced around the circumference (see **Figure 25(d)**)
Over 150	4 strips equidistantly spaced around the circumference

78.3.11 Where internal fitting end pieces are used, the tape shall conform closely to the shape of the end pieces (see Figure 26).

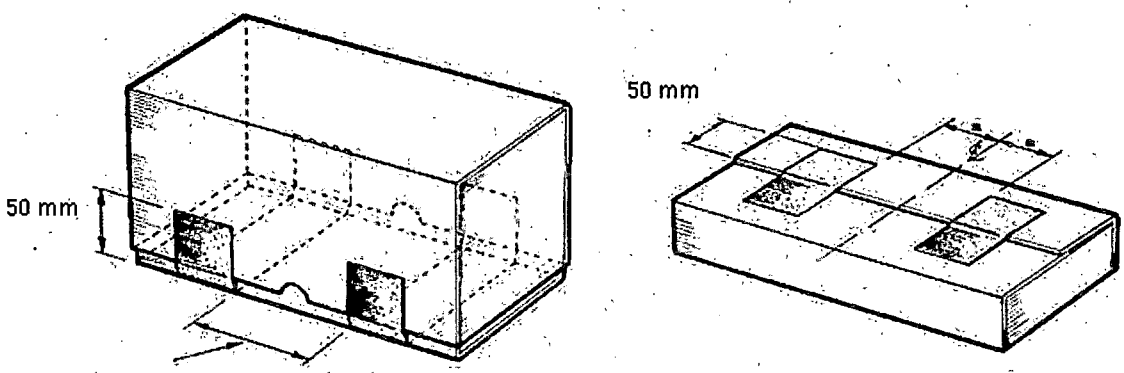
Closure of containers, aluminium, cylindrical, seamless (screw lid).

78.3.12 The lid with its gasket in position shall be firmly screwed on to the body of the container and secured by the application of a suitable tape (typically Type 1) of minimum width 24 mm applied centrally over the complete length of the joint line between the lid and the body. The tape ends shall overlap by a minimum of 12 mm.

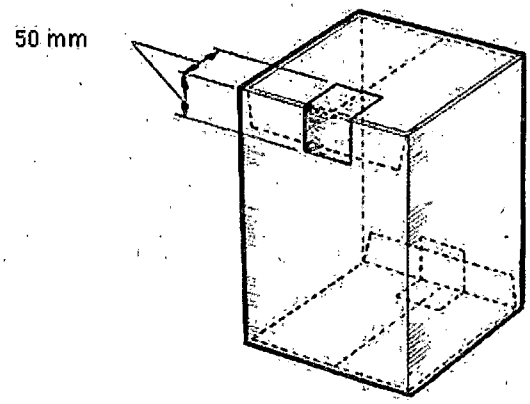
78.3.13 If the depth of the lid is 12 mm or less, the tape shall be applied to the full depth of the lid, with the remainder of the tape being applied to the container body (see Figure 27).



(a) Cartons and boxes, up to and including 150 mm in length



(b) Cartons and boxes over 150 mm in length



(c) Style "J" carton

Figure 22 - Closures - Cartons and Boxes to be Over-wrapped or Over-packed

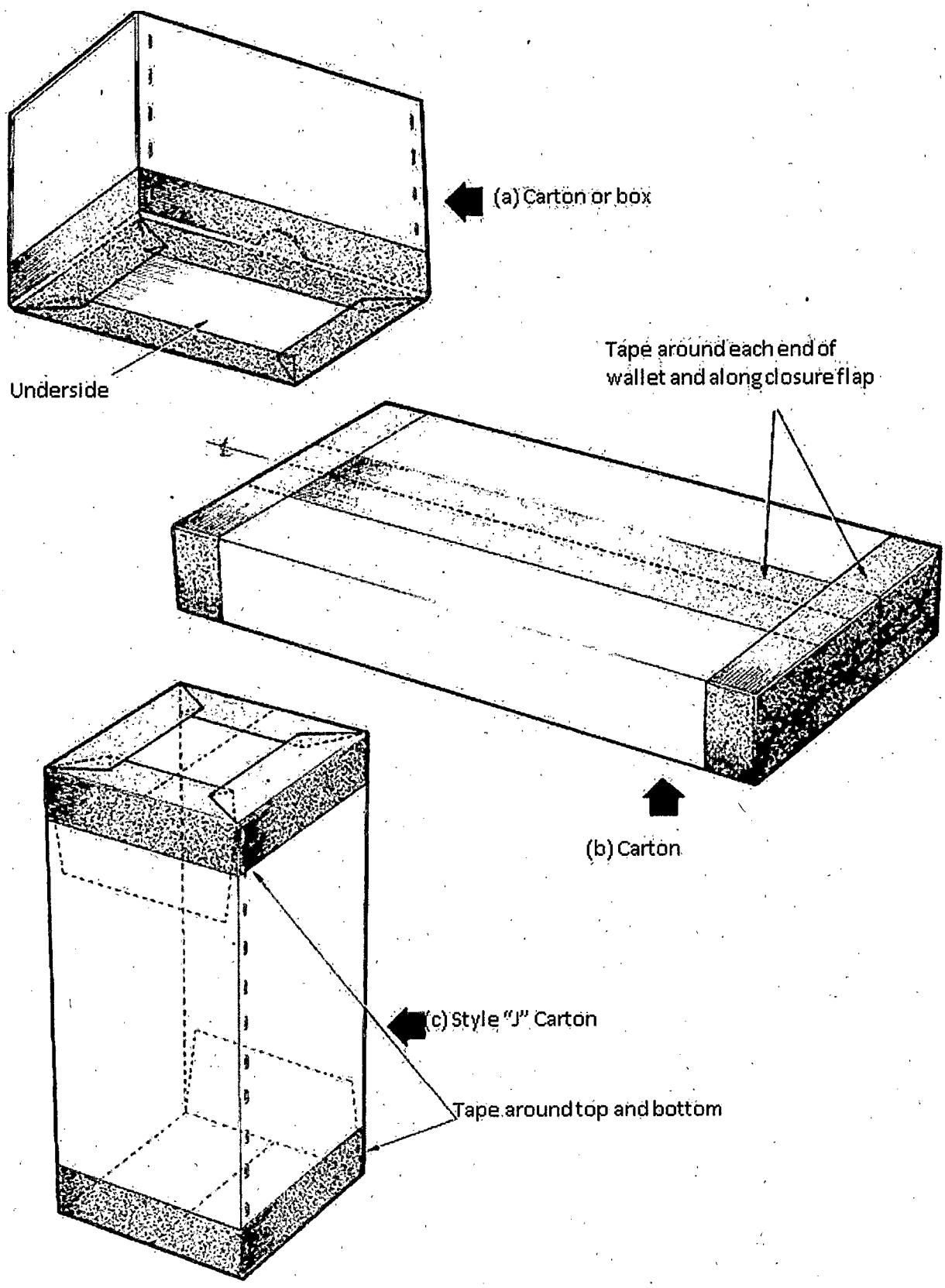
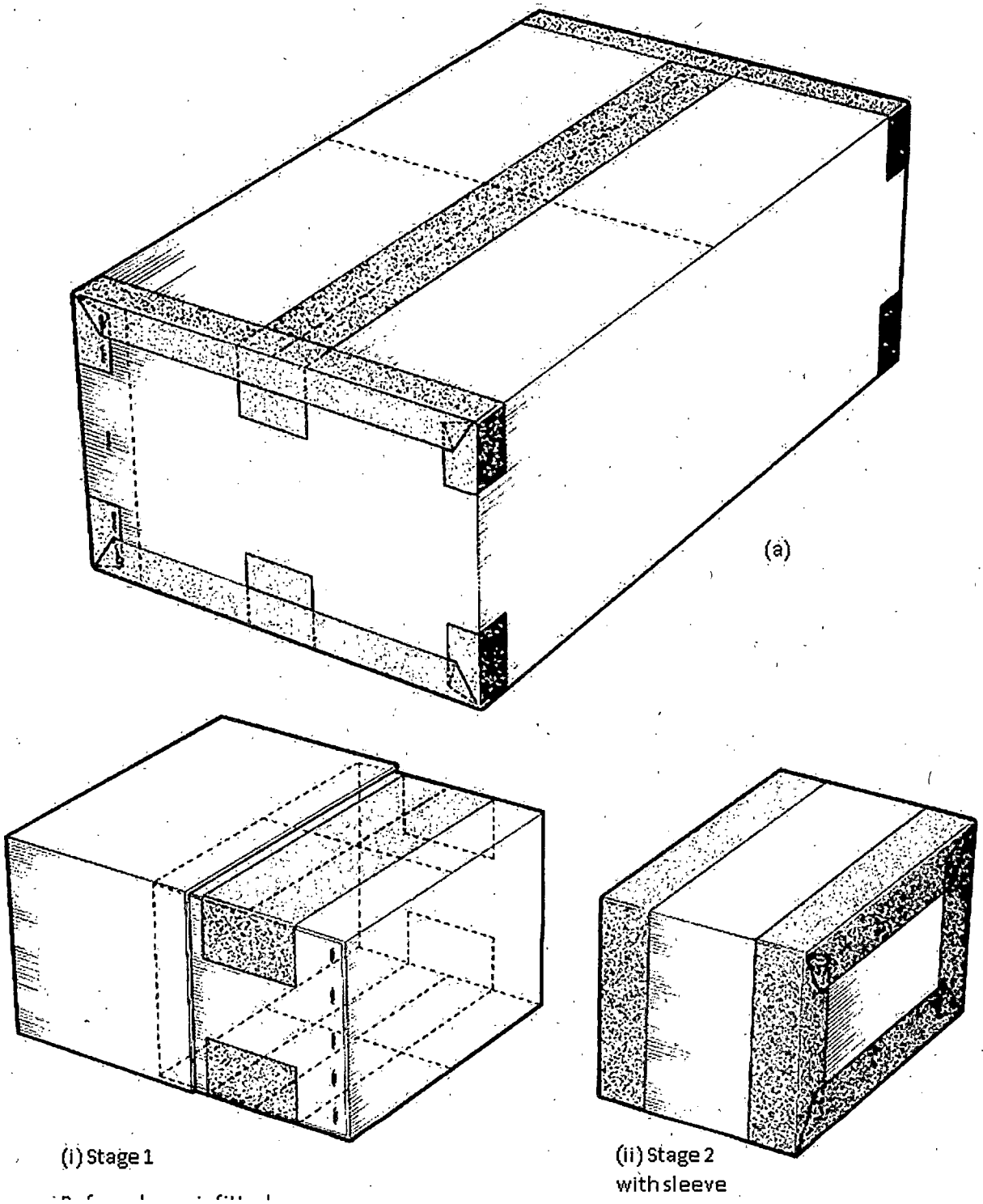


Figure 23 - Closures - Cartons and Boxes not to be Over-wrapped or Over-packed



(b) Cases fitted with sleeve

Figure 24 - Closures - Carton

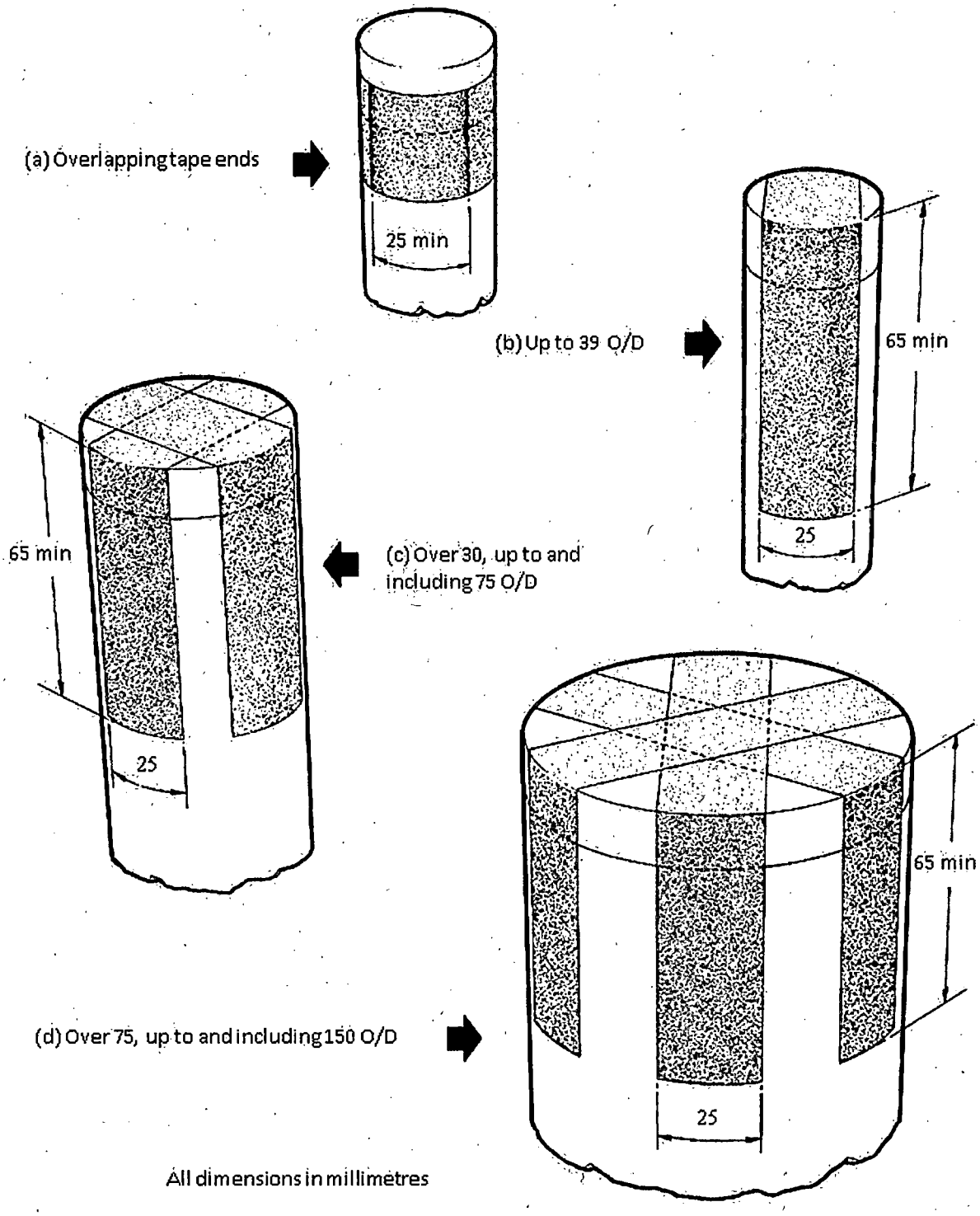


Figure 25 - Closures - Cylindrical Containers with External Flush Fitting End Caps or Slip Lids

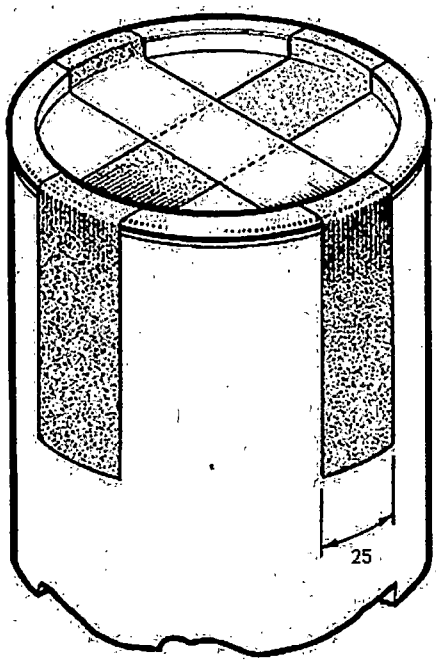


Figure 26 - Closures - Cylindrical Containers with Internal Fitting End Pieces

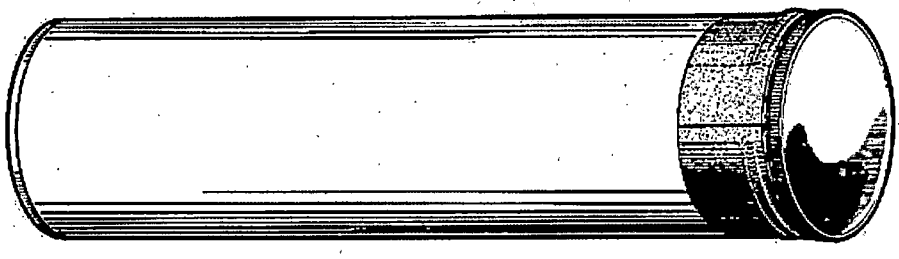


Figure 27 - Closures - Cylindrical Aluminium Containers, Screw Lid

79 Process D17 - Closure of Containers by Sewing with Twine

79.1 General.

79.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

79.2 Materials.

Polypropylene film, twine	BSI BS 4881
Natural fibre twine (rot proofed)	Commercial - 0.4 kN (40 kg) force minimum breaking load

79.3 Method.

79.3.1 Bales wrapped with fabrics shall be secured by sewing with twine. Before the pressure is removed from the bale the seams shall be rolled together and sewn overhead, over-edge. The stitches shall be not more than 25 mm apart with a lockstitch approximately every 150 mm and the twine shall be securely fastened by tying at the end of any seam. Ears of 125 mm minimum length, formed from the surplus material, shall be made at each corner of the bale by wrapping twine three or four turns around their base (see Figure 28).

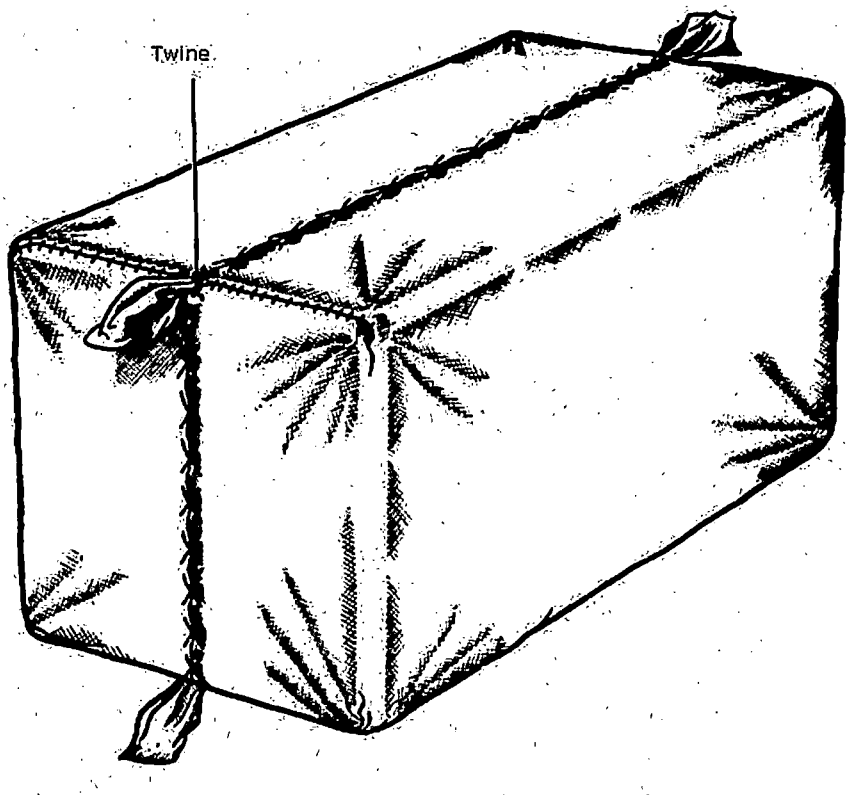


Figure 28 - Closures - Sewing with Twine

80 Process D18 - Closure of Containers by Tying with Wire

80.1 General.

80.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

80.2 Material

Tensional steel wire (round, oval or flat) galvanized Commercial

80.3 Method.

80.3.1 Rolls enveloped with tubular fabric shall be secured at each end by bunching a minimum of 175 mm of free cloth above the contents of the roll and tying with tensional steel wire of a minimum 2 mm^2 cross-sectional area (see Figure 29).

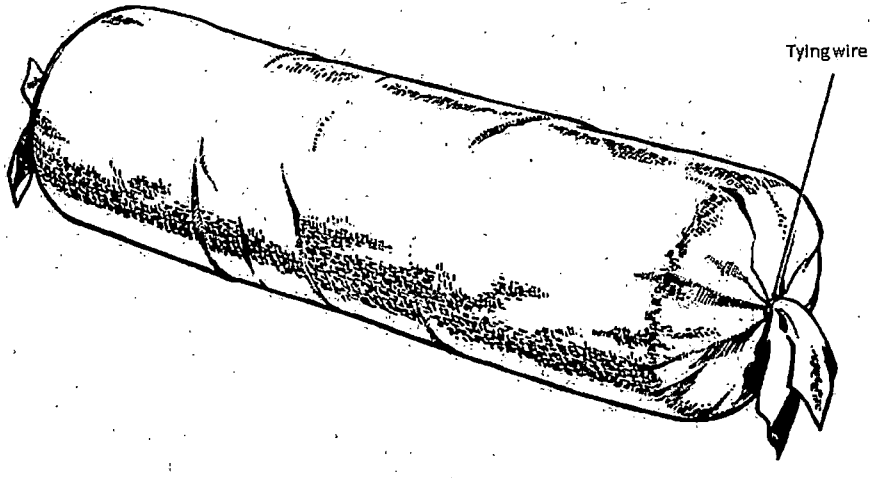


Figure 29 - Closures - Tying with Wire

81 Process D19 - Closure Reinforcement of Containers

81.1 General.

81.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

81.2 Materials

Tensional steel strapping	BSI BS EN 13246
Non-metallic tensional strapping	BSI BS EN 13394
Mild steel hoop iron	Commercial
Staples (of round section wire, made rust proof by a phosphate treatment or electroplate finish)	Commercial

81.3 Method

Tensional steel strapping (flat)

81.3.1 A minimum tensile strength of 620 MPa shall be applied so that no part of the length is unsupported at any time. The sizes shall be as shown in Table 1.

81.3.2 Strapping applied to wooden containers (including battened plywood containers and wooden crates) shall be tensioned so that where it passes over an edge of the container the strap sinks into the wood to a depth approximately twice the thickness of the strap. Strapping applied to metal-edged containers shall be tensioned as tight as possible without damage to the container.

Reinforcement of wooden containers.

81.3.3 Closure reinforcement in the form of tensional steel strapping shall be applied around wooden containers as shown in Table 8.

Table 8 Reinforcement Straps for Wooden Containers

LENGTH OF CONTAINER (mm)	UNBATTENED	WITH GIRTH BATTENS ONLY	WITH GIRTH AND DIAGONAL BATTENS
Up to 500	1 strap placed centrally in its length	---	---
Over 500 up to 1000	2 straps positioned in the length so that both straps are inset from each end of the container by 17%.	2 straps positioned in the length with each strap applied as near to the inside edge of each girth batten as possible	2 straps positioned in the length with each strap as near to the outside edge of each girth batten as possible
Over 1000 up to 2000	3 straps; 2 placed as above and one centrally in the length of the container	3 straps; 2 placed as above and one centrally in the length of the container	2 straps placed as above

Reinforcement of battened plywood containers.

81.3.4 Closure in the form of tensional steel strapping shall be applied to battened plywood containers as shown in Table 9.

Table 9 Reinforcement Straps for Plywood Containers

LENGTH OF CONTAINER (mm)	POSITION AND NUMBER OF STRAPS
Up to 500	2 straps applied one at each end of the container, over the girth battens
Over 500 up to 2000	A strap applied around each set of girth battens

Reinforcement of metal-edged plywood containers.

81.3.5 Closure reinforcement in the form of tensional steel strapping shall be applied to metal-edged plywood containers that are over 500 mm in length as shown in Table 10.

Table 10 Reinforcement Straps for metal-edged Plywood Containers

LENGTH OF CONTAINER (mm)	POSITION AND NUMBER OF STRAPS
Over 500 up to 1000	2 straps positioned in the length of the container so that one strap is inset from each end of the container by 17%.
Over 1000 up to 2000	3 straps; two positioned as above, and the third positioned centrally in its length

Reinforcement of wooden crates.

81.3.6 Closure reinforcement shall be applied to wooden crates as follows:

81.3.7 Crates without girth battens. Reinforcement shall be in the form of mild steel hoop iron applied to all corners secured by nails driven into each face of the crate, with the width and thickness of the hoop iron as shown in Table 11 (see Figure 30).

Table 11 Hoop Iron Reinforcement

MASS OF CONTENTS (kg)	HOOP IRON SIZE width x thickness (mm)
Up to 18	12 x 0.46
Over 18	19 x 0.56

81.3.8 Crates with girth battens. Reinforcement shall be of flat tensional steel strapping applied over each set of girth battens. Steel wire staples with a minimum cross-sectional area of 2 mm^2 and 3 mm wider than the strapping with legs a minimum of 12 mm long shall be driven diagonally over straps on battens 300 mm or greater. One staple shall be placed 50 mm from each end of the batten and additional staples shall be placed (225 ± 75) mm along the length of the batten.

Non-metallic tensional strapping.

81.3.9 Non-metallic tensional strapping shall be in accordance with BSI BS EN 13394, Polypropylene Type 1. The sizes shall be as shown in accordance with Table 2. When applied to fibreboard containers the strapping shall be tensioned as tight as possible without causing damage to the container or its contents.

Reinforcement of fibreboard and, fibreboard and wood containers.

81.3.10 Closure reinforcement in the form of polypropylene strapping shall be applied to fibreboard, and fibreboard and wood containers as shown in Table 12.

Table 12 Polypropylene Strapping

LENGTH OF CASE (mm)	POSITION AND NUMBER OF STRAPS
Up to 500	1 strap placed centrally in its length
Over 500 up to 1000	2 straps positioned in the length of the container so that each strap is inset from each end of the case by 17%.
Over 1000	3 straps; two positioned as above with the third positioned centrally around the length

81.3.11 Strapping joints shall be made by means of a suitable tensioning machine.

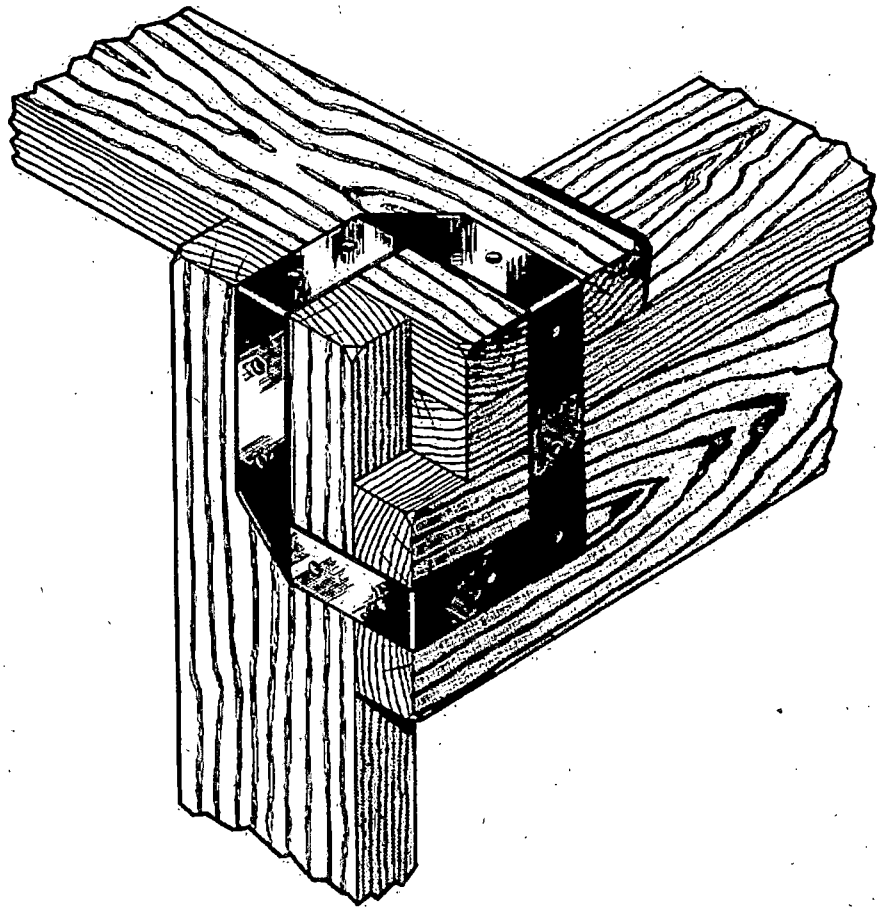


Figure 30 - Corner Reinforcement of Timber Crates

82 Process D20 - Closure of Containers, Fibreboard and Wood with Overlapping Flaps

82.1 General.

82.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

Note: When the item is classed as being of a magnetically sensitive nature it shall be packaged in accordance with Def Stan 81-130.

82.2 Materials

Steel Wire Nails Part 1: Loose nails for general applications	BSI BS EN 10230
Nails	BSI BS 1202, Part 1, Table 3
Tape, pressure-sensitive adhesive (water-resistant fabric)	Type 2a, See Note 1
Tape, pressure-sensitive adhesive (water-resistant film)	Type 4, See Note 1

Note 1: See associated Def Stan in Section 3

82.3 Procedure

Nailing

82.3.1 The nails shall be a minimum of 2.36 mm diameter and be of such a length that they penetrate a minimum of 30 mm into the receiving member.

82.3.2 The nails shall be driven through the flaps so that they enter along the centre line of the end framing of the container, avoiding going within 10 mm of the joints between members. The heads shall not project beyond the surface of the fibreboard.

82.3.3 A nail shall be positioned at each end of the container so that it passes through the outer flap approximately 20 mm from its end. A nail shall also be positioned so that it enters approximately centrally in each vertical end batten. Additional nails shall be positioned between the above nails so that the spacing does not exceed 75 mm (see Figure 31).

Taping

82.3.4 After nailing has been completed one of the tapes of 48 mm minimum width shall be applied centrally along the complete length of the joint line between the flaps with a minimum overlap of 50 mm on to the framing at each end of the container.

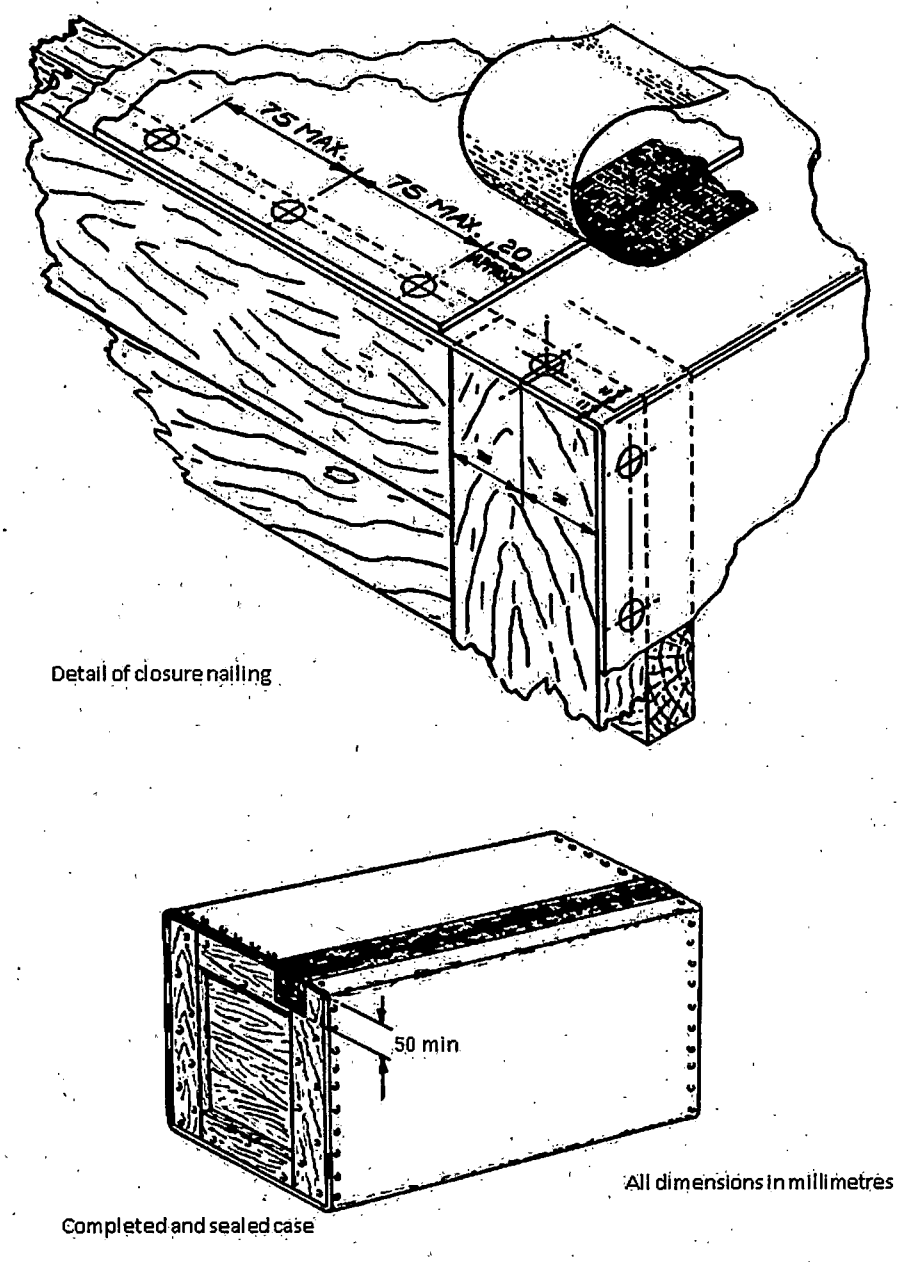


Figure 31 - Closures - Cases, Fibreboard, and Wood, with Overlapping Flaps

83 Process D21 – Vacant

84 Process D22 – Vacant

85 Process D23 – Vacant

86 Process D24 – Vacant

87 Process D25 - Vacant

88 Process D26 - Vacant

89 Process D27 - Vacant

90 Process D28 - Vacant

91 Process D29 - Vacant

92 Process D30 - Vacant

Preservation of Timber

93 Process D31 - Preservation of Timber and Plywood

93.1 General.

93.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

93.2 Materials and Processes

Wood preservation by suitable means. Commercial

Preservatives

93.2.1 by their nature, may be dangerous to health. The main hazards arise in the application of the preservatives and when machining or handling the preserved material. Hence it is a requirement that safety data sheets, relevant COSHH codes of practice are consulted and adhered to.

Note Preservative formulations may include fungicides and/or insecticides.

93.2.2 The following preservative compounds shall not be used for MOD packaging: Dieldrin, Lindane (gamma-BHC), Pentachlorophenol, (and compounds) and Tributyl Tin Oxide.

Selection of a preservative

93.2.3 Selection of a preservative shall take the following into account:

a) the item packaged (containers for rubber based items shall not use a copper based formulation where direct contact is used)

b) the storage environment (temperate storage is unlikely to require termite protection)

c) the store destination (export to certain countries may require application of a particular treatment)

d) the hazards

e) further treatments (whether the item will need to be painted)

93.3 Methods

93.3.1 Where possible all preservative treatments shall be carried out using an industrial process. Manual application should be avoided or minimized and only carried out by trained personnel using the correct protective equipment.

93.3.2 The surface of the timber or plywood shall be free from water, oil, dirt and paint or other surface finishes liable to interfere with the preservation process. A certificate of treatment shall accompany each delivery of treated timber or plywood.

93.3.3 One of the following methods shall be used:

Pressure impregnation

93.3.4 The timber or plywood shall be treated by a commercially available industrial pressure impregnation process. If untreated fibres are exposed subsequently by damage, cutting or planing, they shall be treated to ensure the preservation is not compromised.

Dipping or Immersion.

93.3.5 The timber or plywood shall be immersed for not less than three minutes. If untreated fibres are exposed subsequently by damage, cutting or planing, they shall be treated by dipping in the preservative used for the initial treatment.

Brushing or spraying.

93.3.6 Two coats of the specified preservative shall be applied. The second coat shall not be applied until absorption of the first is complete or a period of 24 hours has elapsed. A coarse jet shall be used when spraying. If untreated fibres are exposed subsequently by damage, cutting or planing, they shall be treated by brushing with the preservative used for the initial treatment.

Adhesives

94 Process D32 - Application of Adhesives

94.1 General.

94.1.1 This process shall be read in conjunction with **Section 1 Warnings** and paragraph 1.

94.2 Materials

Classification of Thermosetting Wood Adhesive for Non-structural Applications: Class C1	BSI BS EN 12765
Synthetic resin adhesives (Phenolic and Amino plastic) for wood	BSI BS EN 301
Synthetic rubber/resin adhesive, No. 7	See Note 1
Hot melt adhesive, for packaging purposes (See Note 2, 3 & 4)	Commercial

Note 1: See associated Def Stan in Section 3

Note 2: A Polyvinyl Acetate (ethylene vinyl acetate copolymer with suitable additives) based solid applied between 100 and 200 °C as a hot viscous tacky fluid that fuses/welds to a substrate forming a bond on cooling. Suitable for use with hand applicators for packaging purposes, where the joints are not subjected to long-term stress loading and temperatures more than 60 °C are not encountered.

Note 3: As a solid it can be supplied in rods, sticks, or granules which should be specified, with sizes. As supplied it should be free from impurities, imperfections, foreign inclusions, and discolouration. A shelf life and appropriate storage conditions should be indicated.

Note 4: The hot melt adhesive selected shall be suitable for the specified application.

94.3 Method.

94.3.1 Adhesives shall be applied in accordance with the manufacturer's instructions. The following general points apply:

a) The surfaces to which the adhesive is to be applied shall be dry and completely free from contaminating substances such as dust, dirt, oil, and grease.

b) An even film of adhesive shall be applied to the surfaces.

c) In joining the surfaces together as much air as possible shall be excluded and a strong even pressure applied.

d) After completion of the process, sufficient time should be allowed to ensure the dispersal of volatiles from containers. This normally requires two hours but the adhesive manufacturer's advice should be sought.

e) For adhesive / substrate combinations, see Def Stan 81 41 (Part 2) Table C.1 and refer to the manufacturer's datasheets / instructions.

Section 3

Normative References

1 The publications shown below are referred to in the text of this standard. Publications are grouped and listed in alpha-numeric order.

Note: Def Stan's can be downloaded free of charge from the DStan web site by visiting **<http://dstan.uwh.diif.r.mil.uk/>** for those with RLI access or **<https://www.dstan.mod.uk>** for all other users. All referenced standards were correct at the time of publication of this standard (see A.2, A.3 & A.4 below for further guidance), if you are having difficulty obtaining any referenced standard please contact the DStan Helpdesk in the first instance.

Def Stans

Number	Title
81-046, Iss 5	Board, Corrugated for Military Packaging
81-041, Pt 2, Iss 9	Packaging of Defence Materiel - Design
81-068, Iss 5	Bags, Desiccant, Silica Gel and Bags, Desiccant, Activated Clay
81-130, Iss 4	The Transportation, Handling, Storage and Packaging of Magnetically Sensitive Equipment
81-148, Iss 1	Board, Processed Wood for General Packaging
05-050, Pt 33, Iss 2	Methods for Testing Fuels, Lubricants and Associated Products - Storage Stability of Grease
68-069, Iss 1	Silicone Compound Electrical Insulating - NATO Code S-736 - Joint Service Designation XG-250
68-127, Iss 2	Antifreeze, Inhibited Ethanediol NATO Code S-757 Joint Service Designation AL-39
80-034, Iss 3	Corrosion Preventive, Compound Oil, Thin Film Joint Service Designation: PX-4
80-083, Iss 3	Corrosion Preventive, Hard Film, Transparent: Cold Application Joint Service Designation: PX-32
80-217, Iss 1	Corrosion Preventive Compound: Soft Film, Cold Application NATO Code: C-614 JSD: PX-1
91-038, Iss 02	Petrolatum, Technical Joint Service Designation: PX-6 Petrolatum, Technical NATO Code No: S-743 Joint Service Designation: PX-7
91-027, Iss 3	Grease, Automotive and Artillery NATO Code No: G-403 Joint Service Designation: XG-279
91-105, Iss 2	Grease, Multi-Purpose, Heavy Duty NATO Code: G-421 Joint Service Designation: XG-291
81-030, Iss 6	Paper Material for Wrapping

81-075, Iss 4	Barrier Material, Aluminium Foil Laminate, Flexible, Heat-Sealable, Water-Vapour Resistant
81-093, Iss 5	Grease Resisting Materials for General Packaging
81-122, Iss 3	Polyethylene, Closed Cell Film for Packaging
81-134, Iss 3	Paper, Kraft, Polyethylene Coated (Heat Sealable)
93-097, Iss 2	Polyethylene Film, Black Electrically Conductive
93-116, Iss 3	Polyethylene (Low Density) Film for Packaging Types 1, 2 and 3
81-083, Iss 4	Bonded Polyurethane Chipfoam
81-099, Iss 5	Paper Wrapping or Location
81-116, Iss 3	Expanded Polyethylene Sheet, Types GP and QX, Grades A, B, C and D
80-117, Iss 3	Synthetic Rubber Resin Adhesive No.7
81-145, Iss 3	Tape, Pressure-Sensitive Adhesive for General Packaging
81-015, Iss 7	Containers, Fibreboard
91-091, Iss 10	Turbine Fuel, Kerosine Type, Jet A-1; NATO Code: F-35; Joint Service Designation: AVTUR
81-119, Iss 4	Plastic Moulding Materials for Packaging
81-146, Iss 1	Packaging, Static Shielding Bags & Dissipative Materials

STANAGs

Number	Title

Allied Publications

Number	Title

Other References

Standard Type	Standard Name
CIVIL	BSI BS 245 - Specification for Mineral Solvents (White Spirit and Related Hydrocarbon Solvents) for Paints and Other Purposes
CIVIL	BSI BS 2869 - Fuel Oils for Agricultural and Industrial Engines and Boilers, Specification
CIVIL	BSI BS 5707 - Specification for Preparations of Wood Preservatives in Organic Solvents
CIVIL	BSI BS 5962 - Specifications for Naphthalene (Including Test Methods)

CIVIL	BSI BS EN 300 - Oriented Strand Board (OSB). Definitions, Classification and Specifications
CIVIL	BSI BS 1726-2 - Cylindrical helical springs made from round wire and bar - Guide to methods of specifying, tolerances and testing - Part 2: Extension spring
CIVIL	BSI BS 2548 - Specification for Wood Wool for General Packaging Purposes
CIVIL	BSI BS 3379 - Combustion modified Flexible Polyurethane Cellular Materials for Load Bearing Applications, Specification
CIVIL	BSI BS 7200 - Specification for Synthetic-Fibre Needlefelts
Other	DR/4 - Package Cushion Design Data
CIVIL	BSI BS EN 12765 - Classification of Thermosetting Wood Adhesive for Non-structural Applications
CIVIL	BSI BS 4J 11 - Pressure - Sensitive Adhesive Paper Masking Tape
CIVIL	BSI BS 7116 - Specification for double sided pressure sensitive adhesive tapes
CIVIL	BSI BS EN 10230-1 - Steel Wire Nails; Loose nails for general applications
CIVIL	BSI BS EN 13246 - Packaging; Specification for tensional steel strapping
CIVIL	BSI BS EN 13394 - Packaging; Specification for non-metallic tensional strapping
CIVIL	BSI BS EN 14592 - Timber structures - Dowel-type fasteners - Requirements
CIVIL	BSI BS EN 61340-5-1 - Electrostatics. Protection of Electronic Devices from Electrostatic Phenomena. General Requirements
CIVIL	BSI BS 718 - Specification for density hydrometers
CIVIL	BSI BS 1202-1 - Specification for nails; Steel nails
CIVIL	BSI BS 4881 - Specification for Polypropylene film cords, lines and twines
CIVIL	ASTM D1404 - Standard Test Method for Estimation of Deleterious Particles in Lubricating Grease
CIVIL	IP50 - Methods of test for Petroleum and its products Part 50. Determination of cone penetration of lubricating grease - BSI BS 2000-50

2 Reference in this Standard to any normative references means in any Invitation to Tender or contract the edition and all amendments current at the date of such tender or contract unless a specific edition is indicated. Care should be taken when referring out to specific portions of other standards to ensure that they remain easily identifiable where subsequent amendments and supersession's might be made. For some standards the most recent editions shall always apply due to safety and regulatory requirements.

3 In consideration of clause A.2 above, users shall be fully aware of the issue, amendment status and application of all normative references, particularly when forming part of an Invitation to Tender or contract. Correct identification of standards is as defined in the ITT or contract.

4 DStan can advise regarding where to obtain normative referenced documents. Requests for such information can be made to the DStan Helpdesk. Details of how to contact the helpdesk are shown on the outside rear cover of Defence Standards.

Definitions

For the purpose of this standard, ISO/IEC Guide 2 'Standardization and Related Activities – General Vocabulary' and the definitions shown below apply.

Definition	Description

Abbreviations

Abbreviation	Description

Defence Standards are published by and obtainable from:

Defence Equipment and Support

UK Defence Standardization

Kentigern House

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File Reference

The DStan file reference relating to work on this standard is 81/41/5.

Contract Requirements

When Defence Standards are incorporated into contracts, users are responsible for their correct application and for complying with contractual and statutory requirements. Compliance with a Defence Standard does not in itself confer immunity from legal obligations.

Revision of Defence Standards

Defence Standards are revised as necessary by an up-issue or amendment. It is important that users of Defence Standards ensure that they are in possession of the latest issue or amendment. Information on all Defence Standards can be found on the DStan Websites https://www.dstan.mod.uk and http://dstan.uwh.diif.r.mil.uk/, updated weekly. Any person who, when making use of a Defence Standard, encounters an inaccuracy or ambiguity is encouraged to notify UK Defence Standardization (DStan) without delay in order that the matter may be investigated and appropriate action taken.

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