
**Ships and marine technology —
Measures to prevent asbestos emission
and exposure during ship recycling**

*Navire et technologie maritime — Mesures préventives concernant
l'émission et l'exposition à l'amiante lors du recyclage des navires*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 30007 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*.

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Ships and marine technology — Measures to prevent asbestos emission and exposure during ship recycling

1 Scope

This International Standard provides effective methods for minimizing the dangers of asbestos during ship recycling, reducing both the release of asbestos into the environment and worker exposure to asbestos. It helps ship recyclers to fulfil the requirements of *The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships*, 2009^[5].

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1

asbestos

variety of fibrous silicate minerals, namely actinolite asbestos, amosite, anthophyllite asbestos, chrysotile, crocidolite and tremolite asbestos

2.2

asbestos-containing material

ACM

material containing more than one percent asbestos or defined material regulated by national rule

2.3

clean room

uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment

2.4

competent person

person capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure and who has the authority to take prompt corrective measures to eliminate them

NOTE The competent person will have appropriate training, certification and/or license that meets the requirements of national legislation for the specific tasks undertaken.

2.5

decontamination zone

enclosed area adjacent and connected to asbestos-removal area and consisting of an equipment room (change room), shower area and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos

2.6

equipment room

change room

contaminated room located within the decontamination zone that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment

2.7

high-efficiency particulate air filter

HEPA filter

filter capable of trapping and retaining around at least 99,97 % of all mono-dispersed particles of 0,3 µm in diameter

2.8

ship recycling

activity of complete or partial dismantling of a ship at a ship recycling facility in order to recover components and materials for reprocessing and reuse or for disposal, including processing hazardous and other materials, and their associated operations such as storage and treatment of components and materials on site, but not their further processing or disposal in separate facilities

2.9

inventory

inventory of hazardous materials

NOTE The inventory is a requirement for recycling ships that is specified by *The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships*, 2009.

[ISO 30006:2010, definition 3.2]

2.10

wetting agent

water, or water to which surfactant has been added (to increase the ability of the liquid to penetrate), that is applied to ACM to suppress dust emission during removal

3 Work categorization (grade) to minimize asbestos emissions and exposure during ship recycling

In order to minimize the generation of asbestos dust and potential worker exposure during ship recycling operations, the ship recycling facility's competent person shall determine the appropriate work grade in accordance with Table 1, and shall determine corresponding working procedures in accordance with the methodologies given in Table 2.

Since the difficulty of performing a task can be estimated by the type and manner of use of ACM, three work grades have been established accordingly. See Table 1.

Table 1 — Work grading

Work grade	Description
1	Work for removal of sprayed-on asbestos, which requires strict measures to minimize emission of asbestos to environment and exposure of worker to asbestos such as thermal system insulation or surfacing ACM
2	Work for removal of ACM except sprayed-on asbestos for thermal insulation for main and auxiliary engines, thermal insulation for other pipes and armouring materials subjected to heat
3	Work for removal of ACM except sprayed-on asbestos used in accommodation and service spaces; walls (ceilings, floorings and linings) and moulded seal materials for devices or piping (joint sheets, gaskets, gland packing, packing and linings) ^a
As factors such as workload, the working environment, and methodologies may vary, the competent person shall periodically review tasks for asbestos abatement both before and during operations to determine if the work grade should be amended.	
The user shall ensure compliance with the national requirements.	
^a When ACM is cut by power-tool, the work shall be categorized in work grade 2.	

4 Preliminary check for asbestos-containing materials

In order to determine whether asbestos is used in the ship on which work is to be performed, the competent person shall check

- the inventory, and
- the related documents and diagrams.

Equipment, systems or areas that are specified as free of asbestos need not be handled in the same way as ACMs.

5 Planning removal of ACM

5.1 General

Prior to removal of ACM, a written plan in accordance with 5.2 to 5.7 shall be made.

5.2 Operational overview

The operational overview shall specify the title of the operation, work period, details of the operation (separately by area) and layout of work site indicated on the plan of the ship.

The overview shall specify the equipment, system or areas in which ACMs are used (based on the check specified in Clause 4) and the work procedure summary for removal of ACM for each work grade. Additionally, a layout for the removal zone shall be made giving dimensions and the precise location of work sites and decontamination zones (in the case of work grade 1), negative-pressure dust collectors (in the case of work grade 1) and the asbestos-containing waste storage.

The user shall ensure compliance with the national requirements.

Regardless of the work grade, removal of asbestos-containing material should be conducted, to the maximum extent practicable, prior to the removal of other hazardous materials or deconstruction of the vessel itself.

5.3 Organizational chart for managing asbestos removal

An organizational chart to manage asbestos removal shall be made. Especially when directly engaged in ACM removal operations, the employer should attach the document of authorization to perform ACM removal to the chart if necessary.

Documents showing that workers have completed the necessary training and have undergone medical checkups for the specified operations shall be attached to the organizational chart.

5.4 Operating schedule

For items related to the operating schedule, see the removal procedure specified in Clause 6. The schedule should indicate the number of days required for each operation.

5.5 Removal written plan

5.5.1 General

The removal written plan shall provide information in accordance with the removal procedure specified in Clause 6, in addition to the information required by 5.5.2 and 5.5.3.

5.5.2 Equipment, tools and protective measures

The written plan shall contain a list of equipment and tools needed for removal.

The list shall specify the types and quantities of personal protective equipment required for each job (or task) performed, including but not limited to respirators and protective clothing.

The manufacturers, product names and quantities of wetting agent shall be specified.

5.5.3 Layout of the decontamination zone

The written plan shall incorporate a layout and structural diagram of the decontamination zone [equipment room (change room), shower area, and clean room] and other illustrations that illustrate operational specifics, such as the location of the negative-pressure dust collector.

5.6 Asbestos-monitoring plan

If asbestos monitoring (atmosphere, working environment, water, and soil) is required in accordance with national law, there shall be a written plan to specify measuring cycles, locations, methods and designated persons or organization.

5.7 Waste disposal plan

The waste disposal plan shall specify methods for storage, transport, and final disposal of removed ACM. The plan shall also specify the estimated quantity of the ACM wastes.

6 Work procedures for each work grade

6.1 General

Operations for each grade shall be performed in accordance with the procedures specified in Table 2. For additional information see 6.2 to 6.4.

6.2 Work grade 1

6.2.1 General

Asbestos-removal operations of work grade 1 shall be carried out as specified in 6.2.2 to 6.2.7.

6.2.2 Preparation for work

6.2.2.1 General

Preparation of tools, material and equipment shall be conducted in accordance with the asbestos-removal plan specified in Clause 5, before starting the asbestos-removal operation.

Table 2 — Work procedure for each work grade

	Work grade 1	Work grade 2	Work grade 3
Work plan	Draw up plan for removal of ACM ^a		
Competent person	Competent person shall be assigned as supervisor		
Special training	Provide workers with special asbestos training ^b		
Protective equipment	Powered air-purifying respirator or full face piece respirators with particulate filter (solid particle collecting efficiency shall be at least 99,9 %) (if possible, pressure-demand-type combination air-line mask respirator) Protective gloves Protective clothing Protective footwear	Same as for work grade 1, or half-mask respirators with particulate filter (solid particle collecting efficiency shall be at least 99,0 %) can be used for removal without cutting and breaking asbestos thermal insulations Goggles Protective gloves Protective clothing Protective footwear	Same as for work grade 2, or half-mask respirators with particulate filter (solid particle collecting efficiency shall be at least 95,0 %) Goggles Protective gloves Working clothing
Emission prevention	Same as for work grade 2	Same as for work grade 3 and in addition the following: Prepare work area: remove all non-fixed items before starting work Isolate the work site with plastic sheeting or any other physical barrier ^c Install a negative-pressure dust collector (in work site) Set up decontamination zone A small project, such as the removal of a small section with asbestos insulation, may be worked by using a glove bag without isolation with plastic sheeting	Post signs, e.g. "KEEP OUT — ASBESTOS HAZARD" Use a vacuum cleaner incorporating a HEPA filter Sealed disposal container for waste
During/after work	Same as for work grade 2	Saturate and/or solidify materials with wetting agent (dust suppressants) Evaluate/measure the working environment Place waste in the specified sealed disposal container and store in an interim waste storage area Clean up the work site Dispose of or wash protectors used by workers Create work records and maintain on file	Saturate materials with wetting agent (dust suppressants); if moulded products containing asbestos must be crushed, cut, or ground during removal, wetting agent shall be used Clean up the work site Dispose of or wash protectors used by workers Draw up work records and maintain on file
Waste disposal	Disposal and washing of waste varies with material; ACM and objects contaminated with asbestos shall be disposed of in accordance with the laws and regulations allowable within the country in which the work is performed.		
Remark	To carry out work on piping and machinery insulated with asbestos materials, the procedure provided in 6.5 shall be taken into consideration.		

^a A simplified plan can be acceptable for grade 3.

^b The training course is different for each work grade. Refer to 6.2 to 6.4 for the details of training to carry out.

^c The physical barrier (plastic sheeting) shall be sufficiently designed and placed to prevent migration of airborne asbestos fibres.

6.2.2.2 Establishment of supervising organization of removal of asbestos

a) Assignment of person responsible

- The competent person shall be assigned as supervisor.

b) Establishment of organization for removal of asbestos

- The organization for removal of asbestos under the supervision of the competent person shall be established.

c) The competent person shall ensure the following.

- The workers are correctly wearing appropriate protective equipment.
- The dust collectors are working correctly.
- There is no damage or opening of the isolating sheet.
- The air pressure of the asbestos-removal area is negative relative to the outside air pressure.
- The workers have received relevant education and training and have had an appropriate medical evaluation.
- The equipment and work area are monitored at appropriate intervals to ensure that the work environment and procedures, as described above, remain satisfactory.

6.2.2.3 Preliminary education and training for workers

If the workers have not received education and training specific to asbestos, such training shall be carried out prior to commencing asbestos removal work.

The contents of the education and training specific to asbestos include

- awareness of the harmful effects of asbestos,
- methods of suppressing scattering of asbestos particles,
- methods of use of protective equipment and training on wearing them,
- emergency procedures,
- regulations concerned, and
- methods of handling waste.

The level of training and education received shall be commensurate with the job duties of the worker.

All workers shall be trained in a language that they understand.

An examination should be conducted to ensure that workers have effectively understood and retained the training.

6.2.2.4 Preparations for protective equipment

Appropriate protective equipment shall be provided.

The respiratory protective equipment shall be a powered air-purifying respirator or full face piece respirators with particulate filter (solid particle collecting efficiency shall be at least 99,9 %), and pressure-demand-type combination air-line mask respirators.

Protective clothing, protective gloves and overshoes covering footwear shall be constructed of materials to which asbestos particles do not easily adhere, and shall be disposable.

Protective footwear should be of a type that is easily decontaminated.

It is necessary to seal with tape any gaps between the respirators and clothing, between gloves and clothing, and between overshoes and clothing.

Protective clothing should be of Type 5 (ISO 13982-1) or equivalent.

Powered air purifying respirators should be compliant with EN 12941 or equivalent.

6.2.2.5 Preparation and installation of equipment to prevent scattering

6.2.2.5.1 Isolation

Prepare work area by removing all non-fixed items before starting work.

The area for removal of asbestos shall be isolated by an isolating sheet or any other physical barrier to prevent asbestos from leaking to the outside. The floor of the area shall be covered with a double layer of the isolating sheet, and the wall and ceiling of the area shall be covered with a single layer of the isolating sheet. The joints of the isolating sheet shall be tightly closed in order not to allow asbestos to migrate from the joint. The isolating sheet shall be impermeable and have sufficient strength, and shall not be easily damaged or broken.

The integrity of the isolated area needs to be checked.

A small project, such as the removal of a small section with asbestos insulation, may be carried out by using a glove bag without isolation with plastic sheeting.

6.2.2.5.2 Establishment of decontamination zone

The decontamination zone shall be established adjacent and connected to the asbestos-removal area.

Install extraction ventilation in the decontamination zone with air flow direction from the clean room to the equipment room.

An equipment room (change room) shall be supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

A shower area shall have a water shower or air shower.

The clean room shall have facilities for the storage of employees' street clothing and uncontaminated materials and equipment. It is, typically, also adjacent and connected to the decontamination zone.

6.2.2.5.3 Installation of negative-pressure dust collector

The negative-pressure dust collector shall be installed in order for the asbestos-removal area to be kept at negative atmospheric pressure relative to the outside and to reduce the concentration of asbestos particles in the asbestos-removal area. The dust collector shall be able to ventilate the working area volume at least four times per hour or at a rate in accordance with national regulations applicable to asbestos-removal areas. The dust collector shall be installed taking into account the dwell of air inside the asbestos-removal area.

The dust collector shall be able to collect more than 99,97 % of asbestos particles and be equipped with a HEPA filter.

The opening of the suction duct of the dust collector used for the asbestos-removal area should be located away from the (outside) air-intake opening in order to prevent contaminated air inside the asbestos-removal area.

6.2.2.5.4 Installation of vacuum cleaners with HEPA filters

One vacuum cleaner with HEPA filter shall be installed in each equipment room and asbestos-removal area.

The vacuum cleaner with HEPA filter for the equipment room shall be used to clean clothes and protective equipment for workers.

The vacuum cleaner with HEPA filter for the asbestos-removal area shall be used for the cleaning thereof.

A vacuum cleaner with HEPA filter shall be available in the decontamination zone to clean the clothes and protective equipment of workers and any waste sacks that are removed from the isolating enclosure.

6.2.2.5.5 Wetting agents and their application

Wetting agents shall be prepared according to the type of materials to be removed. Wetting agents shall not contain harmful substances such as volatile organic compounds (VOCs).

A sprayer shall be used to apply wetting agent to the surface of the material. Where possible, controlled pressure injection of wetting agents directly into the bulk of the ACM should be used.

6.2.2.5.6 Installation of signboard and notice board

Signboard and notice boards shall be prepared and set up at relevant places close to the asbestos-removal area to inform persons not involved in asbestos-removal operations that such operations are being conducted and a danger of scattering of asbestos exists.

The signs and method of noticing could be for example "KEEP OUT — ASBESTOS HAZARD", and shall comply with relevant national or local regulations.

6.2.2.5.7 Tools for removal of asbestos

Hand tools suitable for removal of asbestos include shovels, rakes and wipes. Tools operated by electricity or pressurized air shall not be used.

6.2.2.5.8 Storage facility for waste containing asbestos

A facility to store waste containing asbestos shall be prepared. Signs or notices to indicate the nature of the facility shall be installed in proximity, and measures to prevent asbestos from scattering out from the storage facility shall be taken.

6.2.3 Asbestos-removal operations

Asbestos-removal operations shall be carried out as follows.

- a) Protective equipment shall be worn prior to entering the asbestos-removal area.
- b) Start operation of the negative-pressure dust collector.
- c) Controlled pressure injection or sprayed application of wetting agent to the ACM to be removed.
- d) Remove asbestos with removal tools (hand tools). Care shall be taken to prevent asbestos particles from leaking during the removal operation.
- e) Visual checks shall be conducted to ensure that all asbestos has been removed. If asbestos remains, continue the removal work.
- f) After removal has ceased, the negative-pressure device shall be kept in operation for at least one hour.

- g) The negative-pressure device shall be kept in operation for at least one hour at the end of every working day.
- h) The asbestos-removal area shall be cleaned using a vacuum cleaner with HEPA filter when the removal work is finished or before all the workers leave from the asbestos-removal area.
- i) Removed asbestos should be placed promptly into waste bags; loose waste should not be left to accumulate. During removal there should be frequent cleaning up, with a thorough clean up at the end of the shift.

6.2.4 Monitoring of asbestos particles

Monitoring of asbestos particles shall be conducted in accordance with national regulations. Monitoring should be done upon completion of the project to ensure that no airborne asbestos fibres remain.

6.2.5 Post-treatment

After asbestos removal is complete, post-treatment operations shall be carried out as follows.

- a) Spray wetting agent onto the areas where asbestos has been removed.
- b) Spray wetting agent onto isolating sheets.
- c) Remove isolating sheets.
- d) Clean asbestos-removal area with vacuum cleaners with HEPA filters.

6.2.6 Disposal of waste containing asbestos

Disposal of waste containing asbestos shall be carried out as follows.

- a) Each item containing asbestos (wastes, isolating sheets, protective mask respirators, dust filters, gloves, footwear and protective clothing) shall be recorded in the log of asbestos-removal operations. The items shall be disposed of in accordance with national regulations. Unless specifically prohibited, these items shall be placed in sealable containers (bags) designed for waste disposal to prevent asbestos particles from scattering during temporary storage and transportation.
- b) Clean the surface of sealable containers (bags) for disposable wastes using vacuum cleaners with HEPA filters and place the containers in other sealable waste bags; this shall be done in the equipment room.
- c) The doubled sealable containers (bags) for disposable wastes shall be transferred to a storage facility via the shower area and clean room.
- d) The waste containing asbestos shall be disposed of in accordance with the national regulations of the country concerned.

6.2.7 Production and storage of reports for completion of work

After completion of the asbestos-removal operation, the competent person shall make a report of the operation and store it for such period as required by national regulation.

NOTE Compliance with national regulations might require storing the report for a period of 30 to 40 years so as to take into account the long incubation period of the health hazards posed by asbestos.

As a minimum, the report shall contain

- the names of workers involved,
- the amount of removed asbestos and ACMs,
- the location and period of storage of removed asbestos and ACMs, and
- the report of the medical evaluation of the workers.

If an asbestos exposure accident occurs, the worker information and the outline of the accident shall be recorded.

6.3 Work grade 2

6.3.1 General

Asbestos-removal operations of work grade 1 shall be carried out as specified in 6.3.2 to 6.3.7.

6.3.2 Preparation for work

6.3.2.1 General

Preparation of tools, material and equipment shall be conducted in accordance with the asbestos-removal plan specified in Clause 5, before starting the asbestos-removal operation.

6.3.2.2 Establishment of supervising organization of removal of asbestos

Subclause 6.2.2.2 applies.

6.3.2.3 Preliminary education and training for workers

Subclause 6.2.2.3 applies.

6.3.2.4 Preparations for protective equipment

Appropriate protective equipment shall be provided.

In the case of half-mask respirators, protective equipment shall be as specified in 6.2.2.4. Alternatively, a half-mask respirator with particulate filter (solid particle collecting efficiency shall be at least 99,0 %) and goggles may be used.

It is necessary to ensure that the respiratory protective equipment fits the workers correctly.

Protective clothing, protective gloves and overshoes covering footwear shall be constructed of materials to which asbestos particles do not easily adhere, and shall be disposable.

Protective footwear should be of a type that is easily decontaminated.

It is necessary to seal with tape any gaps between the mask respirators and clothing, between gloves and clothing, and between overshoes and clothing.

Protective clothing should be of Type 5 (ISO 13982-1) or equivalent.

Half-mask respirators should be compliant with EN 140 or equivalent and fitted with a P3 filter.

6.3.2.5 Preparation and installation of equipment to prevent scattering

6.3.2.5.1 Isolation

Subclause 6.2.2.5.1 applies.

6.3.2.5.2 Establishment of decontamination zone

Subclause 6.2.2.5.2 applies.

6.3.2.5.3 Installation of negative-pressure dust collector

Subclause 6.2.2.5.3 applies.

6.3.2.5.4 Installation of vacuum cleaners with HEPA filters

Subclause 6.2.2.5.4 applies.

6.3.2.5.5 Wetting agents and their application

Subclause 6.2.2.5.5 applies.

6.3.2.5.6 Installation of signboard and notice board

Subclause 6.2.2.5.6 applies.

6.3.2.5.7 Tools for removal of asbestos

Subclause 6.2.2.5.7 applies.

6.3.2.5.8 Storage facility for waste containing asbestos

Subclause 6.2.2.5.8 applies.

6.3.3 Asbestos-removal operation

Subclause 6.2.3 applies.

6.3.4 Monitoring of asbestos particles

Subclause 6.2.4 applies.

6.3.5 Post-treatment

Subclause 6.2.5 applies.

6.3.6 Disposal of waste containing asbestos

Subclause 6.2.6 applies.

6.3.7 Production and storage of reports for completion of work

Subclause 6.2.7 applies.

6.4 Work grade 3

6.4.1 General

Asbestos-removal operations of work grade 3 shall be carried out as specified in 6.4.2 to 6.4.6.

6.4.2 Preparation for work

6.4.2.1 General

Preparation of tools, material and equipment shall be conducted in accordance with the asbestos-removal plan specified in Clause 5, before starting the asbestos-removal operation.

6.4.2.2 Establishment of supervising organization of removal of asbestos

a) Assignment of person responsible

- The competent person shall be assigned as supervisor.

b) Establishment of organization for removal of asbestos

- The organization for removal of asbestos under the supervision of the competent person shall be established.

c) The competent person shall ensure the following.

- The workers are correctly wearing appropriate protective equipment.
- The workers have received relevant education and training and have had an appropriate medical evaluation.
- The equipment and work area are monitored at appropriate intervals to ensure that the work environment and procedures, as described above, remain satisfactory.

6.4.2.3 Preliminary education and training for workers

Subclause 6.2.2.3 applies.

6.4.2.4 Preparations for protective equipment

Appropriate protective equipment shall be provided.

In the case of half-mask respirators, protective equipment shall be as specified in 6.3.2.4. Alternatively, a half-mask respirator with particulate filter (solid particle collecting efficiency shall be at least 95,0 %) and goggles may be used.

It is necessary to ensure that the respiratory protective equipment fits the workers correctly.

Protective clothing, protective gloves and overshoes covering footwear shall be constructed of materials to which asbestos particles do not easily adhere, and shall be disposable.

Protective footwear should be of a type that is easily decontaminated.

Working clothing should be of a type that is easily decontaminated.

Half-mask respirators should be compliant with EN 140 or equivalent and fitted with a P3 filter.