

PAS 109:2013

Specification for the
production of reprocessed gypsum
from waste plasterboard



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Foreword

This PAS was sponsored by WRAP (Waste & Resources Action Programme)¹⁾. Its development was facilitated by BSI Standards Limited and is published under licence from The British Standards Institution. It came into effect on 31 July 2013.

The overall aim of this PAS is to provide a specification that can be adopted by reprocessors for producing defined grades of reprocessed gypsum from waste plasterboard, such that potential customers will be assured that they are procuring a material of consistent and verifiable quality.

Acknowledgement is given to the following individuals and organizations involved in the development of this PAS as members of the steering group:

- Environment Agency²⁾
- Gypsum Products Development Association (GPDA)³⁾
- Gypsum Reprocessors' Association for the UK and Ireland (GRAUKI)⁴⁾
- Waste & Resources Action Programme (WRAP)

Acknowledgement is also given to those individuals and organizations that submitted comments during the public consultation.

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This PAS is not to be regarded as a British Standard.

It will be withdrawn upon publication of its contents in, or as, a British Standard.

The PAS process enables a specification to be rapidly developed in order to fulfil an immediate need in industry. A PAS may be considered for further development as a British Standard, or constitute part of the UK input into the development of a European or International Standard.

Supersession

This PAS supersedes PAS 109:2008, which is withdrawn.

Information about this document

This is a full revision of the PAS, and introduces the following principal changes:

- a) inclusion of further end-user markets under the scope (see Clause 1);
- b) revised procedure for receipt of waste materials (see Clause 6);
- c) revised product specification (see Clause 8).

Use of this document

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

¹⁾ WRAP helps individuals, businesses and local authorities to reduce waste and recycle more, making better use of resources and helping to tackle climate change. Established as a not for profit company in 2000, WRAP is backed by government funding from England, Scotland, Wales and Northern Ireland. More information on WRAP's work can be found on www.wrap.org.uk.

²⁾ Environment Agency: www.environment-agency.gov.uk.

³⁾ Gypsum Products Development Association (GPDA): www.gpda.com.

⁴⁾ Gypsum Reprocessors' Association for the UK and Ireland (GRAUKI): <http://membe43.wix.com/grauki>.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element. The word “should” is used to express recommendations, the word “may” is used to express permissibility and the word “can” is used to express possibility, e.g. the consequence of an action or event.

Spelling conforms to *The Shorter Oxford English Dictionary*.

Contractual and legal considerations

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Compliance with this publication cannot confer immunity from legal obligations, including those that apply to the transport, processing and use of waste. Waste controls can prohibit certain uses of gypsum from waste plasterboard. Check with the regulator for the latest information.

Introduction

Waste plasterboard can readily be reprocessed into its constituent parts – gypsum and paper. The reprocessed gypsum has use in a variety of applications which currently use natural (mined or quarried) gypsum or synthetic gypsum (by-products from industrial processes). A number of new applications have also been developed. However, while there has always been some reprocessing of waste plasterboard the majority of this waste has been disposed of to landfill, which results in the loss of a useful resource.

UK and European landfill legislation, and the increasing costs of landfill disposal, are driving good materials resource efficiency and the reduction, reuse and recycling of wastes. Initiatives have been developed that support the segregation, collection and reprocessing of waste plasterboard, and the development of end-market uses for the resulting reprocessed gypsum.



Through its quality management requirements and product specifications, PAS 109 intends to increase the material users' confidence in reprocessed gypsum. Developing a freely available published PAS can reduce the proliferation of individually agreed specifications that can exist between some material users and reprocessors.

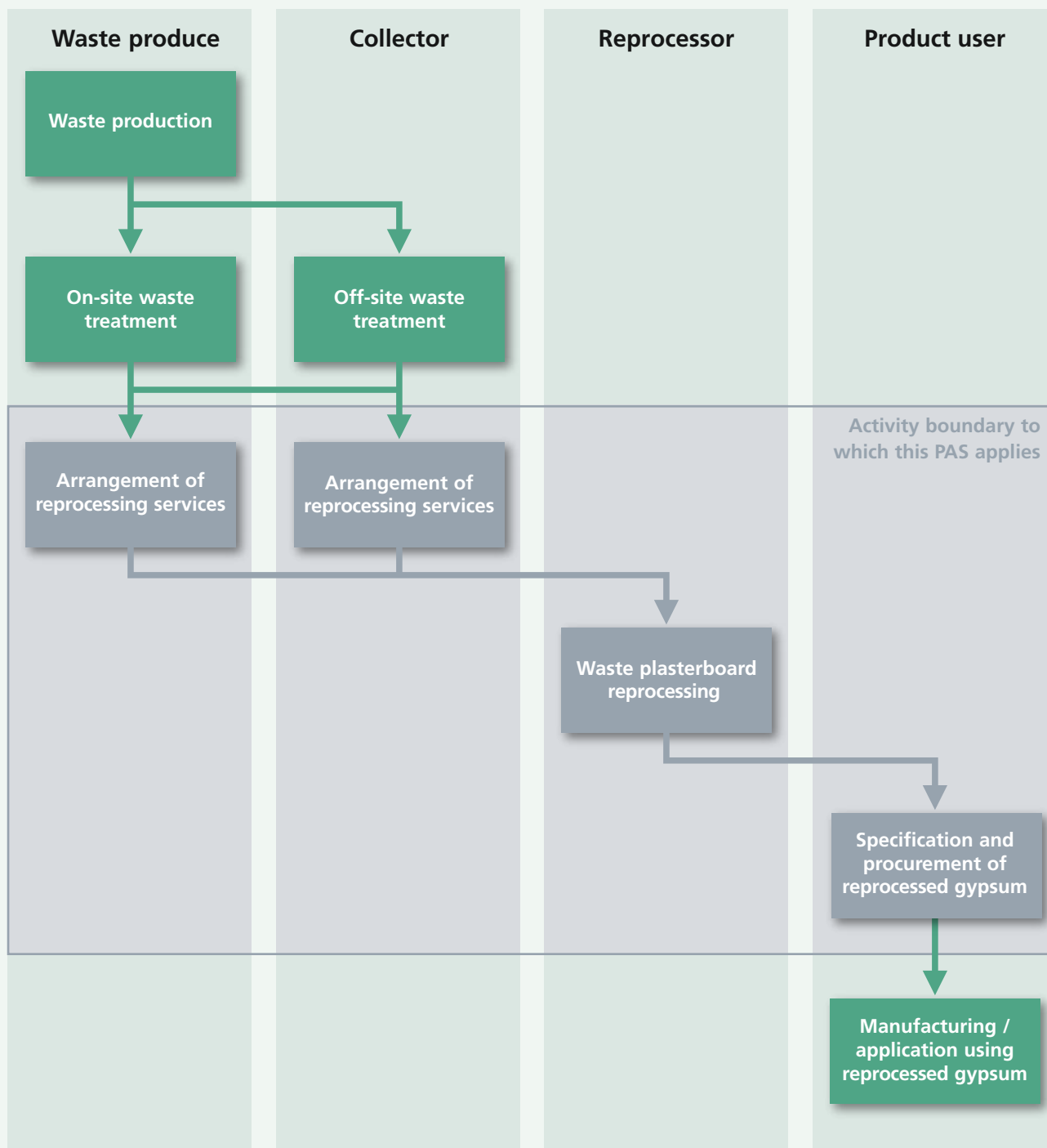
Intended for use by the plasterboard reprocessors and material users of reprocessed gypsum, PAS 109 defines the requirements and product specifications for producing reprocessed gypsum from waste plasterboard. Figure 1 illustrates the intervention point of this PAS.

This PAS defines the specifications for three material grades of reprocessed gypsum, and the sampling and test methods required to verify compliance with the specifications. It also states requirements for quality management, encompassing:

- a) organizational requirements;
- b) supply and handling of waste plasterboard for recycling;
- c) processing;
- d) material verification;
- e) handling;
- f) storage and dispatch.

This PAS can enable reprocessors to produce, and material users to procure, a quality assured reprocessed gypsum of consistent and defined quality (see 8.1). This will increase confidence in the use of reprocessed gypsum, leading to growth in existing markets and the development of new markets.

Figure 1 – Applicability of PAS 109



NOTE Figure 1 is only generic; some companies might fulfil more roles than indicated. For example, some plasterboard reprocessors might also provide waste plasterboard collection services to sites.

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1 Scope

This PAS specifies minimum requirements for the production of reprocessed gypsum from waste plasterboard intended for a range of applications in existing and emerging end markets.

This PAS covers the selection, receipt and handling of input materials, the specifications of material grades, and the storage, labelling, dispatch and traceability of the materials. It also specifies requirements for a quality management system for the production of grades of reprocessed gypsum to ensure they are consistently fit for their intended uses.

This PAS is for reprocessed gypsum produced from waste plasterboard that has been separately collected, or sorted and segregated from, other wastes, products or materials.



Likely sources of waste plasterboard include:

- a) plasterboard manufacturing waste;
- b) over ordering on construction sites;
- c) boards damaged during transportation, handling or storage;
- d) off-cuts during installation; and
- e) plasterboard stripped out during refurbishment and demolition works.

The requirements for the reprocessed gypsum grades specify particle size distribution, residual paper content, purity, physical contamination and chemical composition limits, and acceptability of both colour and smell.

The end markets to which this PAS applies include, but are not limited to:

- 1) plasterboard manufacture;
- 2) cement manufacture;
- 3) manufacture of construction products;
- 4) soil treatment in agriculture and horticulture;
- 5) manufacture of growing media;
- 6) manufacture of proprietary fertilizers;
- 7) soil stabilization and binding;
- 8) dewatering agent for sludges;
- 9) clarifying aquatic environments; and
- 10) absorbent for liquid spills.

In order to accommodate the widening range of end user requirements for reprocessed gypsum variations or additions to an end user specification might be required. However, in all instances, the standard set by this PAS could be the minimum requirement. In addition to meeting the standard set by this PAS, the reprocessor is responsible for attaining any requirement permits and consistently fulfilling any additional quality needs, such that the materials are safe and consistently fit for their intended purposes.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 933-1, *Tests for geometrical properties of aggregates – Part 1: Determination of particle size distribution – Sieving method*

VGB M701e, Analysis of FGD gypsum – Instruction sheet. VGB-Kraftwerkstechnik GmbH, Darmstadt/Essen, 2nd edition, 2008⁵⁾



⁵⁾ www.vgb.org/shop/m701e.html

3 Terms and definitions

For the purposes of this PAS the following terms and definitions apply.

3.1 acceptance criteria

criteria against which the reprocessor will assess the waste plasterboard load to ascertain if they will accept it for processing or reject it

3.2 batch (material)

quantity of material manufactured by the same process under the same conditions in one period of production, labelled in the same manner and understood to have the same characteristics

3.3 batch (waste)

quantity of collected waste having the same or sufficiently similar characteristics and nature of origin to enable it to be considered as having consistent characteristics

NOTE For example, this may be used to describe a series of waste loads from similar activities at one site.

3.4 composite code

designated code applied to a waste plasterboard load to describe its type, source, site and collection details

3.5 contamination

unwanted material or substances in waste plasterboard or reprocessed gypsum

3.6 facility

premises, equipment and plant used to process waste plasterboard into reprocessed gypsum

3.7 fit for purpose

having all of the properties and characteristics that are necessary for its intended use

3.8 gypsum

material composed of calcium sulphate dihydrate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$)

NOTE This forms the core of plasterboard and has other applications.

3.9 load (noun)

single consignment

3.10 material user

individual or company procuring or accepting reprocessed gypsum produced by the reprocessor for a specified purpose

3.11 period of production

shortest period of time between subsequent validations, revalidations, or testing of the procedures, processes and/or reprocessed gypsum, during which processing occurs

3.12 plasterboard

product composed of:

- a) a gypsum plaster core encased in, and firmly bonded to, strong durable paper liner to form a flat rectangular board. The paper surfaces may vary according to the use of the particular type of board and the core may contain additives to impart additional properties. The longitudinal edges are paper covered and profiled to suit the application [SOURCE: BS EN 520:2004, definition 3.1]; or
- b) gypsum boards with mat reinforcement: a gypsum core firmly bonded to a woven or non woven sheet of inorganic or organic fibres located on or just below the surfaces. The sheet may consist of single or multiple layers and may be reinforced by filaments or webs of fibre strands. The surfaces may vary according to the use and the core can also contain fibres, additives and/or fillers to impart additional properties...the surfaces and edge profiles vary according to the use of the particular type of board [SOURCE: BS EN 15283-1:2008+A1:2009, definition 3.1]; or

- c) gypsum fibre boards: set gypsum plaster reinforced with dispersed fibres, which may be inorganic and/or organic, to form flat rectangular boards. They may contain additives and/or fillers to impart additional properties. The surfaces may vary according to the use. The edges and ends may be profiled to suit the application [SOURCE: BS EN 15283-2:2008+A1:2009, definition 3.1]; or
- d) plasterboard cornice: preformed paper covered gypsum section with profiled face supported by shoulders [SOURCE: BS EN 14209:2005, definition 3.1]; or
- e) gypsum plasterboards from reprocessing produced to BS EN 14190; or
- f) gypsum plasterboard laminated with thermal insulation produced to BS EN 13950.

3.13 process (noun)

means by which waste plasterboard is separated into its constituent parts of gypsum and paper, and contaminants are removed

3.14 process (verb), processing

production of reprocessed gypsum from waste plasterboard, incorporating the removal of contamination and the paper lining

3.15 purity

percentage content of calcium sulphate in gypsum

3.16 quality assurance

part of quality management focused on providing confidence that quality requirements will be fulfilled

[SOURCE: BS ISO 9000:2005, definition 3.2.11]

3.17 quality control

part of quality management focused on fulfilling quality requirements

[SOURCE: BS ISO 9000:2005, definition 3.2.10]

3.18 quality management system (QMS)

management system to direct and control an organization with regard to quality

[SOURCE: BS ISO 9000:2005, definition 3.2.3]

3.19 quality manual

document specifying the quality management system of an organization

[SOURCE: BS ISO 9000:2005, definition 3.7.4]

3.20 reprocessed gypsum

gypsum resulting from the processing of waste plasterboard in accordance with this PAS, and having a specification meeting one of the material grades defined in this PAS, also known as the "material"

NOTE This definition does not allow for the inclusion of magnesium oxide-based board.

3.21 reprocessor

individual or company that processes waste plasterboard to produce reprocessed gypsum

3.22 standard operating procedure (SOP)

defined documented quality or operating procedure to be followed in order to fulfil the relevant part of the reprocessor's quality management requirements and requirements of this PAS

3.23 supplier

individual or company that provides products, materials or services to the reprocessor

3.24 waste plasterboard

plasterboard which the holder discards, intends to discard or is required to discard

NOTE For the purposes of this PAS, plasterboard includes the products defined in .

3.25 waste supplier

individual or company that provides waste plasterboard to the reprocessor

4 Quality management

4.1 General

4.1.1 The reprocessor shall operate a quality management system (QMS) that demonstrates effective assurance and control of all operations and associated quality management activities necessary to achieve reprocessed gypsum that is fit for its intended purposes.

NOTE Although this PAS covers key aspects of quality management systems it does not prescribe the required format, or specify all the requirements in BS EN ISO 9001 because many reprocessors in the UK do not yet have the resources to operate a 9001-compliant system. Compliance with BS EN ISO 9001 is recommended but not mandatory.

4.1.2 The reprocessor shall establish, document and implement:

- a) a quality policy in accordance with 4.2;
- b) a quality manual and standard operating procedures (SOPs) that result in reprocessed gypsum fit for its intended purposes; and
- c) objectives to improve quality.

4.1.3 Documents that cover quality management activities relating to this PAS shall be controlled in accordance with 4.3.2.

4.1.4 The QMS shall be specific to a defined recycling process and its resulting materials for which the reprocessor claims PAS 109 conformity. Each process producing material that conforms to this PAS shall be kept separate from any other processes carried out at the same site and from any by-products and/or outputs from other such processes.

4.1.5 The recycling process shall be arranged in such a manner as to maintain reprocessed gypsum that is fit for purpose and to ensure that input and output materials are segregated to prevent cross-contamination.

4.2 Quality policy

There shall be a clearly defined quality policy that:

- a) includes commitment to achieving the minimum specifications specified in Clause 8 for the product types being produced;
 - b) includes commitment to fulfilling customers' requirements for materials which are fit for their required purpose;
 - c) is appropriate to the recycling operation and the resources committed to quality management;
 - d) has a clearly identified scope of application; and
- NOTE This is the reprocessing location, process and each of the product types the policy applies to.*
- e) is documented, implemented and communicated to all personnel whose activities affect quality management and the quality of the materials.

4.3 Control procedures

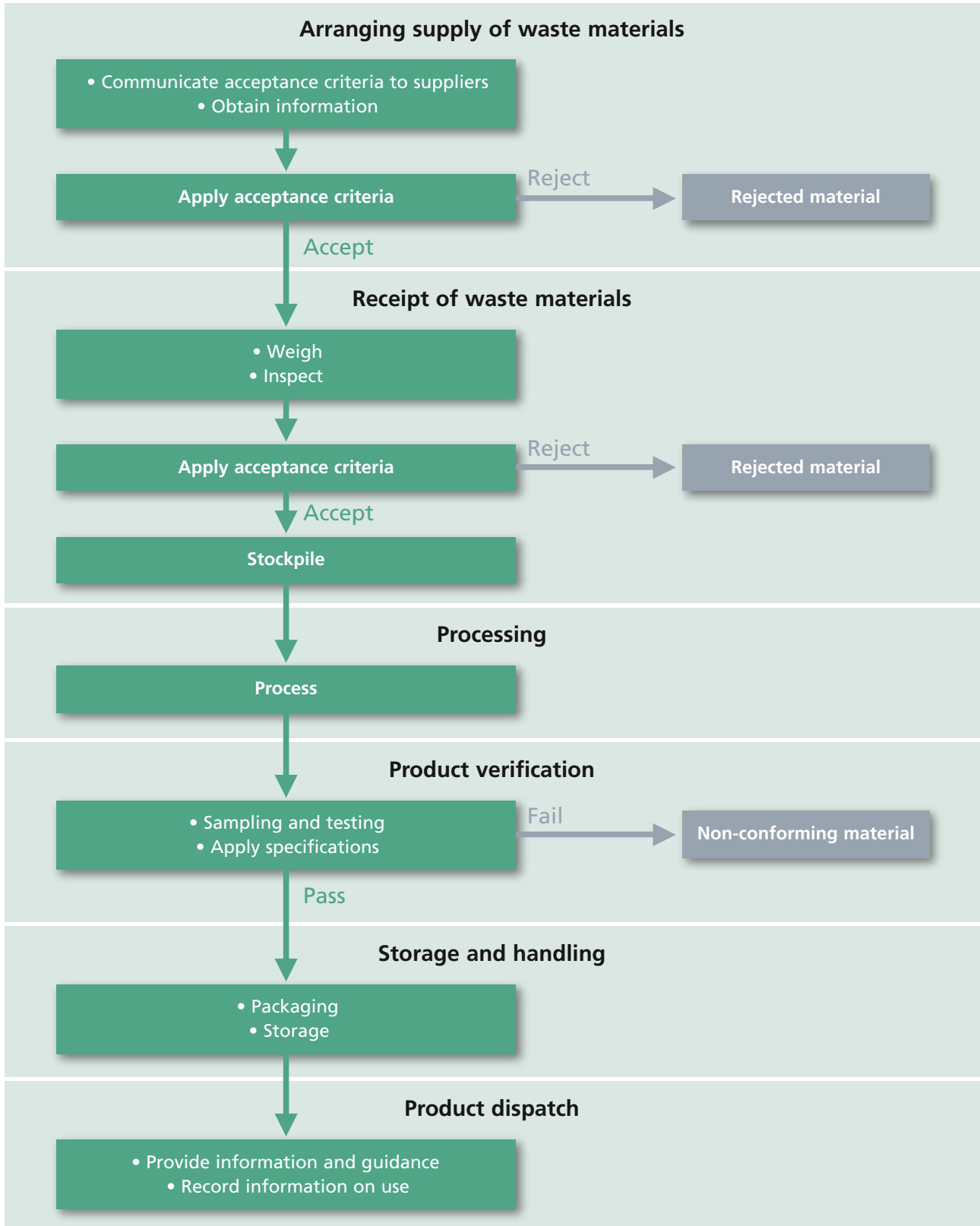
4.3.1 Quality manual

4.3.1.1 The reprocessor shall establish and maintain a quality manual, setting out the procedures by which the requirements for factory production control are satisfied.

4.3.1.2 The scope of the quality manual shall include, as a minimum, the generic production processes shown in Figure 2 and the requirements of Clauses 5 to 11.

NOTE The processes shown in Figure 2 are not exhaustive and further methods, processes or stages may be required. The reprocessor should satisfy themselves that their processes and procedures provide full compliance with their quality manual and QMS.

Figure 2 – Generic processes in producing PAS 109 reprocessed gypsum, and minimum scope of the quality manual



4.3.1.3 The quality manual shall include documented procedures:

- a) to identify and control the materials (see Clauses 5 to 7);
NOTE These can include procedures for maintaining and adjusting processing equipment, inspection or testing material sampled during processing.
- b) to identify and control any hazardous materials to ensure that they do not exceed the limits in force according to the provisions valid in the place of use of the reprocessed gypsum (see Clause 8);
- c) to ensure that the material is put into stock in a controlled manner and the storage locations and their contents identified (see 6.5);
- d) to ensure that material taken from stock has not deteriorated in such a way that its conformity is compromised (see 8.2); and
- e) to enable identification of the material up to the point of sale as regards source and type (see Clause 10).

4.3.1.4 The performance of the quality management system shall be assessed according to the principles used in this PAS.

4.3.2 Document and data control

4.3.2.1 Document and data control shall include those documents and data that are relevant to this PAS, covering receipt and dispatch of materials, processing, inspection of materials and the quality manual documents.

4.3.2.2 A procedure concerning the management of documents and data shall be documented in the quality manual, covering methods and responsibilities for approval, issue, distribution and administration of internal and external documentation and data; and the preparation, issue and recording of changes to documentation.

4.3.3 Subcontract services

If any part of the operation is subcontracted by the reprocessor, a means of control shall be established. The reprocessor shall communicate the essential requirements of PAS 109 to the subcontractor. The reprocessor shall retain overall responsibility for any parts of the operation subcontracted.

4.3.4 Knowledge of input material

There shall be documentation detailing the nature and source of the input material. The minimum requirements that shall be obtained and recorded are detailed in Clauses 5 and 6.

NOTE It is the reprocessor's responsibility to ensure that if any dangerous or hazardous substances are identified, their content does not exceed the limits in force according to the provisions valid in the place of use of the reprocessed gypsum.

4.4 Responsibilities and authority

4.4.1 General

The responsibility, authority and the interrelation between all personnel who manage, perform and check work affecting quality shall be defined, including personnel who need organizational freedom and authority to:

- a) initiate action to prevent the occurrence of material non-conformity; and
- b) identify, record and rectify any material quality deviations.

4.4.2 The management

NOTE The management is fully accountable for quality, including of the organization, processes and materials.

4.4.2.1 The QMS shall define the responsibilities of the management of the recycling organization, which shall include:

- a) introducing and maintaining the QMS;
- b) defining the quality policy;
- c) ensuring that measurable quality objectives and material requirements are established at relevant levels and functions within the organization;
- d) ensuring responsibilities and authorities are defined;
- e) ensuring that the QMS is clearly communicated within the organization, and adhered to;
- f) ensuring all staff are trained to enable them to undertake their responsibilities in ensuring the QMS is adhered to;
- g) ensuring all staff are informed of the relevance and importance of their activities and how they contribute to the achievement of the quality objectives;
- h) acting on any reported breaches of the QMS or quality of the materials; and
- i) conducting reviews of the whole system at planned intervals in accordance with 4.7.

4.4.2.2 The management shall appoint a member of staff with responsibility for looking after the QMS and for ensuring the requirements of it, and this PAS, are implemented and maintained.

NOTE The nominated member of staff should have recognized authority within the recycling organization.

4.4.3 The operational staff

The QMS shall define the responsibilities of the staff of the organization, which shall include:

- a) undertaking required training to enable them to undertake their allocated roles and responsibilities;
- b) undertaking their allocated roles and responsibilities in accordance with the QMS, quality manual and SOPs to ensure that quality is upheld; and
- c) reporting to management any actual, potential or near breaches of the QMS or quality of the materials.

4.5 Resource management

4.5.1 People

As a minimum, the QMS shall provide the following information on and for the staff working in the organization and/or site:

- a) definition of roles within the organization and/or site with a description of their responsibilities, and a clear reporting structure;
- b) details of the procedures for training staff, including identification of the staff responsible for managing the training; and
- c) methods of communication of, and staff involvement in, the QMS.

4.5.2 Suppliers

A procedure shall be defined and documented for acquiring suppliers and checking their ability to provide the materials and services required by the organization. This procedure shall include the following as a minimum:

- a) the means by which statutory and regulatory requirements will be met;
- b) that the supplier shall be informed of the reprocessor's requirements for the materials or service. For input waste plasterboard, the reprocessor shall provide details of their acceptance criteria, as defined in Clause 5;
- c) the procedures and controls by which the supplier's ability to supply the right materials or services shall be checked. For input waste plasterboard, the reprocessor shall obtain certain information, as defined in Clauses 5 and 6; and

- d) the means by which acceptance or rejection of a supplier's materials or services shall be promptly communicated to them.

4.5.3 Premises, plant and equipment

4.5.3.1 Premises, plant, equipment and all vehicles used for transportation shall be:

- a) suitable for the intended purposes;
- b) used so as to maintain materials that are fit for purpose;
- c) kept clean and in good working order; and
- d) serviced regularly and calibrated where applicable.

NOTE The quality manual requires that the reprocessor provides for the control, calibration and maintenance of inspection, measuring and test equipment.

4.5.3.2 Records shall be maintained of plant and equipment identification, details, and service and calibration history, in accordance with 4.8.

NOTE Maintenance contracts should be considered as these can help to ensure service and calibration intervals advised by the equipment manufacturers, required by other standards and specifications, and stated in the QMS, are not exceeded and can give financial savings through reduced downtime from fast response to breakdowns.

4.5.4 Stores

Storage areas for goods such as input materials, equipment and materials, shall be identified to ensure that such goods are stored to prevent damage and deterioration and can be maintained in accordance with the supplier's recommendations, regulatory requirements, and the requirements of Clauses 6 and 9.

NOTE If not already required by the regulations under which the reprocessor operates then it is good practice to produce a plan of the recycling facility showing, along with other details, the position of the storage areas.

4.6 Validation

4.6.1 The reprocessor shall validate that the QMS and SOPs achieve all of the intended levels of control and that the reprocessed gypsum is fit for purpose.

4.6.2 The reprocessor shall:

- a) define and document a procedure for validating the required effectiveness of the QMS and SOPs;

NOTE This is part of quality assurance, which is an integral element of an effective QMS.

- b) operate all SOPs under normal working conditions and monitor their performance and outputs;
- c) from the results of monitoring the SOPs, verify that the process is working as defined;
- d) sample and test each relevant grade of reprocessed gypsum, in accordance with 8.2;
- e) assess whether each relevant grade of reprocessed gypsum conforms to the minimum quality requirements and product specifications stated in 8.1; and
- f) document the results of the validation in accordance with 4.8.

4.6.3 All reprocessed gypsum produced during validation shall be quarantined until the tests on it have been carried out and the results obtained.

- a) If the results demonstrate that the reprocessed gypsum meets the specification for one of the material grades in Table 1 then the batch shall be granted the relevant grade designation and released from quarantine to final storage and dispatch.
- b) If the results demonstrate that the reprocessed gypsum does not meet the specification for one of the material grades in Table 1 then the procedure of 8.3 for non-conforming material shall apply.

4.6.4 If any change is made or occurs to the defined material acceptance criteria, production, or handling and storage procedures, the required effectiveness of the quality and SOPs shall be re-validated before any material produced since the change is designated as PAS 109-reprocessed gypsum and sold or distributed.

4.7 Auditing

4.7.1 The following documents and procedures shall be audited and reviewed at planned intervals (defined in the QMS) to ensure their continuing suitability and effectiveness:

- a) quality manual;
- b) SOPs;
- c) validation procedure.

4.7.2 Records of such reviews shall be maintained in accordance with 4.8.

4.7.3 Auditing shall be carried out by a competent person with appropriate skills, knowledge and authority for this to be undertaken effectively, and for the findings to be acted upon by the management.

***NOTE 1** Internal audits, or first-party audits, are conducted by, or on behalf of, the organization itself for management review and other internal purposes, and may form the basis for an organization's declaration of conformity. In many organizations, particularly in smaller organizations, independence can be demonstrated by the freedom from responsibility for the activity being audited.*

***NOTE 2** External audits include those generally termed second- and third-party audits. Second-party audits are conducted by parties having an interest in the organization, such as customers, or by other persons on their behalf. Third-party audits are conducted by external, independent auditing organizations. Users of this PAS are advised to consider the desirability of a third-party audit to validate the effective operation of the QMS and SOPs.*

4.8 Record keeping

4.8.1 The QMS shall define what documents and data are recorded and kept. The records required by all parts of this PAS shall be included.

4.8.2 A procedure shall be defined for how each different form and type of document and data are recorded and kept.

4.8.3 The records shall be kept for at least the statutory period, or four years if there is no applicable statutory requirement.

***NOTE** "Statutory period" is the period of time records are required to be kept in accordance with regulations applying at the place of production.*

4.8.4 Records shall be kept safe, secure, free from damage, and in accordance with all relevant data protection regulations.

***NOTE 1** Paper records should be stored in a damp-free and vermin-free location. Electronic records (spreadsheets, etc.) should be protected using reliable back-up and virus protection systems.*

***NOTE 2** Attention is drawn to BS ISO 15489-1, which provides guidance on managing records.*

5 Arranging supply of waste materials

5.1 General

5.1.1 Before a load of waste plasterboard is delivered to the reprocessing facility, information shall be communicated between the prospective waste supplier and the reprocessor (see 5.3), and a decision made by the reprocessor whether to receive the waste.

NOTE 1 The quality of the “material out” is related to the quality of the material in. Quality control of the input waste plasterboard is therefore important in producing a quality assured reprocessed gypsum material.

NOTE 2 Good communication between the reprocessor and supplier minimizes the risk of the waste being rejected by the reprocessor upon receipt at the facility.

5.1.2 The reprocessor shall define a procedure for identifying whether the waste plasterboard intended to be supplied to the reprocessor is suitable for the defined recycling process. This procedure shall be stated in the quality manual and include the following stages as a minimum:

- a) provision of certain information from the reprocessor to the waste supplier (see 5.2);
- b) the reprocessor shall obtain certain information from the waste supplier (see 5.3); and
- c) application of acceptance criteria and the rejection or acceptance of the material supply agreement (see 5.4).

5.2 Information to be provided

5.2.1 When arranging supply of waste plasterboard from a new or existing waste supplier, the reprocessor shall state their acceptance criteria and delivery requirements.

5.2.2 Evidence of supplying this information shall be recorded in accordance with 4.8.

5.2.3 The quality manual shall state who is responsible for providing the information.

5.2.4 The acceptance criteria shall be stated in the quality manual.

NOTE Acceptance criteria can be described using the composite coding system detailed in Annex A, which provides a way of describing the type, source, site and collection method of a waste plasterboard load, using a composite code. These composite codes are intended to standardize the description of plasterboard waste.

5.3 Information to be obtained

5.3.1 The reprocessor shall obtain and record documentation detailing the nature of the waste plasterboard and its source.

NOTE 1 The reprocessor is required by law to obtain and maintain certain information on the waste they receive, for inspection by the relevant authorities.

NOTE 2 As it is the responsibility of the reprocessor to ensure that any hazardous or dangerous substances at the facility are managed in accordance with relevant regulations and within limits in force, it is advisable that they obtain as much information as possible on the input waste materials with regard to such substances.

5.3.2 The quality manual shall state the information to be obtained by the reprocessor from the prospective supplier, and how often it shall be obtained. The reprocessor shall obtain the following information as a minimum:

- a) List of Wastes (LOW) code of the waste;

NOTE These were formerly referred to as European Waste Catalogue (EWC) codes.
- b) description of the waste;
- c) quantity (weight) in each load, and number of loads in the batch;
- d) packaging of the waste (e.g. bulk bags, 40 yard skip);
- e) details of the company/contractor and site the material originated from, and the supplier of the material to the facility;
- f) date of waste arising;
- g) waste carrier's/waste broker's licence number and registration details; and

- h) date and time each load will be delivered to the facility.

NOTE Using the composite code (Annex A) can help to describe the waste and provide details about its source.

5.3.3 The information obtained shall be recorded in accordance with **4.8**.

5.3.4 The quality manual shall state who is responsible for obtaining and recording the information.

5.4 Apply acceptance criteria

5.4.1 The information obtained on each waste load shall be compared with the acceptance criteria.

- a) If the waste load does meet the criteria, the load shall be delivered to the facility.
- b) If the waste load does not meet the criteria, then the waste shall not be delivered to the facility and the prospective waste supplier shall be notified immediately. The reprocessor shall provide an explanation to the waste supplier for the reasons for rejecting the load, to enable them to make changes so future loads can be accepted.

NOTE Actions may be undertaken on a failed load to rectify its failure, such as removal of contamination by the waste supplier or a third party, and it then being re-submitted to the reprocessor for consideration for receipt.

5.4.2 A record of the assessment and decision shall be kept in accordance with **4.8**.

5.4.3 The quality manual shall state who is responsible for:

- a) comparing the information on the prospective waste loads with the acceptance criteria;
- b) making the accept/reject decision;
- c) notifying the prospective supplier accordingly; and
- d) maintaining a record of the information.



6 Receipt of waste materials

6.1 General

6.1.1 The procedure for the receipt of waste plasterboard shall be defined in the quality manual.

6.1.2 This procedure shall include the means by which any hazardous substances or materials received shall be managed in accordance with relevant regulations and within limits in force.

6.1.3 The quality manual shall state who is responsible for:

- inspecting the load;
- making the accept/reject decision; and
- maintaining a record of the information.

NOTE Each load of waste plasterboard delivered to the facility should be accompanied by a waste transfer note, as required by legislation and regulation.

6.2 Weigh

The vehicle delivering the waste load shall be weighed upon arrival. The weight shall be recorded on the waste transfer note, and in the reprocessor's deliveries log in accordance with the requirements of 4.8.

6.3 Stockpile

6.3.1 Accepted waste plasterboard shall be put into stock in a controlled manner, such that it cannot be contaminated with other waste and is in an identifiable location.

6.3.2 The quality manual shall state whether different types of material need to be stockpiled separately for

different processes or to produce different types of reprocessed gypsum.

6.3.3 The storage areas at the facility shall be individually identified so that all staff know where to find the materials needed for a given process. This requirement shall also be stated in the quality manual and QMS.

NOTE It is good practice in traceability for loads to be stockpiled in identifiable batches rather than simply in a single stockpile. If an issue is retrospectively found with a load, action need only then be undertaken on that batch rather than the entire stockpile.

6.3.4 Each stockpile shall be managed to ensure the waste in the stockpile:

- cannot contaminate or mix with any other material or process;
- cannot be contaminated by, or mixed with, any other material;
- cannot degrade; and
- is protected from wet weather.

6.3.5 If bays are used to enclose the stockpiles the walls and floor shall be formed from concrete or other hard, stable material. Compacted earth floors shall not be used. The waste plasterboard shall be stored short of the full length and height of the bay to avoid spillage of the contents of the bay into adjacent bays.

NOTE It is good practice for the waste plasterboard to be extracted from the middle of the bay, leaving the sides untouched, in order to avoid scrapings (of wood or concrete, for example) from the walls into the material.



7 Processing

NOTE Attention is drawn to the Waste (England and Wales) Regulations 2011 [1], Waste (Scotland) Regulations 2012 [2], and Waste Regulations (Northern Ireland) 2011 [3].

7.1 Process

NOTE Different facilities operate different equipment and processes, yet are equally capable of producing PAS 109 reprocessed gypsum. The requirements here are therefore necessarily general in nature.

7.1.1 The processes used shall produce the required grade or grades of reprocessed gypsum as set out in Table 1.



7.1.2 The processes used shall be defined in SOPs. The processes shall include, where appropriate, means of removing contaminants in the waste plasterboard being processed.

NOTE 1 It is good practice to remove contaminants from the waste plasterboard at the earliest possible opportunity otherwise their presence may damage processing machinery, and they are generally more difficult to remove after size reduction of the waste. Removing contaminants before processing may also result in the paper material from the processing being suitable for separate marketing.

NOTE 2 Contaminant removal may require:

- a) overband magnets;
- b) underband magnets;
- c) eddy current separators;
- d) hand picking;
- e) trommels;
- f) screens; or
- g) a combination of these or other equipment.

7.1.3 The operators of the process shall be trained and their individual roles and responsibilities defined in the quality manual.

7.1.4 The output from the process shall be handled and stored in accordance with Clause 9.

NOTE Processing waste plasterboard has the potential to create dust, and so consideration should be given to how this will be mitigated.



8 Material verification

8.1 Material specifications

8.1.1 Reprocessed gypsum designated as conforming to this PAS shall conform to the specification for one of the three grades defined in Table 1. Gypsum not conforming to any of these specifications, either in part or in entirety, shall not be designated as PAS 109 reprocessed gypsum.

NOTE 1 The grades can be summarized as:

- a) fine – a fine powder;
- b) coarse – granular;
- c) custom – allows the particle size distribution to be defined to suit specific use requirements (see 8.1.2).

NOTE 2 The defined grades are differentiated only by their gypsum particle size distribution. The specifications for all other parameters are the same for all grades.

NOTE 3 To satisfy the needs of some markets, more stringent specification for some of the parameters may be required (for example, smaller maximum size of residual paper pieces, or lower chemical composition limits). The resulting reprocessed gypsum may still be

designated as conforming to PAS 109 as it would not be falling below the defined specifications of Table 1. Details of the increased specification may be included in the labelling and marking of the reprocessed gypsum in addition to the required information in .

NOTE 4 It is permissible for the reprocessor to undertake post-processing on the process gypsum output to produce the required grades. Examples include:

Example 1: Reprocessing may produce a primary material of a well graded custom grade (having a defined particle size distribution suitable for a particular end use market), of which the reprocessor may then post-process a proportion by screening to produce fine grade, coarse grade, and a further custom grade (having a defined particle size distribution suitable for a further particular end use market).

Example 2: The gypsum output from the primary process (which may be being sold by the reprocessor as non-PAS 109 reprocessed gypsum) may undergo post-processing to reduce the paper content sufficiently to enable it to meet the specification for PAS 109 reprocessed gypsum.



Table 1 – Specification for PAS 109 reprocessed gypsum

Parameter	Specification					
Particle size distribution (% w/w retained on BS sieve individually)	Fine grade		Coarse grade		Custom grade	
	Lower limit	Upper limit	Lower limit	Upper limit	Lower limit	Upper limit
31.5 mm	0	0	0	0	As defined to suit intended end market (8.1.1), with an upper limit of 31.5 mm	
16 mm	0	0	40	80		
8 mm	0	0	20	60		
4 mm	0	0	0	40		
2 mm	0	0	0	20		
1 mm	0	10	0	10		
0.500 mm	0	20	0	5		
0.250 mm	0	40	0	2		
0.125 mm	20	60	0	2		
0.063 mm	40	80	0	2		
Residual paper/fibres						
Content	<1% w/w					
Size of paper pieces	Maximum 10 mm largest dimension					
Purity (content of CaSO ₄ .2H ₂ O)	>85% w/w					
Physical contaminants	<2 mm, upper limit 0.25, of which 0.12 is plastic (unit of % mass/mass of air dry sample)					
End uses	Agriculture				Plasterboard manufacture and other uses	
Chemical composition						
Soluble chloride	<0.1% w/w				<0.02% w/w	
Magnesium oxide (MgO)	n/a (see Note 3 below)				<0.2% w/w	
Sodium oxide (Na ₂ O)	<0.06% w/w				<0.06% w/w	
Colour	White, light grey or light beige, with no coloured particles					
Smell	Odourless/neutral					

NOTE 1 Purity: The remainder 15% allows for materials present within mined gypsum such as natural rock clays.

NOTE 2 Physical contaminants: Total glass, metal, plastic and any other non-stone fragments (excluding paper). Physical contaminants that are sharp, as defined in PAS 100, are unacceptable in any application where reprocessed gypsum is bagged or supplied for any use where it is handled without protective gloves.

NOTE 3 Chemical composition, MgO for agricultural use: Good practice guidance (for example DEFRA's Fertiliser Manual RB209 [4]) should be followed, since it is possible to apply too much magnesium.

NOTE 4 See Figures 3 and 4 for limits of particle size distribution for fine and coarse grade reprocessed gypsum.

Figure 3 – Limits of particle size distribution, fine grade reprocessed gypsum

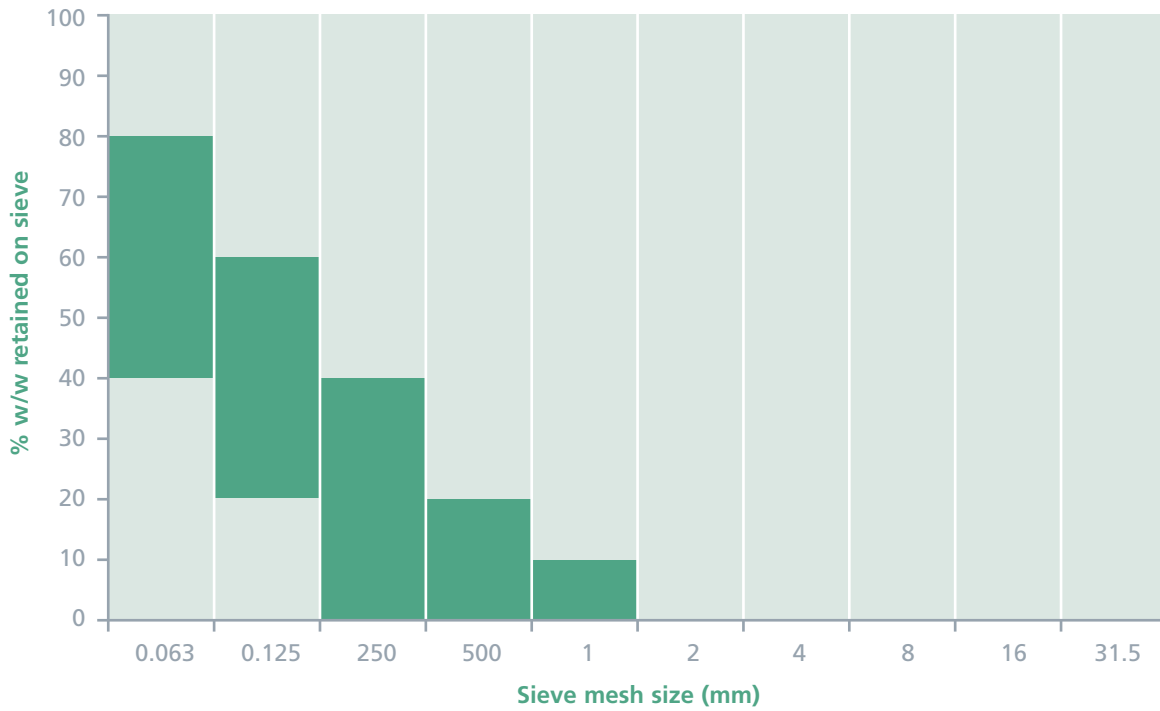
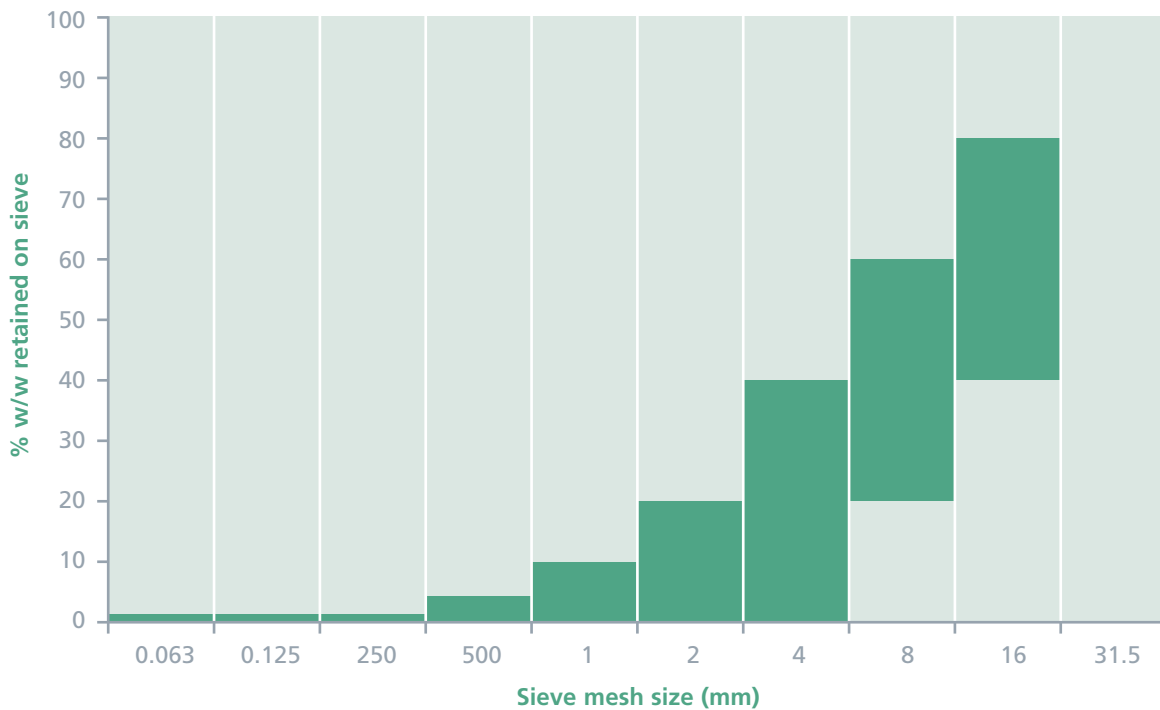


Figure 4 – Limits of particle size distribution, coarse grade reprocessed gypsum



8.1.2 Particle size distribution for custom grade reprocessed gypsum

8.1.2.1 The particle size distribution shall be commensurate with the requirements of the application and shall ensure the reprocessed gypsum is fit for that purpose.

NOTE Custom grade allows the reprocessor or material user to define the particle size distribution to suit particular use application(s).

8.1.2.2 The particle size distribution shall be specified in a similar form to those for the fine and coarse grade reprocessed gypsum in Table 1, i.e. a minimum and maximum weight retained on each sieve in the range 0.063 mm and 31.5 mm. This range is the minimum that shall be used.

8.2 Sampling and testing

8.2.1 General

8.2.1.1 The reprocessor shall make available all the facilities, equipment and trained personnel to carry out the required inspections, sampling and testing. These shall be detailed in the quality manual.

NOTE This does not preclude the use of third-party bodies, such as a consultant or testing laboratory.

8.2.1.2 The reprocessor shall prepare a schedule of sampling and test frequencies for each parameter in accordance with the minimum requirements specified in Table 2. This schedule shall be stated in the quality manual and the sampling and testing shall be carried out for each parameter in accordance with this schedule.

NOTE 1 The following circumstances can lead to a need to increase the frequencies of the inspections or testing:

- a) *if there are deviations in parameters in the visual inspections;*
- b) *when a measured value is close to a specified limit;*
or
- c) *contractual obligations between the reprocessor and material user.*

NOTE 2 See 4.2 regarding the triggers for re-validation.

8.2.1.3 The reprocessor shall identify and document all regulatory sampling and testing requirements relevant to the supply of the reprocessed gypsum into the intended applications and markets.

8.2.1.4 For reprocessed gypsum being supplied for application to land for agricultural benefit, the reprocessor shall determine with the material user who is responsible for arranging testing for toxic elements (sometimes referred to as "heavy metals") in the receiving soil. The outcome shall be recorded.

NOTE 1 The material user then uses the test data, and the existing levels in the intended host soil, to calculate the appropriate application rate to ensure safe levels in the soil are not exceeded

NOTE 2 For further information refer to the Codes of Good Agricultural Practice [5].

8.2.1.5 If the reprocessor is to provide the toxic element test data, the reprocessor shall ensure that the data provided to the material user is in a form that can be directly used in application rate calculations.

Table 2 – Minimum sampling and test frequencies, and relevant procedures

Parameter	Test type	Minimum test frequency		Test method
		Validation	Business as usual	
Particle size distribution	Visual	Per waste batch input to process	Once per working day	Annex D
	Measured	Once, during stable operation in accordance with SOPs	Once per 1,000 tonnes	BS EN 933-1:2012 (The test portion shall be dried at 45°C ± 2°C. Dry sieving shall be used and the procedure for washing specified in 7.1 of BS EN 933-1:2012 shall not be applied. <i>NOTE The oven temperature has been reduced from that stated in BS EN 933-1:2012 to ensure it is significantly below the temperature at which calcination of the gypsum would occur.</i>
Residual paper/fibres	Visual	Per waste batch input to process	Once per working day	Annex D
	Measured	Once, during stable operation in accordance with SOPs	Once per 1,000 tonnes	Annex E
Purity	Measured	Once, during stable operation in accordance with SOPs	Once per 1,000 tonnes	VGB-M701e gravimetric (as calcium oxalate) method for determination of gypsum content (degree of purity, R°), or other comparable analysis method
Physical contaminants	Visual	Per waste batch input to process	Once per working day	Annex D
	Measured	Once, during stable operation in accordance with SOPs	Once per 1,000 tonnes	Annex E
Chemical composition	Measured	Once, during stable operation in accordance with SOPs	Once per 1,000 tonnes	VGB-M701e photometric methods with atomic absorption spectroscopy (AAS), or other comparable analysis method
Colour	Visual	Per waste batch input to process	Once per working day	Annex D
Smell		Per waste batch input to process	Once per working day	Annex D

8.2.2 Equipment

8.2.2.1 The reprocessor's responsibility for the control, calibration, and maintenance of inspection, measuring and test equipment, in addition to the requirements of **4.5.3**, shall be stated in the quality manual.

8.2.2.2 The following aspects shall be defined in the quality manual:

- a) accuracy and frequency of calibration shall be in accordance with the equipment manufacturer's recommendations, applicable to the equipment's use in the context of this PAS;
- b) equipment shall be used within its defined limits of operation, in accordance with the manufacturer's instructions and the defined SOPs;
- c) equipment shall be uniquely identified;
- d) calibration records shall be retained, in accordance with **4.8**.

8.2.3 Sampling

8.2.3.1 The procedure described in Annex B for sampling the material as it is output from the final process and before it lands on the stockpile shall be used, as long as safe working conditions are ensured.

NOTE Obtaining a representative sample of reprocessed gypsum from a stockpile can be problematic as the larger and finer particles can separate as the stockpile is formed.

8.2.3.2 If the procedure in **8.2.3.1** cannot be used, then the procedure described in Annex C for sampling from a stockpile shall be used, with particular care taken to ensure the samples taken are representative of the entire stockpile.

8.2.3.3 If neither of the procedure described in **8.2.3.1** and **8.2.3.2** are feasible due to safe working considerations or the design of the reprocessing equipment, then another procedure shall be used as long as it meets the same objectives in ensuring a representative sample is obtained.

8.2.3.4 The sampling procedure used shall be detailed in a SOP and referenced in the quality manual.

8.2.4 Testing

8.2.4.1 The test procedures to be used shall be stated in SOPs and recorded in the quality manual.

NOTE Normative procedures are detailed in Annexes D and E, with their applicability to the parameters as stated in Table 2.

8.2.4.2 Any testing undertaken by an external testing laboratory shall be specified to ensure the results are directly comparable with the parameters in Table 1.

8.2.4.3 Following successful validation or re-validation (see **4.6**) demonstrating that the process consistently produces reprocessed gypsum meeting the specification for one or more of the material grades in Table 1, the reprocessed gypsum shall be granted the relevant grade designation and dispatched for use, which shall be communicated in the consignment documentation (see **10.2.1**).

8.2.4.4 The reprocessed gypsum shall continue to be designated the relevant grade while the testing at planned intervals demonstrates that it continues to meet the specification for that grade.

8.2.4.5 If from the validation, re-validation or testing at planned intervals, the reprocessed gypsum does not meet the specification for one of the material grades in Table 1 then the procedure of **8.3** for non-conforming material shall apply.

8.2.5 Reference sample

Following successful validation or re-validation, a 2 kg reference sample shall be retained from the bulk sample used in that testing. This reference sample shall:

- a) supersede any previous equivalent (same grade, process, etc.) reference sample;
- b) be stored in a clean, dry, impervious, resealable bag or container in a dark dry location at a temperature in the range from 5 °C to 15 °C;
- c) be labelled with:
 - 1) sampling date;
 - 2) unique sample number;
 - 3) reprocessed gypsum grade;
 - 4) particle size distribution if custom grade;
 - 5) batch number or other identification to enable it to be related to its source and relationship to the current process output; and
 - 6) name and signature of the sampler;
- d) be used in the periodic visual testing.

8.3 Non-conforming material

8.3.1 Following an inspection or test, which indicates that reprocessed gypsum produced does not meet one of the defined type specifications in Table 1, the affected material shall:

- a) not be designated as PAS 109 reprocessed gypsum, and any existing designation removed retrospectively to the last validation, re-validation or periodic test, which demonstrated that the reprocessed gypsum did meet the required grade specification in Table 1; and
- b) be kept physically separated from conforming material.

8.3.2 In instances where reprocessed gypsum already dispatched to a material user has its designation removed retrospectively, then the reprocessor shall notify the user that it no longer conforms to PAS 109, giving the reason for the designation being removed. The procedure for adequately notifying material users shall be defined in the quality manual.

NOTE This highlights the balance that should be made between the cost of frequent testing and what the quality assurance testing brings (which minimizes the potential impact on the business and customers).

8.3.3 All cases of non-conformity shall be recorded by the reprocessor, investigated and corrective action shall be taken.

NOTE Corrective actions can include:

- a) *investigation to the cause of non-conformity, including an examination of the testing procedures and making any necessary adjustments;*
- b) *analysis of processes, operations, quality records, service reports and customer complaints to detect and eliminate potential causes of non-conformity;*
- c) *applying controls to ensure that effective corrective actions are taken;*
- d) *implementing and recording changes in procedures resulting from corrective actions; and*
- e) *initiating preventive actions to deal with problems to a level corresponding to the risks encountered.*

8.3.4 If action can be taken on non-conforming material to bring into conformity under one of the defined specifications, the material shall then be re-sampled and tested in accordance with **8.2**, and evaluated against the relevant grade specification of Table 1.

NOTE If material is non-conforming due to contaminant levels, a preferable action is to reduce the levels by removing the contaminants, rather than by reducing their concentration by blending with cleaner material.

8.3.5 Following investigation and corrective action, the process, quality manual and SOPs shall be re-validated in accordance with **4.6**.

8.4 Material conformity

NOTE 1 Under 4.7 users of this PAS are advised of the desirability of a third-party audit to validate effective operation of the QMS and SOPs. This can provide assurance to the material user that the reprocessed gypsum has been produced in a defined and controlled way in accordance with this PAS. This is different to, and does not provide, certification of conformity of the material with PAS 109.

NOTE 2 Marking PAS 109:2013 on, or in relation to, a material represents a reprocessor's declaration of conformity, i.e. a claim by or on behalf of the reprocessor that the material meets the requirements of this PAS. The accuracy of the claim is therefore solely the responsibility of the person making the claim.

Such a declaration is different from third-party certification of conformity – a separate and optional third-party service which the reprocessor can employ, applying to some or all of the materials supplied. Third-party product certification is desirable, since it can provide further assurance to the material user since the material has been independently verified.

9 Material handling and storage

9.1 General

9.1.1 The choice of handling method, storage and packaging shall be made and recorded, with consideration of the means of dispatch and delivery to the material user, and their likely requirements for handling and using the material.

9.1.2 The reprocessed gypsum shall not become contaminated or degraded as a result of the choice of handling method, storage and packaging. It shall be kept dry and physically separated from other materials by being stored under cover in labelled, allocated compounds, containers or packaging separated by grade.

9.2 Loose material

9.2.1 Loose reprocessed gypsum shall be stored in hard storage bays, containers or silos.

NOTE For example, in storage bays constructed from concrete and/or metal.

9.2.2 In bays, the material shall be stored short of the full length and height of the bay to avoid spillage of the contents of the bay into adjacent bays.

NOTE 1 It is good practice for the material to be extracted from the middle of the bay, leaving the sides untouched, in order to avoid scrapings (of wood or concrete, for example) from the walls into the load.

NOTE 2 The ends of the bay walls should be protected with metal or timber posts to prevent damage from impact with vehicles.



9.2.3 Silos and the handling system shall be suitable for the physical characteristics of the reprocessed gypsum being stored.

NOTE The handling system can, for example, include pneumatic blowing.

9.2.4 If more than one grade of reprocessed gypsum is being produced and stored but a common system is being used for filling and emptying the silos, then measures shall be in place to ensure that the different grades cannot mix.

9.2.5 If reprocessed gypsum is being provided to the material user in loose form, measures shall be in place to ensure that it can be transferred to the delivery vehicle without contamination or water ingress.

9.3 Packaged material

The methods and materials used for packaging shall not contaminate or degrade the material, or allow it to become so.

NOTE 1 For example, packaging should be waterproof to prevent water ingress.

NOTE 2 For bulk bags and other similar open packaging, these can be made waterproof by wrapping with polyethylene shrink wrap.

NOTE 3 Packages, including bulk bags, should be stacked and secured on a pallet to facilitate handling, prevent damage, and prevent moisture ingress through the base.

NOTE 4 Reusable and sustainably sourced transit materials should be considered where possible.

NOTE 5 Reprocessors should satisfy themselves of their obligations under the Packaging (Essential Requirements) Regulations 2003 [6] and the Producer Responsibility Obligations (Packaging Waste) (Amendment) Regulations 2007 as amended [7] and The Producer Responsibility Obligations (Packaging Waste) (Amendment) Regulations (Northern Ireland) 2007 as amended [8].

10 Material dispatch

10.1 General

10.1.1 The reprocessor shall supply (see **10.2**), obtain and retain (see **10.3**) information necessary to demonstrate, when required, that reprocessed gypsum supplied is destined for appropriate use.

NOTE One method for the reprocessor to demonstrate this is to provide the material user with suitable contracts of supply for each consignment of reprocessed gypsum and retain copies of them. The reprocessor is not expected to make or retain contracts of supply when reprocessed gypsum is supplied for domestic use or is for the reprocessor's own use.

10.1.2 If the delivery is for domestic use or for the reprocessor's own use, the delivery shall still be accompanied by the information required by **10.2**.

10.1.3 If a delivery deviates from the customer's specification, the reprocessor shall inform the customer.

10.2 Labelling and marking

10.2.1 The following information about each purchase of PAS 109 reprocessed gypsum dispatched from the reprocessing facility shall be supplied to the material user:

- a) material grade, either:
 - 1) fine grade;
 - 2) coarse grade; or
 - 3) custom grade;
- b) for custom grade reprocessed gypsum, the particle size distribution;
- c) quantity (in kilograms);
- d) instructions for storage;
- e) guidelines and conditions for use;
- f) safety data sheet (SDS) warning about material misuse, risks when handling and safety advice or symbols, as appropriate;
- g) statement of conformity with this PAS: "Conforms to PAS 109:2013 (latest edition)";

NOTE See 8.4 for guidance on claims of conformity.
- h) information that enables traceability checks;

NOTE Examples of information that enables traceability checks are material batch code, date of bagging and dispatch records. The composite code (see Annex A) may be a useful method for describing in a standardized way the types and sources of input materials to the recycling process from which the reprocessed gypsum was produced.

- i) contact details of the reprocessor or any organization acting as reseller, either on behalf of the reprocessor or independently.

10.2.2 Consignment information shall be printed on the packaging or, for loose material, on a separate document.

10.3 Information to be obtained and recorded

10.3.1 Records shall be kept of all materials (including reprocessed gypsum, paper and wastes) leaving the reprocessing facility. For reprocessed gypsum, these records shall correspond to the contracts of supply (where used) issued to the material user.

10.3.2 The following details of the destination of the material shall be kept:

- a) date of dispatch;
- b) quantity (in kilograms), material grade(s) and batch code(s);
- c) name and address of receiving business/ establishment; and
- d) designated end market sector or use.

10.3.3 The procedure for obtaining required information shall be defined in the quality manual.

10.3.4 The information obtained shall be recorded in accordance with **4.8**.

10.3.5 The quality manual shall state who is responsible for obtaining and recording the information.

11 Traceability

11.1 A system of on-site materials identification and traceability that is appropriate to the reprocessing process and materials shall be detailed in the quality manual, and operated. Its efficacy, and record of any actions to modify this aspect of the QMS, shall be included in the management review.

11.2 The reprocessor shall identify materials and carry out operations such that materials are traceable from arrival on site as recycling process inputs to dispatch from the site, whether PAS 109 reprocessed gypsum or not.

***NOTE** This requirement applies whether or not the materials or non-conforming batches are used by the reprocessor, on behalf of the reprocessor, or by another party.*

11.3 Any material bagged off site by or on behalf of the reprocessor shall also be traceable.

11.4 Any rejected material, reprocessed batch, batch which has been partially processed then disposed of, or any such part batch, shall also be traceable.

11.5 During any period when storage space is restricted such that material batches are stored in one or more continuous piles, batches shall be deposited and marked such that:

- a) they remain separately identifiable; and
- b) when dispatched, information supplied about each consignment includes reference to the relevant batch(es).

11.6 The reprocessor shall make and retain records that enable traceability checks, in accordance with 4.8.



Annex A (informative) Composite code for describing plasterboard waste

The composite code is a system for describing the type, source, site and collection method of a waste plasterboard load. It is intended to standardize the description of plasterboard waste, which enables

plasterboard reprocessors to communicate clearly their acceptance criteria to potential suppliers, and facilitate comparing incoming waste with their acceptance criteria.

The composite code is formed from individual codes from Tables A.1 to A.4 presented in the following combined form:

TYPE CODE / SOURCE CODE / SITE CODE / COLLECTION CODE / DETAIL [if Source Code O]



Table A.1 – Type code

Type	Example	Type code
“Standard” gypsum plasterboard		A
Gypsum plasterboard with reduced water absorption rate		H
Gypsum sheathing board (used in external walls, and has a reduced water absorption rate)		E
Gypsum plasterboard with improved core adhesion at high temperature		F
Gypsum baseboard		P
Gypsum plasterboard with controlled density		D
Gypsum plasterboard with enhanced strength		R
Gypsum plasterboard with enhanced surface hardness		I
Gypsum plasterboard with thin laminations (paper)	With non-vinyl wall paper covering	X
Gypsum plasterboard with thin laminations (non-paper)	Lamination of metal or plastic foil to increase vapour resistance	Y
Gypsum plasterboard with other materials bonded to the surface	Composite board of plasterboard with mineral fibre bonded to one face	Z
Gypsum board with mat reinforcement		GM
Gypsum fibre board		GF
Gypsum plasterboard from reprocessing		GR
Gypsum plasterboard laminated with thermal insulation		TL
Preformed plasterboard cornice		C
Unknown or mixed	If the type(s) of plasterboard cannot be identified with any certainty	U

NOTE 1 The type codes are defined in BS EN 520:2004+A1:2009, with the exception of type codes X, Y, Z, GM, GF, C and U. “Thin laminations” used in Types X and Y are defined in BS EN 14190:2005 as “material applied to one or more surfaces to impart decoration or functional properties”. Type codes GM and GF are defined in BS EN 15283-1:2008+A1:2009 and BS EN 15283-2:2008+A1:2009.

If a waste load contains material of more than one of the types identified in Table A.1, then codes should be joined by a hyphen ‘ - ’.

NOTE 2 If the load contains a large number of different types of plasterboard then type code U may be used.

Table A.2 – Source code

Source	Example	Source code
Production waste from plasterboard manufacturing	Out-of-specification board, board damaged during packaging	P
Damaged or unused plasterboard from distributors and retailers		D
Fit-out waste from plasterboard installation	Offcuts, boards damaged or unused on site	F
Strip-out waste from plasterboard removal		R
Other sources		O A description of the source should be appended to the end of the composite code

If a waste load contains material from more than one of the sources identified in Table A.2, then codes should be joined by a hyphen ' - '.

Table A.3 – Site code

Site	Example	Site code
Single site of origin	A construction site sending its waste plasterboard directly to the reprocessor	S
Multiple sites of origin	A waste transfer station bulking waste plasterboard from multiple construction sites before sending to the reprocessor	M

Table A.4 – Collection code

Collection method	Example	Collection code
Separated at source	A demolition site putting waste plasterboard into a dedicated skip, with no other materials	S
Processed from mixed waste	A materials recycling facility processing mixed construction and demolition waste into its constituent materials for separate recycling	P

NOTE 3 Examples of composite codes:

- Example 1* A load of production waste from a production run of standard plasterboard at a single plasterboard manufacturing plant. A / P / S / S
- Example 2* A project refurbishing an office kitchen area, stripping out vinyl wallpaper covered plasterboard partitions and re-fitting partitions with moisture resistant plasterboard. The waste is being put in a dedicated skip and sent directly to the reprocessor. HZ / F-R / S / S
- Example 3* A skip company processing mixed construction and demolition waste, separating and bulking the plasterboard before sending to the reprocessor. The type of plasterboard varies widely and cannot be determined within each load. U / F-R / M / P

Annex B (normative)

Procedure for sampling, from the process output

B.1 Principle

A bulk sample is collected as it is output from the process and then reduced to appropriately sized test samples.

This procedure shall only be used if safe working conditions can be ensured.

B.2 Apparatus

B.2.1 *Container*, minimum 10 litres capacity, clean, dry and non absorbent, such as a plastic bucket, for collecting the bulk sample.

B.2.2 *Balances(s)*, calibrated and accurate to within 0.1% of the initial or maximum test sample.

B.2.3 *Containers*, clean, dry, impervious, and sealable, such as clear bags made of plastic at least 100 µm thick or lidded plastic containers, for sending samples to laboratories and storing samples.

B.2.4 *Disposable dust mask, eye protection.*

B.3 Procedure

NOTE *Personal protective equipment should be worn during this procedure.*

B.3.1 Collect a bulk sample of at least 4 kg as the reprocessed gypsum is output from the process equipment and before it lands on a pile, using a suitable container (**B.2.1**), ensuring that the sample is representative of the process output.

B.3.2 Place the bulk sample on a dry, clean non-absorbent surface, located out of direct sunlight or draughts, where material will not be lost, foreign material will not be introduced, and the material will not dry out or become damp.

B.3.3 Thoroughly mix the bulk sample.

B.3.4 Determine the required testing sample weight, based on the test(s) to be conducted.

B.3.5 Weigh out (**B.2.2**) each test sample and place in a suitable container (**B.2.3**). Record the weight of the test samples. Label (**B.4.2**) the test samples and the remainder of the bulk sample.

B.4 Labelling of samples

B.4.1 Store the retained portion of the bulk sample in suitable containers (**B.2.3**).

B.4.2 Label each sample with the following:

- a) date;
- b) batch reference number;
- c) grade of reprocessed gypsum;
- d) additional description if required;
- e) unique test sample number;
- f) sample weight; and
- g) name and signature of the sampler.

Annex C (normative)

Alternative procedure for sampling, from a stockpile

C.1 Principle

Bulk samples are collected from within the material stockpile, mixed to form a single homogenous bulk sample, and then reduced to appropriately sized test samples.

This procedure shall only be used if safe working conditions can be ensured.

C.2 Apparatus

C.2.1 *Long-handled scoop, shovel, or sampling spear.*

C.2.2 *Containers, clean, dry and non absorbent, such as plastic buckets, for collecting the bulk samples.*

C.2.3 *Balances(s), calibrated and accurate to within 0.1% of the initial or maximum test sample.*

C.2.4 *Containers, clean, dry, impervious, and sealable, such as clear bags made of plastic at least 100 µm thick or lidded plastic containers, for sending samples to laboratories and storing samples.*

C.2.5 *Disposable dust mask, eye protection.*

C.3 Procedure

NOTE *Personal protective equipment should be worn during this procedure.*

C.3.1 Collect a bulk sample of at least 2 kg by plunging the scoop (C.2.1) into the stockpile, extracting gypsum from at least 10 cm below the surface of the stockpile, and place it in a suitable container (C.2.2), ensuring that the sample is representative of the load.

NOTE *The samples are taken below the surface of the stockpile to avoid material on the surface which may have separated into patches of fine and coarse particles.*

C.3.2 Repeat C.3.1 two more times in different places roughly equally across the stockpile, placing each in a different container (C.2.2), so three samples in total are obtained.

C.3.3 Place the three bulk samples on a dry, clean non-absorbent surface, located out of direct sunlight or draughts, where material will not be lost, foreign material will not be introduced, and the material will not dry out or become damp.

C.3.4 Thoroughly mix the bulk samples to create one homogenous bulk sample.

C.3.5 Determine the required testing sample weight, based on the test(s) to be conducted.

C.3.6 Weigh out (C.2.3) each test sample and place in a suitable container (C.2.4). Record the weight of the test samples. Label (C.4.2) the test samples and the remainder of the bulk sample.

C.4 Labelling and storage of samples

C.4.1 Store the retained portion of the bulk sample in suitable containers (C.2.4).

C.4.2 Label each sample with the sampling date, unique sample reference number, batch reference number or other identification to enable it to be related to its source, grade of reprocessed gypsum, additional description if required, and name and signature of the sampler.

Annex D (normative)

Procedure for visual inspection of reprocessed gypsum

D.1 Principle

A test sample of reprocessed gypsum and the equivalent reference sample are spread out in separate trays. For the parameters in Table 2, the test sample is compared against the relevant grade specification in Table 1 using the reference sample as a guide.

D.2 Apparatus

D.2.1 *Test sample*, 2 kg.

D.2.2 *Tray*, 2 of, 500 × 500 mm (approx.), with raised sides 25 mm high (approx.), rigid, white or black single colour (both trays shall be of the same colour), clean, dry and non absorbent.

NOTE *Horticultural gravel trays may be suitable.*

D.2.3 *Reference sample*, 2 kg.

D.2.4 *Magnifying glass or eyepiece*, handheld, approx. 2.5 to 4 times magnification.

D.2.5 *Disposable dust mask*.

D.3 Procedure

NOTE *Suitable personal protective equipment should be worn during this procedure.*

D.3.1 General

D.3.1.1 This procedure shall be undertaken in a location out of direct sunlight or draughts, where material will not be lost, foreign material will not be introduced, and the material will not dry out or become damp.

D.3.1.2 Empty the test sample (D.2.1) from its container into one of the trays (D.2.2), and spread to form a thin even layer.

D.3.1.3 Empty the reference sample (D.2.3) from its container into the other tray (D.2.2), and spread to form a thin even layer. Place the two trays side by side to enable comparison.

D.3.1.4 Undertake the visual inspections as detailed in D.3.2 to D.3.6.

D.3.1.5 Record the results of the tests on a test data sheet in accordance with 4.8.

D.3.1.6 Immediately upon completing the tests, return the test sample to its container, and the reference sample to its container, taking care to ensure neither sample becomes contaminated or suffers loss of material.

D.3.2 Particle size distribution

Visually compare the particle size distribution of the test sample with the reference sample. If they appear similar then the result shall be a pass; if they are not similar and the particle size distribution of the test sample appears to be outside the required grade specification in Table 1 then the result shall be a fail.

D.3.3 Residual paper/fibres

Visually compare the residual paper/fibre content of the test sample with the reference sample, and with the specification in Table 1. If the test sample appears to meet the specification, using the reference sample as a guide (for example, the test sample contains less paper/fibre and/or of smaller dimension), then the result shall be a pass; otherwise the result shall be a fail.

D.3.4 Physical contaminants

Visually compare the quantity of physical contaminants in the test sample with those in the reference sample, and with the specification in Table 1. This may be assisted by using the magnifying glass/eyepiece (D.2.4). If the test sample appears to meet the specification, using the reference sample as a guide (for example, the test sample contains no visible contaminants), then the result shall be a pass; otherwise the result shall be a fail.

D.3.5 Colour

Visually compare the colour of the test sample with the reference sample, and with the specification in Table 1. If the test sample meets the specification in Table 1 and is no darker than the reference sample then the result shall be a pass; otherwise the result shall be a fail.

D.3.6 Smell

Smell the test sample, taking care not to inhale any particles, and compare with the specification in Table 1. If the test sample meets the specification in Table 1 and does not have any perceptible unusual odours (for example, from contamination by solvents) then the result shall be a pass; otherwise the result shall be a fail.

Annex E (normative)

Determination of paper/fibre content and physical contamination level of the material

E.1 Principle

An air-dried test sample is weighed and the mass recorded. The sample is spread onto a clean flat surface and any paper pieces and fibres, and physical contaminants, separated out by hand. The mass of each group is measured and expressed individually as a proportion of the original sample mass.

NOTE "Air-dried" refers to reprocessed gypsum conditioned to ambient temperature and humidity. Samples are usually dried at less than 30°C, to avoid loss of waters of crystallization, until they feel dry to the touch.

E.2 Apparatus

E.2.1 Dish or beaker, clean and dry, of sufficient size to contain 2 kg sample of gypsum without spillage.

E.2.2 Balance(s), calibrated, capable of measuring a sample of 2 kg and its container, and accurate to 0.1 g.

E.2.3 Test sample, 2 kg, air dried.

E.2.4 Tray, 500 x 500 mm (approx.), with raised sides 25 mm high (approx.), rigid, white or black single colour, clean, dry and non absorbent.

NOTE A horticultural gravel tray may be suitable.

E.2.5 Small saucer or beaker, clean and dry.

E.2.6 Tweezers.

E.2.7 Magnifying glass or eyepiece, handheld, approx 2.5 to 4 times magnification.

E.2.8 Disposable dust mask.

E.3 Procedure

NOTE Personal protective equipment should be worn during this procedure.

E.3.1 This procedure shall be undertaken in a location out of direct sunlight or draughts, where material will not be lost, foreign material will not be introduced, and the material will not become damp.

E.3.2 Place the dish (E.2.1) on the balance (E.2.2), zero the balance, gently empty the test sample (E.2.3) into the dish, and record its mass as M_s .

E.3.3 Remove the dish from the balance, gently empty the test sample into the tray (E.2.4), and spread to form a thin even layer.

E.3.4 Place the saucer (E.2.5) on the balance, and zero the balance.

E.3.5 Using the tweezers (E.2.6), and the magnifying glass/eyepiece (E.2.7) if necessary, remove from the test sample all visible traces of physical contaminants (such as glass, plastic, and metal items), place them in the saucer on the balance, and when all traces have been removed record the mass as M_c . Repeat this step to determine plastic contaminant content.

E.3.6 Record a mass less than 1 g as trace.

E.3.7 Using the tweezers (E.2.6), and the magnifying glass/eyepiece (E.2.7) if necessary, remove from the test sample as far as practicable all traces of paper and fibres, place them in the saucer on the balance, and when all traces have been removed record the mass as M_p .

E.3.8 Upon completing the test, return the test sample (including the contaminants) to its container taking care to ensure the sample does not become contaminated or suffers loss of material.

E.4 Calculations

E.4.1 Record the various masses on a test data sheet, in accordance with 4.8.

E.4.2 Calculate the mass of the paper/fibre as a percentage P_p of the total mass of the sample in accordance with the following equation.

Fraction mass %

$$P_p = \frac{M_p}{M_s} \times 100$$

E.4.3 Calculate the mass of the physical contaminant fraction as a percentage P_c of the total mass of the sample in accordance with the following equation.

Fraction mass %

$$P_c = \frac{M_c}{M_s} \times 100$$

E.4.4 Record the calculated percentages on the test data sheet alongside the corresponding contaminant fraction type to the nearest 0.10%.

E.5 Test report

The test report shall include the following information, as a minimum:

- a) reference to this PAS 109;
- b) identification of the test sample;
- c) identification of the test laboratory;
- d) sample reception date;
- e) analysis date;
- f) method of analysis;
- g) the measured masses and the calculated percentages; and
- h) details of any deviation from the specified procedure.



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