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COMMITTEE OF EXPERTS ON THE TRANSPORT OF DANGEROUS GOODS

GROUP OF RAPPORTEURS ON THE PACKING OF DANGEROUS GOODS

Sixteenth session
Geneva

REPORT BY THE GROUP OF RAPPORTEURS ON ITS SIXTEENTH SESSION

(12-16 August 1974)

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REPORT

1. The Group of Rapporteurs on the Packing of Dangerous Goods held its sixteenth session from 12 to 16 August 1974. The session was attended by Rapporteurs and observers from the following countries: Canada; France; Germany, Federal Republic of; Italy; Union of Soviet Socialist Republics; United Kingdom of Great Britain and Northern Ireland and United States of America, and from the World Health Organization (WHO); the Inter-Governmental Maritime Consultative Organization (IMCO); the Central Office for International Railway Transport (OCTI); the International Chamber of Commerce (ICC); the International Road Transport Union (IRU); the International Chamber of Shipping (ICS); the International Air Transport Association (IATA); and the European Council of Chemical Manufacturers' Federations (CEFIC).

2. A Rapporteur from the Netherlands was invited by the Group to participate as an observer in the discussion of certain agenda items.

ADOPTION OF THE AGENDA

3. The Group adopted the provisional agenda prepared by the Secretariat (E/CN.2/CONF.5/R.351) and settled the time-table for the consideration of certain items.

ELECTION OF OFFICERS

4. Mr. L. SAVI (Italy) was re-elected Chairman, and Mr. H. KEMLER (France) and Mr. L. SPENCER (United Kingdom) were re-elected Vice-Chairmen, by acclamation.

5. Mr. Spencer was invited to preside over the discussion of agenda items 4, 5 and 6 and Mr. Kemler over the discussion of items 3 and 9.

MULTIMODAL TANK-CONTAINERS

6. The Group agreed in principle that part I of the requirements applicable to tank-containers (E/CN.2/CONF.5/R.332/Rev.1) should be put into final form and submitted to the Committee of Experts for consideration. It was further agreed that a representative portion of part II of the requirements should be submitted to the Committee at the same time if it could be prepared. The Group decided to examine first the proposals in part II relating to Class 8 (Corrosives) as set forth in the tables in document E/CN.2/CONF.5/R.363 submitted by the Rapporteur from the United States of America.

7. A long discussion took place on the minimum test pressures and calculation pressures given for tank-containers in these tables. The Rapporteur from the United States of America took the view that the tables should prescribe minimum pressures, while the Rapporteurs from the Federal Republic of Germany and the United Kingdom requested that the pressures in question should be differentiated.

8. The Rapporteurs from France and Italy added that if minimum pressures were adopted the outcome would be a proliferation of types of tank-containers, which was not desirable from the point of view of safety. The representative of ICC expressed the same views as the Rapporteurs from the Federal Republic of Germany, France and Italy.

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9. The Rapporteur from the United Kingdom considered that it would be possible to limit the range to two types (not including tank-containers for the carriage of such special products as bromine). In his opinion, the figures given in the IMCO Code covered the desirable range of containers used.

10. The Group ultimately adopted a proposal by the Rapporteur from France, as amended by the Rapporteur from the United Kingdom, the purpose of which was:

(1) With regard to pressure, to adopt the following figures:

for substances of Packaging Groups I and II : 4 kp/cm^2;

for substances of Packaging Group III : the value prescribed in the IMCO Code, i.e., 2.65 kp/cm^2;

(2) With regard to the presence or absence of the bottom discharge facility:

for substances of Group I : to prohibit bottom discharge;

for substances of Group II : to prohibit bottom discharge in principle, except for certain substances to be considered individually;

for substances of Group III : to permit bottom discharge.

11. The Group requested a working group to meet outside the meeting hours of the Group of Rapporteurs in order to examine the tables in detail and to amend part I in the light of that examination. The Rapporteurs from the Federal Republic of Germany, France, the United Kingdom and the United States of America and the representative of ICC said that they would take part in the working group's activity.

12. The Group of Rapporteurs then examined document E/CN.2/CONF.5/R.383 prepared by the Rapporteur from the United Kingdom, on the subject inter alia of inflammable liquids (Class 3); it also examined the comments set forth in a conference-room document prepared by the Rapporteur from the United States of America (E/CN.2/CONF.5/R.414).

13. As the discussion proceeded, it became apparent that the various Rapporteurs did not agree on whether the grouping of dangerous goods by hazard category should or should not apply to carriage by tank-container.

14. Some Rapporteurs wondered whether it would not be preferable for the Group of Rapporteurs to concentrate its efforts on part I rather than part II of the requirements, while others took the view that it would be better to continue work on part II without keeping strictly to the distribution of substances into packaging groups.

15. The Group finally decided by a majority to proceed with the examination of part I, but without abandoning work on part II in the working group.

16. The Group then took a position on the outstanding points in part I (provisions in square brackets and proposals put forward in a conference-room document submitted by the Rapporteur from the United States of America and on documents E/CN.2/CONF.5/R.359, R.363 and R.383). It adopted the amendments or additions shown in annex 1 to this report.

17. After deleting the reference to liquid, gaseous, powdery and granular substances from the first paragraph of the preamble, the Group agreed to revert to that question and to the question of cryogenic gases when the time came to take up part II of the requirements.

18. The Group agreed to give consideration later to document E/CN.2/CONF.5/R.362 (ullage) prepared by the Rapporteur from the United States of America.

19. The Rapporteur from the United Kingdom, Chairman of the working group reported on that group's work, which had led to general agreement on certain amendments. The Group of Rapporteurs decided to adopt the amendments to part I (see annex 1 to this report). The amendments to part II will also be incorporated in that annex by the Secretariat for approval by the Committee of Experts at its next session.

20. The Rapporteur from France observed that in the shut-off device referred to in paragraph 17.2.1. it was essential that the valve preceding the blank flange should be fitted with a device showing whether the valve was open or closed. Paragraph 17.2.1. might be supplemented by the following sentence: "The 'open' or 'closed' position of the valve preceding the blank flange shall be readily verifiable."

21. The representative of ICC expressed concern at the proliferation of regulations on tank-containers and voiced the hope that more would be done to harmonize them. His statement was supported by the Rapporteur from France and the Rapporteur from the Federal Republic of Germany. In reply the Rapporteur from the United States of America maintained that the fears expressed were unfounded inasmuch as the requirements adopted could serve as a framework for the various sets of regulations.

22. The Rapporteur from France then said that some of the technical and technological requirements of document E/CN.2/CONF.5/R.332/Rev.1 were incompatible with RID/ADR and that, without some harmonization, it would be impossible to build multimodal containers, for example, for carriage between Europe and the United States of America without departing from either the United Nations Recommendations or the European regulations. He cited the installation and adjustment of valves as an example.

REFERENCE TEMPERATURES FOR THE FILLING OF RECEPTACLES

23. The Group noted that no study on this topic had been put forward for consideration at the present session.

POLICY CONCERNING THE STRUCTURE AND PRESENTATION OF THE RECOMMENDATIONS

24. The Rapporteur from the United States of America introduced document E/CN.2/CONF.5/R.411, in which he asked the Group to take decisions on certain matters of policy before further developing the grouping of dangerous goods into five categories. Specifically, he asked the Group to give more importance to goods presenting significant risks; to undertake a serious review of the entire structure of the Recommendations; to use a single system of serial numbering world-wide; to review the criteria for the classification of substances and the notion "n.o.s."; and to crown its efforts by revising the presentation of the Recommendations.

25. The other Rapporteurs expressed agreement with the Rapporteur from the United States of America concerning the need to revise the Recommendations but took the view that, since such revision would be binding for the future, it should be preceded by detailed study before the Committee's next session. The Group considered that the revision could proceed in two phases, one dealing with the presentation, which should be adopted speedily so as to end the system of "Supplements", and the other dealing with questions of substance, which should be worked out between the Committee's 1974 and 1976 sessions.

26. The IATA representative, noting the reference to his organization in the proposals made by the Rapporteur from the United States of America, explained that the numbering of substances in the IATA Regulations was principally designed to aid translation rather than to identify substances, and that IATA would shortly be considering the possibility of including the United Nations number as well in its Regulations.

27. The Rapporteurs were invited to submit proposals to the Committee of Experts, and the Group drew the Committee's special attention to the importance it attaches to this problem.

GROUPING OF DANGEROUS SUBSTANCES FOR PACKING PURPOSES BY DEGREE OF DANGER

Class 3 - Inflammable liquids

28. The Rapporteur from the Federal Republic of Germany outlined his proposals as set forth in document E/CN.2/CONF.5/R.402.

29. The Rapporteur from the United States of America indicated the points on which he agreed and those on which he disagreed with the Rapporteur from the Federal Republic of Germany, and put forward counter-proposals applicable to inflammable liquids as a whole.

30. The Rapporteur from France said that the proposals in question would greatly complicate classification. The two fundamental criteria in Class 3 were flash-point and vapour pressure. He could accept viscosity in the case of liquids having a flash-point above 32°C.

31. The Rapporteur from the Union of Soviet Socialist Republics said that the main criterion for grouping inflammable liquids should be flash-point, not boiling-point or other such notions. Other criteria such as viscosity should be used for supplementary purposes.

32. The Rapporteur from the United Kingdom thought that his revised proposals (E/CN.2/CONF.5/R.347 and Amend.1) represented an approach based on the same principles as that of the Rapporteur from the Federal Republic of Germany, but more subtly differentiated.

33. After examining the points of convergence between documents E/CN.2/CONF.5/R.343 (United States of America), R.349 (Union of Soviet Socialist Republics), R.347 and Amend.1 (United Kingdom) and R.402 (Federal Republic of Germany), the Group agreed not to make any fundamental changes in the existing criteria for the time being.

34. The Rapporteur from the Federal Republic of Germany drew attention to his proposals for a Group IV (E/CN.2/CONF.5/R.402, para.7), which the Rapporteur from the United Kingdom found too stringent. However, the latter Rapporteur said that he was prepared to accept those proposals if the Group would decide to revert to them later in order to fill in the gaps. The Rapporteur from the United States of America took the view that a Group IV was unnecessary and that cases of exemption should be dealt with individually. The Rapporteurs from France and Italy supported that view, while the Rapporteur from the United States of America cited as an illustration the provisions of the IATA Restricted Articles Regulations. The Rapporteur from the Union of Soviet Socialist Republics expressed disagreement with the proposals made, which would entail reconsidering the definition of the Class and taking a hasty decision.

35. A number of compromise proposals were put forward, but none was adopted.

36. The Rapporteurs heard a statement by the representative of ICC to the effect that millions of unprotected receptacles up to 25 litres in capacity, containing paints or adhesives, were carried by land.

37. The Group was unable to reach a decision in the time available, but a number of Rapporteurs held that an exemption from the conditions of packing and from danger-labelling could be allowed only for the carriage by land of pasty inflammable liquids of a viscosity to be specified and having a flash-point of 40°C or over, when enclosed in receptacles not exceeding 25 litres in capacity.

Division 4.2 - Substances liable to spontaneous combustion

38. The proposals made by the small group which had met during the previous session (E/CN.2/CONF.5/53, annex 2) were adopted by the Group of Rapporteurs.

Division 5.1 - Oxidizing substances, other than organic peroxides

39. The Group did not put any substances of this Division into a Group IV.

Division 6.1 - Poisonous (toxic) substances

40. The WHO representative commented on the "Proposal for a WHO tentative classification of pesticides by hazard" (E/CN 2/CONF.5/R.356) and invited the Group to record its comments on the proposal so that they might be considered by the Executive Board of his organization at its fifty-fifth session, in January 1975.

41. The Rapporteurs from Canada, the Federal Republic of Germany, the Union of Soviet Socialist Republics, the United Kingdom and the United States of America spoke on a number of highly technical points, which were covered by the WHO representative in his replies.

42. A discussion ensued on whether the criteria adopted by the Committee should be modified. The Rapporteurs were divided in their views on that point. Some, such as the Rapporteurs from France and the United States of America, took the view that there was no need to modify them, while others, such as the Rapporteur from the United Kingdom, said that they ought to be revised. The Rapporteur from the Union of Soviet Socialist Republics stated that the present criteria should be retained, but he called for changes in certain figures.

43. Document E/CN.2/CONF.5/R.395, prepared by the Rapporteur from the Union of Soviet Socialist Republics and amended by a conference-room document, was examined by the Group, which consequently had to take a decision on whether - as it appeared from the proposals made for Group IV - the limits should be extended beyond the figures already adopted.

44. The Group's attention was also drawn to document E/CN.2/CONF.5/R.365, prepared by the Rapporteur from the Federal Republic of Germany, which contained proposals to the same effect. No such extension was approved by the Group, which went on to consider whether it was necessary to have a Group IV consisting of substances selected from Group III. The Rapporteur from the Federal Republic of Germany argued that the existence of a Group IV offered a means of eliminating Class 9 as used by IMCO. The question was raised whether it would not be better to refrain from establishing criteria for Group IV and to place in that Group the few substances mentioned in the report on the previous session (E/CN.2/CONF.5/53, paras. 22 and 24).

45. Finally, reconsidering the decision it had taken at the previous session, the Group agreed that Packaging Group IV was inappropriate for Division 6.1.

CLASSIFICATION

(a) Information sheet for substances not included in the lists

46. The Group examined the proposals made by the Rapporteur from the United States of America in document E/CN.2/CONF.5/R.386, as supplemented by an item proposed during the meeting concerning the commercial importance of the substance suggested for inclusion.

47. The Rapporteur from the Union of Soviet Socialist Republics requested the Group to adopt the information sheet as it stood and to submit it to the Committee for approval.

48. The Rapporteur from the United Kingdom noted that the proposed information sheet did not include such items as solubility, temperature of spontaneous ignition, etc.; he said that he doubted the need to indicate the commercial importance of the substance. He concluded that such a sheet should be used only for guidance. The Rapporteur from the Federal Republic of Germany said that the sheet seemed to him to be of value mainly for toxic substances; for other substances, more items would have to be added. Apart from that, he thought such a sheet would be very useful. The Rapporteur from Canada said he shared the previous speaker's views with regard to the usefulness of such a sheet and the need to add more items to it.

49. The Rapporteur from the United Kingdom suggested that the Group should adopt the principle of such a list at the present session and revert to the matter later.

50. The Rapporteur from the United States of America said that the information sheet should serve for guidance only, and would be supplemented as appropriate.

51. The Group finally agreed to submit the information sheet to the Committee of Experts, on the understanding that it could be supplemented and was to serve only for guidance in classification (see annex 2).

(b) Enumeration of substances not included in the lists

52. The Group began examining the proposals made by the Rapporteur from the United Kingdom in document E/CN.2/CONF.5/R.323/Add.1, as amended by a document circulated during the meeting (subsequently combined under the symbol E/CN.2/CONF.5/R.323/Add.1/Rev.1). For the purposes of this examination, the Secretariat had prepared a document (E/CN.2/CONF.5/R.407) setting forth the observations made by the Rapporteurs from Canada, France, the Federal Republic of Germany and the United States of America (E/CN.2/CONF.5/R.406, R.353, R.358 and Add.1, R.344 and R.387).

53. The Group adopted the list of substances reproduced in annex 3 to this report.

54. The Rapporteur from the United States of America entered a reservation on the inclusion of chlorinated anthracene oil in Packaging Group II.

55. Having been unable to complete the examination of the proposals for the enumeration of substances not included in the lists, the Group of Rapporteurs considered it desirable that that examination should be completed at an informal meeting of the Group to be held at Geneva, without interpretation or Secretariat services, on 27, 28 and 29 November 1974, just before the eighth session of the Committee of Experts, which was scheduled for 2 to 10 December 1974.

ORGANIC PEROXIDES

56. The Rapporteur from the United States of America reported on the informal meeting held at Washington from 22 to 25 April 1974. He drew attention to the fact that agreement had been reached on most items. The results achieved were set out in a document circulated during the meeting.

57. The Group of Rapporteurs appointed a working group to examine that document.

58. The working group submitted some amendments, which were adopted by the Group of Rapporteurs (see annex 4 to this report).

59. The Rapporteur from the Union of Soviet Socialist Republics said that he had not had an opportunity to study the question and reserved his position on the amendments that had been adopted. He added that he would not have time to consider the matter before the Committee's next session.

HAZARD INFORMATION SYSTEM

60. The Rapporteur from Canada as Chairman of the special working group on Hazard Information Systems set up by the Group of Rapporteurs at its previous session (E/CN.2/CONF.5/53, para. 117), introduced his group's report, which is reproduced in annex 5 to this report.

61. The Rapporteur from the Union of Soviet Socialist Republics took the view that the report should be submitted to the Committee of Experts for consideration. With regard to paragraph 4.2., he strongly urged that it should be possible to show the United Nations serial number in the lower half of the label.

62. The Rapporteur from the United Kingdom agreed that the report as a whole should be submitted to the Committee but he expressed reservations concerning some parts other than those expressly mentioned in annex 5. In his opinion, the Group might recommend the Committee to decide that, in any system, the United Nations serial number should constitute the pivot point.

63. The IATA representative spoke at length on the system in general, and stated in conclusion that his organization would like a system that was equally valid for Europe and for the United States of America. He submitted a draft which in his view offered a universal solution (E/CN.2/CONF 5/R.361).

64. The Rapporteur from Italy said that he shared the opinion expressed by the Rapporteur from the United States of America in the foot-note to paragraph 4.2.1.

65. The Rapporteur from the Union of Soviet Socialist Republics said that the course to be followed for the time being was to continue using the existing systems and at the same time to pursue detailed study of a new world-wide system. At the present stage the Group should transmit the special group's report to the Committee.

66. The Rapporteur from the United States of America also considered that the special group's report should be adopted and submitted to the Committee at its next session. He drew attention to the foot-note to paragraph 4.2.1. of the report, and referred to document E/CN.2/CONF.5/R.411 as a possible solution.

67. The IMCO representative reported on the results of the work done by his Organization. He said that what was needed most was to agree on a code number.

68. After further statements by the Rapporteurs from the United Kingdom, Canada and the United States of America on particular points, the Rapporteur from the Federal Republic of Germany expressed the view that the details of the system should be differentiated according to the mode of transport. The Rapporteur from France, on the other hand, considered that a single, simple system should be recommended.

69. In conclusion the Group of Rapporteurs adopted the report of the special group (annex 5 to this report), which will be submitted to the Committee at its next session. The Group of Rapporteurs congratulated the Chairman of the special group on the work done.

FLASH-POINT TESTING

70. The Rapporteur from the United Kingdom presented a new method of flash-point testing (E/CN.2/CONF.5/R.409). His statement was followed by a demonstration of a tester developed in the United Kingdom by an oil company and a company manufacturing oil-testing equipment. In that Rapporteur's opinion, test methods using the device in question might at a later stage be considered for addition to the list of methods given in annex 1, appendix 3, to the Recommendations.

APPROVAL OF THE GROUP'S REPORTS ON ITS FOURTEENTH, FIFTEENTH AND SIXTEENTH SESSIONS

71. The Group submits to the Committee of Experts for approval the reports on its fourteenth, fifteenth and sixteenth sessions, which appear in documents E/CN.2/CONF.5/51, E/CN.2/CONF.5/53 and E/CN.2/CONF.5/55.

Annex 1

DRAFT RECOMMENDATIONS CONCERNING MULTIMODAL TANK-CONTAINERS

Preamble

The provisions of these recommendations apply to tank-containers intended for the carriage of dangerous substances by both land and sea modes of transport. They set out the requirements necessary for through carriage using both modes. Where a less stringent requirement can be applied to one only of the two modes, the fact is indicated.

Exceptionally, tanks not conforming strictly to the requirements set forth but having alternative arrangements which offer at least equivalent safety in use in respect of compatibility with the properties of the substances carried and equivalent or superior resistance to impact, loading and fire may be considered by the competent authority.

These provisions are presented in two Parts. The first contains requirements applicable to tank-containers intended for the carriage of dangerous goods of all Classes. The second comprises a table of dangerous goods, showing the particular provisions which modify or supplement the requirements of Part I for each particular substance. The list of substances in Part II will be required to be brought up to date from time to time by the possible addition of new substances and in the light of technical progress.

The construction, equipment, testing, marking and operation of multimodal tank-containers should be subject to acceptance by the competent authority of the country in which the tank-containers are approved. The general provisions of Part I of this document should be incorporated in the requirements laid down by the national competent authorities.

This document does not apply to road tank-vehicles, rail tank-wagons, tanks of less than 450 litres (118.9 gal) capacity, or non-metallic tanks.

Transitional measures

1. Tank-containers of a capacity below 1,000 litres (264.2 gal) built or being built before the entry into force of these requirements and not conforming to them may, if they were built in conformity with the requirements of a nationally accepted code for the carriage of dangerous goods, be used for a period of three years.

2. Such tank-containers of a capacity of not less than 1,000 litres (264.2 gal) may, with the approval of the competent authority of the owner country, if they were built in conformity with the requirements of an internationally accepted code for the carriage of dangerous goods, be used for a period of five years.

3. All tank-containers shall after the periods prescribed in paragraphs 1 and 2 above either comply with these recommendations or be required to be judged fully equivalent within the meaning of the second paragraph of the preamble.

Definitions

For the purposes of these provisions:

"Tank container" means a tank having a capacity of 450 litres (118.9 gal) or more whose shell is fitted with items of service equipment and structural equipment necessary for the carriage of dangerous liquids [or dangerous gaseous, powdery or granular substances]. The tank-container shall be capable of being carried by land or by sea and of being loaded and discharged without need of removal of its structural equipment, shall possess stabilizing members external to the shell, and shall be capable of being lifted when full;

"Shell" means the tank proper, including the openings and their closures;

"Service equipment of a shell" means filling and discharge, venting, safety, heating and heat-insulating devices and measuring instruments;

"Structural equipment" means the reinforcing, fastening, protective or stabilizing members external to the shell;

"Maximum working pressure" means the higher of the following two pressures:

(a) the highest effective pressure allowed in the shell during filling or discharge; and

(b) the effective pressure to which the shell is subjected by its contents, including such extraneous gases as it may contain, when the temperature of the contents reaches the reference temperature specified by the competent authority;

"Test pressure" means the highest effective pressure which arises in the shell during the hydraulic pressure tests;

"Discharge pressure" means the highest pressure actually built up in the shell when it is being discharged by pressure;

"Leakage test" means the test which consists of subjecting the shell to an effective internal pressure equivalent to the maximum working pressure, but not less than 0.2 kg/cm^2 (2.8 psig) (gauge pressure), by a procedure approved by the competent authority;

"Calculation pressure" means a theoretical pressure which, according to the degree of danger exhibited by the substance being carried, may differ more or less widely upwards from the working pressure. This pressure is used solely to determine the thickness of the barrel of the shell, to the exclusion of any external or internal reinforcing device. The minimum calculation pressure shall in no case be lower than the test pressure;

"Total weight" means the weight of the shell and its service equipment and structural equipment and the heaviest load authorized to be carried.

PART I

GENERAL REQUIREMENTS FOR THE CONSTRUCTION AND OPERATION OF MULTIMODAL TANK-CONTAINER TANKS

1. Shells shall be made of metallic materials suitable for shaping. For welded shells only a material whose weldability has been fully demonstrated shall be used. Welds shall be skilfully made and afford complete safety. The materials of the tank, including any devices and accessories that may come into contact with the contents, shall not react dangerously with them. Suitable lining of tanks to prevent corrosion of the shell is an acceptable method of construction. Tank materials shall be suitable for the external environment in which they may be carried. The use of aluminium as a material of construction shall be restricted to tank-containers intended for land use or for the carriage of products whose vapour pressure at 200°C (392°F) exceeds the set-to-discharge pressure of the tank relief valve or when specifically authorized for use in the marine mode in Part II. In those cases where aluminium is authorized, it shall be insulated to prevent significant loss of physical strength properties for a period of 30 minutes when it is subjected to a heat load of 2.60 gcal/cm^2-sec (34,500 BTU/sq ft-h). The insulation shall be approved by the national competent authority concerned.

2. Gaskets, where used, shall be made of material not subject to attack by the contents of the tank.

2.1. Care shall be taken to avoid damage by galvanic action due to the juxtaposition of dissimilar metals.

3. Tank-containers shall be designed and fabricated with supports to provide a secure base during carriage, and with suitable lifting and tie-down attachments.

4. Shells, their attachments and their service and structural equipment shall be designed to withstand, without loss of contents, at least the internal pressure due to the contents, and static and dynamic stresses in normal handling and carriage.

5. Tank-containers without vacuum-relief valves shall be designed to withstand without permanent deformation an external pressure at least 0.4 kp/cm^2 (6.0 psi) above the internal pressure. Tanks equipped with vacuum-relief valves shall be designed to withstand without permanent deformation an external overpressure of 0.21 kp/cm^2 (3 psig) or greater and shall have their vacuum-relief valve set to relieve at minus the external design pressure or minus (-) 0.21 kp/cm^2 (3 psig), whichever is less.

6. Tank-containers and their fastenings shall under the maximum permissible load be capable of absorbing the following forces:

In the direction of travel: twice the total weight;

Horizontally at right angles to the direction of travel: the total weight (where the direction of travel is not clearly determined, [the maximum permissible load shall be] twice the total weight);

Vertically upwards: the total weight; and

Vertically downwards: twice the total weight.

These forces, multiplied by a safety factor of 1.5, shall be taken into account when calculating the wall thickness of the shell so as to ensure that the total stress at the most severely stressed point of the tank-container shell (including stresses arising from the aforesaid superimposed loads) does not exceed the levels prescribed in paragraph 12 below.

It should be noted that the above loadings do not give rise to an increase in the pressure in the vapour space.

7. Tank-containers shall be carried only on vehicles whose fastenings are capable, in conditions of maximum permissible loading of the tank-containers, of absorbing the forces specified in paragraph 6 above.

7.1. The securing of tank-containers to vehicles when carrying certain dangerous substances designated in Part II of this document shall be effected by means of locks.

8. Tank-containers intended to contain certain dangerous substances shall be provided with additional protection, which may take the form of additional thickness of the shell or a higher test pressure, the additional thickness or higher test pressure being determined in the light of the dangers inherent in the substances concerned, or of a protective device approved by the competent authority. The requirements for each substance are listed in the table in Part II.

9. Cross-sectional design: Tanks shall be of a cross-section which is stress-determinant, i.e. the design shall be capable of being stress-analysed mathematically, or experimentally by resistance strain gauges, or by some other method approved by the competent authority. (This provision does not apply to tanks intended for use on land only.)

10. The pressure on which the dimensioning of the tank-container shell is based shall not be less than the calculation pressure, and shall also take into account the stresses referred to in paragraph 6 above.

11. Except where special conditions laid down for the various substances provide otherwise, the following minimum requirements shall be taken into account: 1/

11.1. The shell of a tank container - whatever its discharge system - intended for the carriage of substances having at the reference temperature a total pressure (i.e. vapour pressure plus partial pressure of inert gases, if any) of not more than 1.75 kp/cm^2 (absolute) (24.9 psia) shall be designed to withstand a test pressure of at least 1.5 kp/cm^2 (21.4 psig) or 1.3 times the discharge pressure, whichever is the greater.

NOTE: Less stringent requirements may be applied to tank-containers for low-vapour-pressure liquids intended for carriage by land only.

11.2. The shell of a tank-container - whatever its discharge system - intended for the carriage of substances having at the reference temperature a total pressure (i.e. vapour pressure plus partial pressure of inert gases, if any) of more than

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1/ See Part II for specific restrictions regarding the use of aluminium.

1.75 kp/cm^2 (24.9 psia) (absolute) and less than 3 kp/cm^2 (43 psia) (absolute) shall be designed to withstand a test pressure equal to the higher of the following two pressures:

(a) 1.5 times the total pressure at the reference temperature, less 1 kp/cm^2 (14.22 psig), subject to a minimum of 2.65 kp/cm^2 (37.7 psig); or

(b) 1.3 times the discharge pressure.

11.3. The shell of a tank-container - whatever its discharge system - intended for the carriage of substances having at the reference temperature a total pressure (i.e. vapour pressure plus partial pressure of inert gases, if any) of more than 3 kp/cm^2 (43 psia) (absolute) shall be designed to withstand a test pressure equal to the higher of the following two pressures:

(a) 1.5 times the total pressure at the reference temperature, less 1 kp/cm^2 (14.22 psig), subject to a minimum of 4 kp/cm^2 (56.9 psig); or

(b) 1.3 times the discharge pressure.

12. In choosing the material and determining wall thickness, the maximum and minimum filling or working temperature shall be taken into account, having regard to the risk of brittle fracture.

At the test pressure, the stress σ (sigma) at the most severely stressed point of the tank-container shell shall conform to the material-dependent limitations prescribed below:

12.1. For metals and alloys exhibiting a clearly-defined yield point or characterized by a guaranteed conventional yield stress Re (generally 0.2 per cent residual elongation; for austenitic steels, 1 per cent residual elongation).

12.2. Where the ratio Re/Rm is not more than 0.50 1/ 2/ (Re = apparent yield stress or 0.2 per cent proof stress; Rm = guaranteed minimum tensile strength)

$$\sigma \leq 0.75 \text{ Re}$$

12.3. Where the ratio Re/Rm exceeds 0.50 1/ 2/

$$\sigma \leq 0.375 \text{ Rm}$$

13. For metals and alloys exhibiting no apparent yield stress and characterized only by a guaranteed minimum tensile strength Rm: 1/ 2/

$$\sigma \leq 0.375 \text{ Rm}$$

1/ Less stringent requirements may be applied to tank-containers intended for land use only.

2/ These values have not yet been specified for tanks intended for the carriage of gases; until such time as they are laid down, values specified by the national competent authority concerned may be utilized.

13.1. In the case of steel the elongation at fracture, in per cent, shall not be less than $\frac{1,000}{Rm}$ where Rm is in kg/cm^2, with an absolute minimum of 20 per cent. In the case of aluminium the elongation at fracture, in per cent, shall not be less than $\frac{1,000}{6\ Rm}$ where Rm is in kg/cm^2, with an absolute minimum of 12 per cent.

NOTE: The specimens used to determine the elongation at fracture shall be taken transversely to the direction of rolling and be so secured that:

$$Lo = 5\ d,$$

where Lo = length of the specimen before the test; and

d = diameter.

14. Tank-containers intended for the carriage of inflammable liquids having a flash-point of not more than 55°C, and for the carriage of inflammable gases and fine powder, shall be capable of being electrically earthed.

15. Minimum shell thickness

15.1. Tank-containers shall be built to an approved technical code which is recognized by the national competent authority concerned. The following formula shall be utilized in conjunction with the calculation pressure, as listed for each commodity in Part II, only for the purpose of obtaining a minimum thickness (in mm) of the cylindrical wall of the shell:

$$e = \frac{Pc \times D}{200 \times \sigma\ (\text{sigma})},$$

where Pc = calculation pressure in kg/cm^2

D = diameter of the tank in mm

σ = permissible stress, as defined in paragraphs 12.2, 12.3 and 13, in kg/mm^2

The thickness shall in no case be less than that prescribed in paragraphs 15.2 and 15.3 below.

15.2. The barrels and ends of tanks not more than 1.80 metre (6 feet) in diameter shall be not less than 5 mm (3/16 inch) thick if of mild steel 1/ (as specified in paragraph 12) or equivalent thickness if of other metal. In tanks more than 1.80 metre (6 feet) in diameter they shall be not less than 6 mm (1/4 inch) thick if of mild steel 1/ (as specified in paragraph 12) or of equivalent thickness if of other metal. The barrels and ends of all tanks shall be at least 3 mm (1/8 inch) thick regardless of the material of construction.

1/ "Mild steel" means a steel having a breaking strength between 37 kg/mm^2 (52,500 psi) and 44 kg/mm^2 (62,500 psi).

15.3. Where additional protection of the tank against damage is provided, the competent authority may authorize a reduction in these minimum thicknesses in proportion to the protection provided. However, the barrels and ends of tanks not more than 1.80 metre (6 feet) in diameter shall be not less than 3 mm (1/8 inch) thick if of mild steel 1/ or of equivalent thickness if of other metal, and those of tanks more than 1.80 metre (6 feet) in diameter shall be not less than 4 mm (5/32 inch) thick if of mild steel 1/ or of equivalent thickness if of other metal.

15.4. The additional protection referred to in paragraph 15.3 may be provided (a) by overall external structural protection, such as suitable "sandwich" construction with the outer shielding secured to the tank, or (b) in part by tank protection and in part by operational factors (e.g. tank supported in a complete framework with longitudinal and transverse structural members and carried at sea in a fully cellular container ship and on land on special-purpose road vehicles or special-purpose flat wagons).

15.5. There shall be no sudden change of plate thickness at the head attachment to the shell and in no case shall the plate thickness at the knuckle be less than that of the shell. The material of construction of the head and shell shall be the same.

16. Service equipment

16.1. Service equipment (valves, fittings, safety devices, gauging devices and the like) shall be so arranged as to be protected against the risk of being wrenched off or damaged during carriage and handling. If the connexion between the frame and the tank shell allows relative movement as between the sub-assemblies, the equipment shall be so fastened as to permit such movement without risk of damage to working parts. Equipment protection shall offer a degree of safety comparable to that of the tank shell.

16.2. All tank-shell openings other than openings for pressure-relief devices and inspection openings shall be provided with manually operated stop-valves situated as near to the shell as is practicable.

16.3. A tank-container or each of its compartments shall, save where it is intended for the carriage of deeply refrigerated gases, be provided with an opening large enough to enable the tank-container or compartment to be inspected.

16.4. External fittings shall preferably be grouped together.

16.5. All tank connexions shall be clearly marked to indicate the function of each.

16.6. Stop-valves with screwed spindles shall close by clockwise rotation.

16.7. No moving parts such as covers, components of closures, etc., which are liable to come into frictional or percussive contact with aluminium tank-containers intended for the carriage of inflammable liquids having a flash-point of not more than 55°C (131°F) or for the carriage of inflammable gases shall be made of unprotected corrodible steel.

17. Bottom openings

17.1. Certain substances listed in Part II must not be carried in tank-containers with bottom openings (bottom-discharge tank-containers).

1/ "Mild steel" means a steel having a breaking strength between 37 kg/mm^2 (52,500 psi) and 44 kg/mm^2 (62,500 psi).

17.2. Every bottom-discharge tank-container shall be equipped with two serially mounted and mutually independent shut-off devices, the first being an internal stop-valve 1/ [attached to the tank shell] and the second being a sluice-valve or other equivalent device, such as a bolted blank flange or a specially approved screw-cap arrangement, mounted one at each end of the discharge piping (save as may be otherwise provided in the case of tank shells intended for the carriage of certain crystallizable or highly viscous substances). The stop-valve may be operable from above or from below. If possible, the setting - open or closed - of the internal stop-valve shall be capable of being verified from the ground in both cases. Stop-valve control devices shall be so designed as to prevent any unintended opening through impact or an inadvertent act.

17.2.1. For certain products listed in Part II and referred to in this paragraph a bottom-discharge tank container shall be equipped with three serially mounted shut-off devices consisting of an internal valve, an external valve and a bolted blank flange or other equivalent device such as a specially approved screw-cap arrangement.

17.2.2. The internal shut-off device shall continue to be effective in the event of damage to the external control device.

17.2.3. In order to avoid any loss of contents in the event of damage to the external discharge fittings (pipe sockets, lateral shut-off devices), the internal stop-valve and its seating shall be protected against the danger of being wrenched off by external stresses or shall be so designed as to resist them. The filling and discharge devices (including flanges or threaded plugs) and protective caps (if any) shall be capable of being secured against any unintended opening.

18. Safety relief

18.1. All tank-containers, except as provided in paragraph 18.2 below, shall be closed and fitted with a pressure-relief device.

18.2. If the competent authority authorizes the use of a tank-container with no relief device, the tank-container shall be approved only if the tank is capable of withstanding the developed vapour pressure of the contents after complete engulfment in fire for 30 minutes, with heat input as defined in paragraph 23 below. The required additional strength may be provided by increasing the tank's design pressure or by providing adequate fire-resistant insulation.

19. Pressure-relief devices

19.1. Every tank shell of 1,900 litres (500 gal) or more, or every independent compartment of a tank shell of similar capacity, shall be provided with one or more pressure-relief valves of the spring-loaded type and may in addition have a frangible disc or fusible element.

19.2. Tank shells for the carriage of substances designated in Part II shall have a pressure-relief valve of the spring-loaded type and may in addition have a frangible disc or fusible element.

1/ "Internal stop-valve" means a stop valve within the tank or within a welded flange or its companion flange, or within a coupling which is an integral part of the tank.

19.2.1. Tank shells for the carriage of substances designated in Part II shall have a pressure-relief device approved by the competent authority. Such device shall comprise a frangible disc preceding a spring-loaded valve. The space between the frangible disc and the valve shall be provided with a pressure gauge or a suitable tell-tale indicator. This arrangement permits the detection of disc rupture, pinholing or leakage which could cause a malfunction of the pressure-relief device.

19.3. Every tank-container with a capacity of less than 1,900 litres (500 gal) shall be fitted with a pressure-relief device which may be a frangible disc if the latter complies with the requirements of paragraph 21.1 below.

19.4. All pressure-relief devices shall be situated in the vapour space of the tank and be so arranged as to ensure that the escaping gas is discharged unrestrictedly and upwards (i.e. above the horizontal) in such manner that it cannot impinge upon the tank shell. Pressure-relief devices shall be situated as nearly as is practicable midway along the length of the tank or compartment.

20. Setting of pressure-relief devices

20.1. It should be noted that the safety device should operate only in conditions of excessive rise in temperature, as the tank will not during carriage be subject to undue fluctuations of pressure due to operating procedures (see however paragraph 23.2).

20.2. The required pressure-relief valve shall be set to start to discharge at a nominal pressure of 83 per cent of the test pressure in the case of tanks having a test pressure below 4.5 kg/cm^2 (64 psi) and of two-thirds of the test pressure in the case of tanks having a test pressure of 4.5 kg/cm^2 (64 psi) or more. The valve shall after discharge close at a pressure not lower than 10 per cent below the pressure at which discharge starts, and shall remain closed at all lower pressures, provided that this requirement shall not be so construed as to prevent the use of vacuum-relief valves or combination pressure-relief and vacuum-relief valves.

21. Fusible elements

21.1. Fusible elements, if allowed under Part II, shall function at a temperature between 110°C (230°F) and 149°C (300°F) and at a pressure lower than the design test pressure of the tank.

21.2. Fusible elements shall not be utilized on tanks with a test pressure which exceeds 2.65 kp/cm^2 (37.6 psig).

22. Frangible discs

22.1. Frangible discs, if used, shall rupture at a nominal pressure equal to the test pressure. Particular attention shall be given to the requirements of paragraphs 16.1 and 19.4 if frangible discs are used. Frangible discs shall not operate within the ambient-temperature range envisaged.

22.2. If the tank-container is fitted with arrangements for air-pressure or inert-gas-pressure discharge, the inlet line shall be provided with a suitable pressure-relief device set to operate at a pressure not higher than the maximum allowable working pressure of the tank shell. A stop-valve shall be provided at the entry to the tank shell.

23. Capacity of relief devices

23.1. The spring-loaded relief valve required by paragraph 19.1 shall have a minimum diameter of 31.75 mm (1.25 in). Vacuum relief valves, if used, shall have a minimum through area of 2.84 cm^2 (0.44 sq in).

23.2. The combined delivery capacity of the relief devices in conditions of complete engulfment of the tank in fire shall be sufficient to limit the pressure in the tank to the hydraulic test pressure.1/ Emergency pressure-relief devices may be used to achieve the full relief capacity prescribed. Emergency pressure-relief devices may be of the spring-loaded, frangible or fusible type.

1/ To determine the total certified capacity of the relief devices, which may be regarded as being the sum of the individual capacities of the several devices, one of the following equivalent formulae may be used:

1(a) $$Q = 5.66 \times 10^6 \frac{FA}{LC}^{0.82} \sqrt{\frac{ZT}{M}}$$

where Q = minimum required rate of discharge in cubic metres of air per hour at standard conditions 15.6°C and 1 atm

A = exposed surface area of tank shell (in square metres);
L = latent heat of evaporation in gcal/g;
Z = compressibility factor for the vapour in g, m, °K units;
T = absolute temperature in degrees Kelvin (°C + 273);
M = molecular weight of vapour in g units;
C = a constant depending on ratio of specific heats of vapour, to be taken as 315 in metre, g, hour and °K units;
F = insulation factor; use 1 for uninsulated tanks where t is in °C, and $\frac{8U\ (921-t)}{93.5 \times 10^6}$ for insulated tanks;
U = thermal conductivity of the insulation at 311°K in gcalories/h (sq metre) (°K). This shall be a function of the thickness of the insulation.

1(b) $$Q = \frac{37,980,000}{LC} A^{0.82} F \sqrt{\frac{ZT}{M}},$$

where Q = minimum required rate of discharge in cubic feet of air per hour at 14.7 lb/in^2 abs. and 60°F;

A = exposed surface area of tank shell (in square feet);
L = latent heat of evaporation in BTU/lb;
Z = compressibility factor for the vapour in lb, ft, °F units;
T = absolute temperature in degrees Rankin (0°F + 460);
M = molecular weight of vapour in lb units;
C = a constant depending on ratio of specific heats of vapour, to be taken as 315 in inch, lb, hour and °F units;
F = insulation factor; use 1 for uninsulated tanks where t is in °F, and $\frac{8U\ (1200-t)}{34,500}$ for insulated tanks;
U = thermal conductivity of the insulation at 100°F in BTU/h (sq ft) (°F). This shall be a function of the thickness of the insulation.

23.3. In determining the capacity of such pressure-relief devices the competent authority shall take account of the heat input into the tank in conditions of exposure to fire.2/ Particular items which shall be considered are the unit heat flux into the tank, the area of the tank exposed to the fire, the external environmental factors (wind, drainage, fire-extinguishing arrangements) and the adjacent environmental factors (insulation).

24. Markings on relief devices

24.1. Every pressure-relief device shall be plainly and permanently marked with the pressure or temperature at which it is set to discharge and the rated free-air delivery of the device.

25. Connexions to pressure-relief devices

25.1. Connexions to pressure-relief devices shall be of sufficient size to enable the required discharge to pass unrestricted to the safety device. No stop-valve shall be installed between the tank shell and the pressure-relief devices except where duplicate devices are provided for maintenance or other reasons and the stop-valves serving the devices actually in use are locked open or the stop-valves are interlocked so that at least one of the duplicate devices is always in use. Vents from the pressure-relief devices, where used, shall deliver the relieved vapour or liquid to the atmosphere in conditions of minimum back-pressure on the relieving device.

26. Siting of pressure-relief valves

26.1. Pressure-relief valves shall be sited on top of the tank and be of such design that means are available for ascertaining that the valve disc is free to lift on its seat. Arrangements shall be made to prevent access to the valves by unauthorized persons and to protect the valves from damage caused by the tank overturning.

Connexion of pressure-relief devices to vapour space

26.2. Pressure-relief devices shall have direct communication only with the vapour space of the tank.

2/ To determine the capacity of the pressure-relief devices, one of the following equivalent formulae may be used:

2(a) $H = 93.5 \times 10^6 A^{0.82} XF$, gcalorie/hour

where H = heat input in gcalorie/hour;
A = exposed tank surface area (sq metre);
F = insulation or environmental factor. At present the value for non-insulated tanks should be taken to be 1.

2(b) $H = 34{,}500\ A^{0.82} F$, BTU/hour,

where H = heat input in BTU/hour;
A = exposed tank surface area (square feet);
F = insulation or environmental factor. At present the value for non-insulated tanks should be taken to be 1.

27. Gauging devices for tank-containers

27.1. Glass level-gauges, or gauges made of other easily destructible material, which are in direct communication with the contents of the tank shall not be used.

28. Tank support, frameworks and lifting attachments

28.1. Tank-containers shall be designed and fabricated with a support structure to provide a secure base during carriage. Skids, frameworks, cradles or other similar devices are acceptable. The loadings specified in paragraph 6 shall also be considered in this aspect of design.

28.2. The combined stresses caused by tank mountings (e.g. cradles, frameworks, etc.) and tank lifting and tie-down attachments shall not cause excessive stress in any portion of the tank shell. Permanent lifting attachments and permanent tie-down attachments shall be fitted to all tanks. Any tie-down attachments added directly to the tank shell shall be secured to doubling plates. Lifting lugs shall not normally be attached to the shell; it is recommended that permanently attached stiffening rings or equivalent devices should be used for the attachment of lifting devices in such cases.

28.3. The stress in the tank shell supports, surrounding framework and lifting and tie-down attachments shall not exceed 0.8 of the specified minimum yield strength of the material of construction under the loading conditions stated in paragraph 6.

28.4. In the design of supports and frameworks due regard shall be paid to the effects of environmental corrosion, and in calculations for all structural members not constructed of corrosion-resistant materials a minimum corrosion allowance of 1.6 mm shall be provided.

28.5. Tank-container frameworks intended to be lifted or secured by their corner casting shall be subjected to internationally accepted special tests. The use of such tank-container frameworks within an integrated system is generally encouraged.*/

28.6. Fork-lift pockets of tank-containers of 10,000 litres (2,642 gal) or more capacity shall be capable of being blanked.

29. Approval, testing and marking of tanks

29.1. The national approval authority or a body authorized by that authority shall issue in respect of every new design of tank-container a certificate attesting that the tank-container and its attachments surveyed by that authority or that body are suitable for the purpose for which they are intended and meet the construction and equipment requirements of Part I of this document and, where appropriate, the special requirements for substances of Part II. The prototype-test results, the substances for whose carriage the tank-container is approved, and an approval number, shall be specified in a test report. If the tank-containers are manufactured without change in structural design, this approval shall be deemed to be design approval. The approval number shall consist of the distinguishing sign or mark of the State in whose territory the approval was granted, and an identification number (the distinguishing sign for use in international traffic, as prescribed by the Convention on Road Traffic, Vienna 1968).

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*/ For example, the ISO system.

29.2. Design approval shall be given in respect of at least one tank of each design and each size, it being, however, understood that a set of tests made on a tank of one size may serve for the approval of smaller tanks made of material of the same kind and thickness by the same fabrication technique and with identical supports and equivalent closures and other appurtenances.

30.1. The shell and items of equipment of each tank-container shall be inspected and tested, either together or separately, first before being put into service (initial inspection and test) and thereafter at intervals (periodic inspection and test). The initial inspection and test shall include a check of the design characteristics, an internal and external examination and a hydraulic pressure test. If the shell and equipment have been pressure-tested separately, they shall together be subjected after assembly to a leakproofness test. The periodic inspections and tests shall include an internal and external examination and, as a general rule, a pressure test. Sheathing, thermal insulation and the like shall be removed only to the extent required for reliable appraisal of the tank-container's condition. The initial and the periodic pressure tests shall be carried out, by an expert approved by the competent authority, at the test pressure indicated on the data plate of the tank-container, except in cases where periodic tests at lower test pressures are authorized.

While under pressure the tank shall be inspected for leakage, corroded areas, dents, or other conditions which indicate weakness that might render the tank unsafe in carriage and if any evidence of such unsafe condition is discovered the tank shall not be placed in or returned to service until it has been repaired and the test, repeated, has been passed.

30.2. Tank-containers shall, first before being put into service and thereafter at intervals not exceeding five years, be tested in conformity with the provisions of paragraph 30.1. Before tank-containers are put into service, and thereafter at intervals not exceeding two and one-half years, a leakproofness test, a test of the satisfactory operation of all service equipment, and an internal and external inspection of the tanks and their fittings with due regard to the substances carried shall be performed; however, the internal inspection may be waived by the competent authority concerned in the case of tanks intended for the carriage of one substance.

NOTE: Departures from these intervals may be allowed in respect of tanks intended for land transport only.

30.3. When a tank-container is damaged it shall be so repaired as to comply with these recommendations. In all cases where welded repairs are made on a tank, a hydrostatic test of at least the original test pressure is required.

30.4. Certificates showing the results of the test shall be issued by the expert approved by the competent authority.

31. Marking

31.1. Every tank-container shall be fitted with a rust-proof metal plate permanently attached to the shell in a place readily accessible for inspection. The following particulars shall be marked on the plate by stamping or by any other similar method. These particulars may be engraved directly on the walls of the shell itself if the walls are so reinforced that the strength of the shell is not impaired.

Country of manufacture .....

Approval number .....

Manufacturer's name or mark .....

Registration number .....

Year of manufacture .....

Test pressure ..... kp/cm^2 (psig)

Maximum allowable working pressure ..... kg/cm^2 (psig)

Capacity[1/] ..... litres (gallons)

Original hydrostatic test date
and witness identification .....

Code to which tank is designed .....

Metallurgical design temperature (only if above
+ 50°C or below - 20°C) ..... °C (.....°F)

Maximum allowable working pressure for coils
(where coils used) ..... kp/cm^2 (psig)

Tank material .....

Lining material (if any) .....

Capacity of each compartment (in
compartmented containers).....

Month, year and test pressure of most
recent periodic test .....

Month, year kp/cm^2 (psig)

Stamp of expert who carried out
most recent test .....

1/ The water capacity should be established to within 1 per cent by practical test rather than by calculation.

31.2. The following particulars shall be inscribed either on the tank-container itself or on a board:

Name of owner or operator .....

Name of substance being carried 1/ .....

Date of the last visual inspection .....

Maximum permissible gross weight ..... kg (pounds)

Unladen (tare) weight ..... kg (pounds)

In addition, tank-containers shall bear the recognized danger symbols.

31.3. Tanks intended and designed for carriage by sea shall be suitably marked on the top portion of the metal plate required by paragraph 31.1 with a symbol representing an "anchor".

31.4. A copy of the certificate specified in paragraph 29.1 shall accompany every shipment for which the tank is used.

32. Carriage requirements

32.1. During carriage, tank-containers shall be adequately protected against lateral and longitudinal impact and against overturning. If the shells and the service equipment are so constructed as to withstand impact or overturning they need not be protected in this way.

Examples of protection of shells against collision:

(1) Protection against lateral impact may consist, for example, of longitudinal bars protecting the shell on both sides at the level of the median line;

(2) Protection against overturning may consist, for example, of reinforcement rings or bars fixed across the frame;

(3) Protection against rear impact may consist, for example, of a bumper or frame.

32.2. Tank-containers shall carry only cargoes specifically authorized by the competent authority.

33. Filling ratios

33.1. Inflammable liquids and low-concentration acids and lyes:

$$\text{Degree of filling} = \frac{97}{1 + \alpha (T_r - t_f)}$$

1/ For carriage by sea the correct technical name is required in accordance with the International Convention for the Safety of Life at Sea. For carriage by land a collective description or an index number may be given instead of the name.

33.2. High-concentration toxic liquids and high-concentration acids and lyes:

$$\text{Degree of filling} = \frac{95}{1 + \alpha (T_r - t_f)}$$

33.3. In these formulae α is the mean coefficient of cubical expansion of the liquid between the mean temperature of the liquid during filling (t_f) and the maximal mean bulk temperature (T_r) and is calculated by the formula:

$$\alpha = \frac{d_{15} - d_{50}}{35 \cdot d_{50}}$$

in which d_{15} and d_{50} are the density of the liquid at 15°C (59°F) and 50°C (122°F) respectively.

33.4. The provisions of paragraphs 33.1 to 33.3 shall not apply to tank-containers whose contents are maintained by means of a heating device at a temperature above 50°C (122°F) during carriage. In such a case the degree of filling at the outset shall be such that, through the action of a temperature regulator, the tank-container is not full to more than 95 per cent of its capacity at any time during carriage.

34. Tank-containers shall not be offered for carriage in an ullage condition liable to produce an unacceptable hydraulic force due to surge within the tank.

35. Tank-containers having residue of lading adhering to the outside of the tank shell shall not be accepted for carriage until cleaned and approved for carriage.

36. Tank-containers found to be leaking or to be damaged to such an extent that the integrity of the tank or its lifting and securing arrangements may be affected shall not be accepted for carriage.

37. Empty tank-containers not cleaned and not gas-free shall comply with the same requirements as tanks filled with the previous substance.

38. Handling requirements

38.1. Fork-lift pockets of tank-containers of 10,000 litres (2,642 gal) or more capacity shall be blanked when the tank is filled.

SPECIAL REQUIREMENTS APPLICABLE TO TANK-CONTAINERS INTENDED FOR THE CARRIAGE OF INFLAMMABLE LIQUIDS (CLASS 3)

39. The following general requirements relate particularly to tank-containers intended for the carriage of inflammable liquids (Class 3). Reference should also be made to the table, in Part II of this document, setting out special requirements for individual substances of this Class.

40. All tank-containers intended for the carriage of inflammable liquids shall be closed tanks and be fitted with relief devices in accordance with paragraphs 18-26.

NOTE: For tank-containers intended for use only on land, the pertinent regulations governing carriage by land may allow open venting systems.

41. In the case of liquids having a vapour pressure of more than 1.75 kg/cm^2 (24.8 psia) (absolute) at 50°C (122°F) and a coefficient of cubical expansion of more than 150 x 10^{-5} the degree of filling for tank-containers shall not exceed 90 per cent.

SPECIAL REQUIREMENTS APPLICABLE TO TANK-CONTAINERS INTENDED FOR THE CARRIAGE OF DANGEROUS GOODS OF OTHER CLASSES

42. Special requirements for the carriage of dangerous goods of all other classes in tank-containers are in preparation and will be published with the corresponding Part II for each class.

PART II

CLASS 3 INFLAMMABLE LIQUIDS[1]

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm^2)	Minimum tank pressures (see para.11) Test (kp/cm^2)	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Acetal	1088	II	-	2.65	2.65	Allowed	-	Normal	-	-
Acetaldehyde	1089	I	-	-	See paras. 11.2. and 11.3.	Allowed	Mild steel, copper, incompatible rubbers	Normal	90%	Load under nitrogen blanket
Acetic acid, over 90%	1842	II	8	4	2.65	Allowed	Mild steel	Normal	See para. 33.2.	See para.17.2.1. for carriage by sea
Acetone	1090	II	-	2.65	2.65	Allowed	Incompatible plastics	Normal	-	-
Acetone oils	1091	II	-	2.65(a) 1.5(b)	2.65(a) 1.5(b)	Allowed	Incompatible plastics	Normal	-	(a) FP below 0°C (b) FP 0°C - 61°C
Acrolein, inhibited	1092	I	6.1	10	4	Not allowed		Special relief, see para. 19.2.1.	See para. 33.2.	Load under nitrogen blanket
Acrylonitrile, inhibited	1093	I	6.1	10	4	Not allowed	All rubbers	Special relief, see para. 19.2.1.	See para. 33.2.	No gloves, etc., made of leather, natural or nitrile rubber to be worn
Alcohol, denatured Alcohol, industrial	1095) 1096)	II II	=	1.5	1.5	Allowed		Normal	-	=
Allyl alcohol	1098	I	6.1	4	4	Not allowed	Rubber copper	Special relief, see para. 19.2.1.	See para. 33.2.	Breathing apparatus to accompany tank
Allyl bromide	1099	I	-	4	4	Not allowed	Aluminium or mild steel for external fittings	Special relief, see para. 19.2.1.	See para. 33.2.	Breathing apparatus to accompany tank

[1] Substances not included in Part II may be carried in accordance with the requirements prescribed by the national competent authority.

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm²)	Test (kp/cm²)	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Allyl chloride	1100	I	6.1	10	4	Not allowed	Aluminium or mild steel for (i) tank, if cargo is wet (ii) fittings at all times	Special relief, see para. 19.2.1.	See para. 33.2.	Breathing apparatus to accompany tank
Amyl acetates	1104	II	-	1.5	1.5	Allowed	Incompatible plastics	Normal	-	
Amyl alcohols	1105	II	-	1.5	1.5	Allowed	Incompatible plastics	Normal	-	
Amyl chloride	1107	II	-	1.5	1.5	Allowed	-	Normal	-	
Amyl formates	1109	II	-	1.5	1.5	Allowed	-	Normal	-	
Amyl mercaptan	1111	II	-	2.65	2.65	Allowed	-	Normal	-	
Amyl methyl ketone	1110	III	-	1.5	1.5	Allowed	Incompatible plastics and rubbers	Normal	-	
Amyl nitrate	1112	II	-	1.5	1.5	Allowed	Incompatible plastics and rubbers	Normal	-	
Amyl nitrite	1113	II	-	2.65	2.65	Allowed	Incompatible plastics and rubbers	Normal	-	
Amylamine	1106	II	-	1.5	1.5	Allowed	-	Normal		
Amylene, normal	1108	I	-		See paras. 11.2. and 11.3.	Allowed	-	Normal		
Benzaldehyde	1990	III	-	1.5	1.5	Allowed	-	Normal		
Benzene	1114	II	-	2.65	2.65	Allowed	Incompatible rubbers	Normal		
Brake fluid, hydraulic	1118	II	-	2.65(a) 1.5 (b)	2.65(a) 1.5 (b)	Allowed	Incompatible rubbers	Normal		(a) FP below 0°C (b) FP 0°C - 61°C
Butanol	1120	II	-	1.5	1.5	Allowed	-	Normal		

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm^2)	Test	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para. 33)	Special requirements
sec. Butanol	1121	II	-	1.5	1.5	Allowed	-	Normal		
tert. Butanol	1122	II	-	1.5	1.5	Allowed	-	Normal		
Butyl acetate, normal	1123	II	-	1.5	1.5	Allowed	Incompatible plastics and rubbers	Normal		
sec. Butyl acetate	1124	II	-	1.5	1.5	Allowed	Incompatible plastics and rubbers	Normal		
Butyl acrylate	*	II	-	2.65	2.65	Allowed	-	Normal		
Butyl bromide, normal	1126	II	-	1.5	1.5	Allowed	-	Normal		
Butyl chloride, normal	1127	II	-	2.65	2.65	Allowed	-	Normal		
Butyl formate, normal	1128	II	-	1.5	1.5	Allowed	-	Normal		
Butylamine, normal	1125	II	-	2.65	2.65	Allowed	Copper, aluminium, zinc, magnesium	Normal		
Butylpropionate	1914	II	-	1.5	1.5	Allowed	-	Normal		
Butyraldehyde	1129	II	-	2.65	2.65	Allowed	-	Normal		
Camphor oil	1130	III	-	1.5	1.5	Allowed	-	Normal		
Carbon disulphide	1131	I	6.1	10	4	Not allowed	Zinc, rubber, incompatible Plastics	Special relief, see para.19.2.1.	See Para. 33.2	Breathing apparatus to accompany tank, load under nitrogen blanket
Cement, adhesive	1133	II	-	2.65(a) 1.5 (b)	2.65(a) 1.5 (b)	Allowed	-	Normal		(a) F.P. below 0°C (b) F.P. 0°C-61°C

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm^2)	Test	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Chlorobenzene	1134	II	-	1.5	1.5	Allowed	All rubbers	Normal		
2-Chloroethanol	1135	II	-	2.65	2.65	Not allowed	-	Special relief, see para. 19.2.1.		Breathing apparatus to accompany tank
Chloroprene, inhibited	1991	I	6.1	4	4	Not allowed	Copper	Special relief, see para. 19.2.1.	See para 33.2	Breathing apparatus to accompany tank
Coal tar distillate	1136	II	-	2.65(a) 1.5(b)	2.65(a) 1.5(b)	Allowed	Copper and its alloys, incompatible plastics, rubbers	Normal		(a) F.P.below 0°C (b) F.P. 0°C-61°C
Coal tar light oil	1137	II	-	2.65(a) 1.5(b)	2.65(a) 1.5(b)	Allowed	Incompatible plastics and rubbers	Normal		(a) F.P.below 0°C (b) F.P.0°C-61°C
Coal tar naphtha	1138	II	-	2.65(a) 1.5(b)	2.65(a) 1.5(b)	Allowed	Incompatible rubbers and plastics	Normal		(a) F.P.below 0°C (b) F.P. 0°C-61°C
Crotonaldehyde, stabilized	1143	II	-	2.65	2.65	Not allowed	-	Normal		Breathing apparatus to accompany tank
Crotonylene	1144	I	-		See paras. 11.2 and 11.3	Allowed	-	Normal		See para.17.2.1. for carriage by sea
Cyclohexane	1145	II	-	2.65	2.65	Allowed	-	Normal		
Cyclohexanone	1915	III	-	1.5	1.5	Allowed	Polythene	Normal		
Cyclopentane	1146	II	-		See paras. 11.2 and 11.3	Allowed	-	Normal		
p-Cymene	2046	II	-	2.65	2.65	Allowed	Incompatible rubbers	Normal		
Decahydronaphthalene	1147	II	-	1.5	1.5	Allowed	-	Normal		
Diacetone alcohol	1148	II	-	1.5	1.5	Allowed	Incompatible plastics	Normal		

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm²)	Test (kp/cm²)	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Dibutyl ethers	1149	III	-	1.5	1.5	Allowed	-	Normal		
Dichloroethyl ether	1916	II	6.1	4	4	Not allowed	-	Special relief, see para 19.2.1.	See para 33.2.	
Dichloroethylene	1150	II	-	2.65	2.65	Allowed	Copper and its alloys	Normal		
Dichloropentanes	1152	II	-	1.5	1.5	Allowed	-	Normal		
Dichloropropene	2047	II		2.65	2.65	Allowed	Incompatible rubbers, aluminium (?)	Normal		
Dicyclopentadiene	2048	II	-	2.65	2.65	Allowed	Incompatible rubbers	Normal		
Diethyl ether	1155	I	-		See paras 11.2. and 11.3.	Not allowed	-	Normal		Load under nitrogen blanket
Diethyl ketone	1156	II	-	1.5	1.5	Allowed	Incompatible plastics and rubber	Normal		
Diethylamine	1154	II	-	2.65	2.65	Allowed	Copper, magnesium, aluminium and their alloys	Normal		See para. 17.2.1. for carriage at sea
1,2-Diethoxyethane	1153	III	-	1.5	1.5	Allowed	Incompatible plastics and rubbers	Normal		
Diethylbenzene	2049	II	-	1.5	1.5	Allowed	Incompatible plastics and rubbers	Normal		

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm²)	Test (kp/cm²)	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Diisobutyl ketone	1157	III	-	1.5	1.5	Allowed	Incompatible rubbers and plastics	Normal		
Diisobutylene	2050	II	-	1.5	1.5	Allowed	-	Normal		
Diisopropylamine	1158	II	-	2.65	2.65	Allowed	Zinc, copper, magnesium, aluminium and their alloys	Normal		See para. 17.2.1. for carriage by sea
Diisopropyl ether	1159	II	-	2.65	2.65	Allowed	-	Normal		
Dimethyl carbonate	1161	II	-	2.65	2.65	Allowed	-	Normal		
Dimethyl sulphide	1164	I	-		See para 11.2. and 11.3.	Allowed	-	Normal		
Dimethylamine 40% solution	1160	II	-	2.65	2.65	Not allowed	Zinc, copper, magnesium, aluminium and their alloys	Normal		
Dimethyldichlorosilane	1162	I	8	10	4	Allowed	Aluminium, mild steel for (1) tank, if cargo is wet (2) fittings at all times	Normal	See para 33.2.	See para. 17.2.1. for carriage by sea
Dimethylethanolamine	2051	II	-	1.5	1.5	Allowed	Copper and its alloys	Normal		
Dimethylhydrazine, unsymmetrical	1163	I	-	4	4	Not allowed	-	Special relief, see para 19.2.1.		
Dioxane	1165	II	-	2.65	2.65	Allowed	Incompatible plastics	Normal		
Dioxolane	1166	II	-	2.65	2.65	Allowed	-	Normal		

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm²)	Test (kp/cm²)	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Dipentene	2052	II	-	1.5	1.5	Allowed	-	Normal		
Dipropylamine	*	II	-	2.65	2.65	Allowed	Zinc, copper, magnesium, aluminium and their alloys	Normal		
Divinyl ether	1167	II	-	4	4	Allowed	Copper and its alloys	Normal		
Driers, paint or varnish in liquid form	1168	II	-	2.65 (a) 1.5 (b)	2.65 (a) 1.5 (b)	Allowed	-	Normal		(a) FP below 0°C (b) FP 0°C - 61°C
Ethanol	1170	II	-	1.5	1.5	Allowed	-	Normal		
2-Ethoxyethanol	1171	III	-	1.5	1.5	Allowed	Incompatible rubbers and plastics	Normal		
2-Ethoxyethyl acetate	1172	II	-	1.5	1.5	Allowed	Zinc and alloys, incompatible plastics	Normal		
Ethyl acetate	1173	II	-	2.65	2.65	Allowed	Copper, incompatible rubbers	Normal		
Ethyl acrylate, inhibited	1917	II	-	2.65	2.65	Allowed	-	Normal		Breathing apparatus to accompany tank. See para. 17.2.1. for carriage by sea
Ethyl amyl ketone	*	III	-	1.5	1.5	Allowed	Incompatible plastics and rubbers	Normal		
Ethyl borate	1176	II	-	2.65	2.65	Allowed	-	Normal		
Ethyl butyl acetate	1177	III	-	1.5	1.5	Allowed	-	Normal		
Ethyl butyl ether	1179	II	-	1.5	1.5	Allowed	-	Normal		
Ethyl butyrate	1180	II	-	1.5	1.5	Allowed	-	Normal		
Ethyl chloroacetate	1181	II	-	2.65	2.65	Allowed	-	Normal		

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. / Test (kp/cm^2)		Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.35)	Special requirements
Ethyl chloroformate	1182	I	6 and 8	To be carried as specified by the competent authorities concerned						
Ethyl crotonate	1862	II	-	1.5	1.5	Allowed	-	Normal	See para. 33.2.	
Ethyl formate	1190	II	-	2.65	2.65	Allowed	-	Normal		
Ethyl hexaldehyde	1191	III	-	1.5	1.5	Allowed	-	Normal		
Ethyl lactate	1192	III	-	1.5	1.5	Allowed	-	Normal		
Ethyl methyl ketone	1193	II	-	2.65	2.65	Allowed	-	Normal		
Ethyl propionate	1195	II	-	1.5	1.5	Allowed	-	Normal		
Ethylbenzene	1175	II	-	1.5	1.5	Allowed	Incompatible plastics and rubbers	Normal		
Ethylbutyraldehyde	1178	II	-	1.5	1.5	Allowed	-	Normal		
Ethyldichlorosilane	1183	II	8	10	4	Not allowed	Aluminium, mild steel for 1. Tank if cargo is wet 2. Fittings at all times	Normal	See para. 33.2.	

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. / Test (kp/cm^2)		Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Ethylene dichloride	1184	II	-	2.65	2.65	Allowed	Aluminium if wet	Normal		
Ethylene glycol monobutyl ether	*	III	-	1.5	1.5	Allowed	Incompatible rubbers and plastics	Normal		
Ethylene glycol monomethyl ether	1188	III	-	1.5	1.5	Allowed	Incompatible rubbers and plastics	Normal		
Ethylene glycol monomethyl ether acetate	1189	III	-	1.5	1.5	Allowed	Zinc and alloys, incompatible plastics	Normal		
Ethyleneimine, inhibited, pure	1185	I	6.1	Not permitted for carriage in tank-containers						
Ethyltrichlorosilane	1196	II	8	10	4	Allowed	Aluminium, mild steel for 1. Tank if cargo is wet 2. Fittings at all times	Normal	See para. 33.2	See para. 17.2.1. for carriage by sea
Extracts and flavourings, liquid	1169 1197	II II	-	$2.65^{(a)}$ $1.5^{(b)}$	$2.65^{(a)}$ $1.5^{(b)}$	Allowed	-	Normal		(a) FP below 0°C (b) FP 0°C-61°C

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm^2)	Test (kp/cm^2)	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Formaldehyde in solutions	1198	II	-	2.65	2.65	Allowed	Carbon steel	Normal		Breathing apparatus to accompany tank
Fuel, aviation, turbine engine	1863	II	-	2.65(a) 1.5 (b)	2.65(a) 1.5 (b)	Allowed	-	Normal		(a) FP below 0°C (b) FP 0°C-61°C
Furfural	1199	II	-	2.65	2.65	Allowed	-	Normal		
Fusel oil	1201	II	-	1.5	1.5	Allowed	-	Normal		
Gas drips, hydrocarbon	1864	II	-	2.65(a) 1.5 (b)	2.65(a) 1.5 (b)	Allowed	-	Normal		(a) FP below 0°C (b) FP 0°C-61°C
Gas oil	1202	II	-	2.65(a) 1.5 (b)	2.65(a) 1.5 (b)	Allowed	-	Normal		(a) FP below 0°C (b) FP 0°C-61°C
Gutta percha solution	1205	II	-	2.65(a) 1.5 (b)	2.65(a) 1.5 (b)	Allowed	-	Normal		(a) FP below 0°C (b) FP 0°C-61°C
Heptane	1206	II	-	2.65	2.65	Allowed	Natural rubber	Normal		
Heptene	*	II	-	2.65	2.65	Allowed	Natural rubber	Normal		
Hexaldehyde	1207	III	-	1.5	1.5	Allowed	-	Normal		
Hexane	1208	II	-	2.65(a) 1.5 (b)	2.65(a) 1.5 (b)	Allowed	Incompatible rubbers and plastics	Normal		(a) FP below 0°C (b) FP 0°C-61°C
Hexene	*	II	-	2.65	2.65	Allowed	Incompatible rubbers	Normal		
Ink, printers	1210	II	-	2.65(a) 1.5 (b)	2.65(a) 1.5 (b)	Allowed	-	Normal		(a) FP below 0°C (b) FP 0°C-61°C
Iron pentacarbonyl	1994	I	6.1	Not permitted for carriage in tank-containers						

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm^2)	Test (kp/cm^2)	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Isobutanol	1212	II	-	1.5	1.5	Allowed	-	Normal		
Isobutyraldehyde	2045	II	-	2.65	2.65	Allowed	-	Normal		
Isobutyl acetate	1213	II	-	1.5	1.5	Allowed	-	Normal		
Isobutylamine	1214	II	-	2.65	2.65	Allowed	Copper	Normal		
Isooctene	1216	II	-	2.65	2.65	Allowed	-	Normal		
Isopentene	*	I	-		See paras. 11.2.and 11.3.	Allowed	Copper and its alloys	Normal		
Isoprene, inhibited	1218	I	-		See paras. 11.2.and 11.3.	Allowed	-	Normal	90%	See para.17.2.1. for carriage by sea
Isopropanol	1219	II	-	1.5	1.5	Allowed	-	Normal		
Isopropyl acetate	1220	II	-	1.5	1.5	Allowed	-	Normal		
Isopropyl nitrate	1222	II	-	Not permitted for carriage in tank-containers						
Isopropylamine	1221	I	-		See paras. 11.2. and 11.3.	Allowed	Copper	Normal		
Isopropylbenzene	1918	II	-	1.5	1.5	Allowed	-	Normal		
Kerosene	1223	II	-	1.5	1.5	Allowed	-	Normal		
Mesityl oxide	1229	II	-	2.65	2.65	Allowed	-	Normal		
Methanol	1230	II	6.1	4	4	Allowed	Incompatible plastics and rubbers	Normal	See para.33.2.	
Methyl acetate	1231	II	-	2.65	2.65	Allowed	Incompatible plastics and rubbers	Normal		

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm²)	Test	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Methyl acetone	1232	II	-	2.65	2.65	Allowed	Incompatible plastics and rubbers	Normal		
Methyl acrylate, inhibited	1919	II	-	2.65	2.65	Allowed		Normal		
Methyl amylacetate	1233	III	-	1.5	1.5	Allowed	Incompatible plastics and rubbers	Normal		
Methyl butyrate	1237	II	-	1.5	1.5	Allowed	-	Normal		
Methyl cyclohexane	*	II	-	2.65	2.65	Allowed	Incompatible plastics and rubbers	Normal		
Methyl cyclohexanone	*	II	-	1.5	1.5	Allowed	Incompatible plastics and rubbers	Normal		
Methyl cyclopentane	*	II	-	2.65	2.65	Allowed	Incompatible plastics and rubbers	Normal		
Methyl formate	1243	I	-		See paras. 11.2. and 11.3.	Allowed	-	Normal	90%	See para. 17.2.1. for carriage by sea
Methyl isobutyl carbinol	2053	II	-	1.5	1.5	Allowed	Incompatible rubbers and plastics	Normal		
Methyl isobutyl ketone	1245	II	-	1.5	1.5	Allowed	Incompatible rubbers and plastics	Normal		

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm²)	Test (kp/cm²)	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Methyl isopropenyl ketone, inhibited	1246	II	-	1.5	1.5	Allowed	Incompatible rubbers and plastics	Normal		
Methyl methacrylate monomer, inhibited	1247	II	-	2.65	2.65	Allowed	Copper, incompatible rubbers	Normal		
Methyl propionate	1248	II	-	2.65	2.65	Allowed	-	Normal		
Methyl propyl ketone	1249	II	-	1.5	1.5	Allowed	Incompatible plastics and rubbers	Normal		
∝ - Methyl valeraldehyde	*	II	-	1.5	1.5	Allowed	-	Normal		
Methyl vinyl ketone	1251	II	-	2.65	2.65	Allowed	Incompatible plastics and rubbers	Normal		
Methylal	1234	II	-	2.65	2.65	Allowed	Incompatible plastics and rubbers	Normal		
Methylamine, aqueous solution	1235	II	-	2.65	2.65	Allowed	-	Normal		
Methylchloromethyl ether	1239	II	-	2.65	2.65	Allowed	-	Normal		
Methyl dichlorosilane	1242	I	8	10	4	Allowed	Aluminium, mild steel for 1. Tank, if cargo is wet. 2. Fittings at all times	Normal	See para.33.2.	See para.17.2.1. for carriage by sea
Methylhydrazine	1244	I	8	10	4	Not allowed	Aluminium, copper	Special relief, see para.19.2.1.	See para.33.2.	
Methytrichlorosilane	1250	II	8	10	4	Allowed	Aluminium, mild steel for 1. Tank, if cargo is wet. 2. Fittings at all times	Normal	See para.33.2.	See para.17.2.1. for carriage by sea

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm²)	Test (kp/cm²)	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Morpholine	2054	II	-	2.65	2.65	Allowed	Copper and its alloys, incompatible rubbers	Normal		
Motor spirit Naphtha, petroleum Natural gasoline Petroleum spirit	1203 1255 1257 1271	II II II II		2.65	2.65	Allowed	Incompatible rubbers	Normal		
Naphtha, solvent	1256	II		1.5	1.5	Allowed	Incompatible rubbers and plastics	Normal		
Nickel carbonyl	1259	I	6.1	**Not** permitted for carriage in tank-containers						
Nitrocellulose solutions	2059 2062	II II	-	2.65	2.65	Not Allowed	Incompatible rubbers and plastics	Normal		
Nitroglycerin, up to 1% solution in alcohol	1204	II	-	Not permitted for carriage in tank-containers						
Nitromethane	1261	II	-	Not permitted for carriage in tank-containers						
Nonane	1920	II	-	1.5	1.5	Allowed	-	Normal		
Octane	1262	II	-	1.5	1.5	Allowed	Incompatible rubbers	Normal		
Paints, etc.	1263	II	-	2.65 (a) 1.5 (b)	2.65 (a) 1.5 (b)	Allowed	-	Normal		(a) FP below 0°C (b) FP 0°C -61°C
Paraldehyde	1264	III	-	1.5	1.5	Allowed	-	Normal		
Pentane	1265	I	-		See paras. 11.2 and 11.3	Allowed	Incompatible rubbers	Normal		(See para.17.2.1. for carriage by sea
Isopentane	1265	I	-		See paras. 11.2 and 11.3	Allowed	Incompatible rubbers	Normal	90%	

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm²)	Test (kp/cm²)	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Perfumery products	1266	II	-	2.65 (a) 1.5 (b)	2.65 (a) 1.5 (b)	Allowed	-	Normal		(a) FP below 0°C (b) FP 0°C - 61°C
α - Picoline	*	II	-	1.5	1.5	Allowed	-	Normal		
β - Picoline	*	II	-	1.5	1.5	Allowed	-	Normal		
Pine oil	1272	III	-	1.5	1.5	Allowed	-	Normal		
Propanal	1274	II	-	1.5	1.5	Allowed	-	Normal		
Propionaldehyde	1275	II	-	2.65	2.65	Allowed	-	Normal		
Propyl acetate, normal	1276	II	-	1.5	1.5	Allowed	Incompatible plastics	Normal		
Propyl chloride	1278	II	-	2.65	2.65	Allowed	-	Normal		
Propyl formates	1281	II	-	2.65	2.65	Allowed	-	Normal		
Propyl nitrate, normal	1865	II	-	Not permitted for carriage in tank-containers						
Propylamine	1277	II	-	2.65	2.65	Not allowed	Copper, zinc, aluminium, magnesium and alloys	Special relief, see para. 19.2.1.		Breathing apparatus to accompany tank
Prophylene dichloride	1279	II	-	1.5	1.5	Allowed	Incompatible plastics and rubbers	Normal		
Propylene oxide	1280	I	-		See paras. 11.2 and 11.3	Allowed	-	Normal		
Propyleneimine	1921	I	-	not permitted for carriage in tank-containers						
Pyridine	1282	II	6.1	2.65	2.65	Not allowed	Copper and its alloys, incompatible rubbers	Special relief, see para. 19.2.1.	See para. 33.2	

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm^2)	Test (kp/cm^2)	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Pyrrolidine	1922	II	-	1.5	1.5	Allowed	-	Normal		
Resin oil	1286	III	-	1.5	1.5	Allowed	-	Normal		
Resin solution	1866	II	-	2.65 (a) 1.5 (b)	2.65 (a) 1.5 (b)	Allowed	-	Normal		(a) FP below 0°C (b) FP 0°C - 61°C
Rubber solution	1287	II	-	2.65 (a) 1.5 (b)	2.65 (a) 1.5 (b)	Allowed	-	Normal		(a) FP below 0°C (b) FP 0°C - 61°C
Shale oil	1288	II	-	2.65 (a) 1.5 (b)	2.65 (a) 1.5 (b)	Allowed	-	Normal		(a) FP below 0°C (b) FP 0°C - 61°C
Sodium methylate solutions in alcohol	1289	II	-	2.65	2.65	Allowed	Tin, zinc, lead, aluminium	Normal		See para. 17.2.1. for carriage by sea
Styrene monomer, inhibited	2055	II	-	1.5	1.5	Allowed	Copper and its alloys	Normal		
Tars, liquid, etc.	1999	II	-	1.5	1.5	Allowed	-	Normal		
Tetraethyl silicate	1292	II	-	2.65	2.65	Allowed	-	Normal		
Tetrahydrofuran	2056	II	-	2.65	2.65	Allowed	Incompatible rubbers	Normal		
Toluene	1294	II	-	1.5	1.5	Allowed	Incompatible rubbers and plastics	Normal		
Triethylamine	1296	II	-	2.65	2.65	Allowed	Copper, zinc, aluminium, magnesium, and their alloys	Normal		
Trimethylamine, aqueous solutions containing not more than 30% trimethylamine	1297	II	-		See paras. 11.2 and 11.3 (2.65 min.)	Allowed	Copper, zinc, magnesium and their alloys	Normal		

CLASS 3 INFLAMMABLE LIQUIDS

Substance	United Nations number and group		Additional labels required	Minimum tank pressures (see para.11) Calc. (kp/cm^2)	Test	Bottom openings	Known unsuitable materials for tank and fittings	Pressure relief requirements	Degree of filling (see para.33)	Special requirements
Trimethylchlorosilane	1298	I	8	10	4	Allowed	Copper, aluminium, mild steel when wet	Normal	See para. 33.2	See para. 17.2.1. for carriage by sea
Tripropylene	2057	II	-	1.5	1.5	Allowed	Incompatible rubbers	Normal		
Turpentine	1299	III	-	1.5	1.5	Allowed	Incompatible rubbers and plastics	Normal		
Turpentine substitute	1300	II	-	1.5	1.5	Allowed	Incompatible rubbers and plastics	Normal		
Valeraldehyde	2058	II	-	1.5	1.5	Allowed	-	Normal		
Vinyl acetate, inhibited	1301	II	-	2.65	2.65	Allowed	Copper and its alloys	Normal		
Vinyl ethyl ether, inhibited	1302	I	-	4	4	Allowed	Copper and its alloys	Normal		
Vinyl isobutyl ether, inhibited	1304	II	-	2.65	2.65	Allowed	Copper	Normal		
Vinylidene chloride, inhibited	1303	I	-		See paras. 11.2 and 11.3	Allowed	Copper and its alloys	No vacuum relief valve		Air to be eliminated by nitrogen or other means
Vinyltrichlorosilane, inhibited	1305	I	8	10	4	Allowed	Aluminium, copper, mild steel when wet	Normal	See para. 33.2	See para. 17.2.1. for carriage by sea
Xylenes	1307	II	-	1.5	1.5	Allowed	Incompatible plastics and rubbers	Normal		

Annex 2

INFORMATION SHEET FOR NEW SUBSTANCES
TO BE ADDED TO THE LISTS

Chemical name:

Other names:

Formula:

Proposed classification: Class _____ Group _____

Physical state: Solid ☐ Liquid ☐ Gas ☐

	°C	°F
Boiling point		
Melting point		

Fire hazard:

Flash-point _____ °C _____ °F Open cup ☐ Closed cup ☐

Toxicity:

LD_{50} oral _____ mg/kg

LD_{50} dermal _____ mg/kg

LC_{50} inh. _____ ml/m^3 (ppm) _____ mg/l

Corrosion: Animal (skin) Positive ☐ Negative ☐

Steel _____ mm/year, _____ in/year

Aluminum _____ mm/year, _____ in/year

Oxidizer: Strong ☐ Medium ☐ Weak ☐

Self-Reactive or polymerize: Violent ☐ Medium ☐ Low ☐

Other hazards

Commercial importance of the product

Remarks

Annex 3 - Annexe 3

CLASSIFICATION

Enumeration of substances not included in the lists

Additions adopted by the Group

Enumération des matières non incluses dans les listes

Additions adoptées par le Groupe

Class, Division, Sub-Division/Serial Number Classe, Division, Subdivision/Numéro d'ordre	Substance (or Group of substances) Article (or Group of articles)	Matière (ou groupe de matières) Objet (ou groupe d'objets)	Subsidiary risk (Class, etc.) Risque subsidiaire (Classe, etc.)	Packaging Group Groupe d'emballage
(a)	(b)	(c)	(d)	(e)
4.2.0/2216	Fish scrap, fish meal, antioxidant treated 1/	Déchets, farine de poisson, traités avec un anti-oxydant 1/		IV
4.2.0/2217	Seed cakes, containing not more than 1.5% of oil and 11% moisture 1/	Tourteaux ne contenant pas plus de 1,5 % d'huile et 11 % d'humidité 1/		IV
8.0.0/2218	Acrylic acid	Acide acrylique		II
3.0.0/2219	Allyl glycidyl ether	Ether allylglycidique (allyloxy-1 éposy-2,3, propane)	6.1	III
4.2.0/2220	Aluminium alkyl halides, in solution	Halogénures d'aluminium alkyles, en solution		II
4.2.0/2221	Aluminium alkyl halides, (pure)	Halogénures d'aluminium alkyles, purs		I

1/ Note by the Secretariat : See E/CN.2/CONF.5/53, annex 2.
Note du Secrétariat : Voir E/CN.2/CONF.5/53, annexe 2.

(a)	(b)	(c)	(d)	(e)
3.0.0/2222	Anisole	Anisole		III
8.0.0/2223	Aryl sulphonic acids	Acides aryl sulphoniques		II
6.1.0/2224	Benzonitrile (phenyl cyanide)	Benzonitrile		II
6.1.0/2225	Benzene sulphonyl chloride	Chlorure de benzène, sulfonyle		III
6.1.0/2226	Benzotrichloride (benzo sulphochloride)	Chlorure de benzylidine (trichlorométhylbenzène)		II
3.0.0/2227	n-Butyl methacrylate	n-Méthacrylate de butyle		III
6.1.0/2228	Butyl phenols, liquid	Butyl phénols liquides		III
6.1.0/2229	Butyl phenols, solid	Butyl phénols solides		III
6.1.0/2230	Chlorinated anthracene oil	Huile d'anthracène chlorée		II
2.0.0/2231	Carbon dioxide compressed	Dioxyde de carbone comprimé		-
6.1.0/2232	Chloroacetaldehyde	Aldéhyde chloracétique		II
6.1.0/2233	p-Chloro-o-anisidine	p-Chloro-o-anisidine		III
3.0.0/2234	Chlorobenzotrifluorides	Trifluorures de chlorobenzylidine		III
6.1.0/2235	p-Chlorobenzyl chloride	Chlorure de p-chlrobenzyle		III
6.1.0/2236	3-Chloro-4-methylphenyl-isocyanate	Isocyanate de chloro-3, méthyl-4 phényle (Isocyanate de chlorotoluylène)		II
6.1.0/2237	Chloronitroanilines	Chloronitranilines		III
-	3-Chloroprop-1-ene see "Allyl chloride" -3.0.0/1100	Chloro-3 propène voir "Chlorure d'allyle" -3.0.0/1100		
3.0.0/2238	Chlorotoluenes	Chlorotoluènes		III
6.1.0/2239	Chlorotoluidines	Chlorotoluidines		III
8.0.0/2240	Chromosulphuric acid	Acide sulfochromique		I

(a)	(b)	(c)	(d)	(e)
3.0.0/2241	Cycloheptane	Cycloheptane		II
3.0.0/2242	Cycloheptene	Cycloheptène		II
3.0.0/2243	Cyclohexyl acetate	Acétate de cyclohexyle		III
3.0.0/2244	Cyclopentanol	Cyclopentanol		III
3.0.0/2245	Cyclopentanone	Cyclopentanone		II
3.0.0/2246	Cyclopentene	Cyclopentène		II
3.0.0/2247	n-Decane	n-Décane		III
8.0.0/2248	Di-(n-butyl) amine	di-n-Butylamine	3	II
6.1.0/2249	sym - Dichlorodimethyl ether */	Ether dichloro-diméthylique */		I
-	Dichlorophenols see "Chlorophenols" -6.1.0/2020 and 2021	Dichlorophénols voir "Chlorophenols" -6.1.0/2020 et 2021		III
6.1.0/2250	Dichlorophenyl isocyanates	Isocyanates de dichlorophényle		II
3.0.0/2251	Dicycloheptadiene	Dicycloheptadiène		II
3.0.0/2252	1,2-Dimethoxyethane	Diméthoxy-1,2 éthane (Ether diméthylique de l'éthylène glycol)		II
6.1.0/2253	N,N-Dimethylaniline	N,N-Diméthylaniline		II

*/ The transport of this substance should be prohibited except with special authorization granted by the competent authorities.

*/ Le transport de cette matière devrait être interdit sauf permission spéciale délivrée par les autorités compétentes.

Annex 4

ORGANIC PEROXIDES

Amendments to Supplement 1973 of the Recommendations (ST/ECA/81/Rev.2/Amend.1) adopted by the Group

Pages 133 and 211

Add the following entry:

"5.2.0/2254	Samples, organic peroxides 1/	Echantillons de peroxydes organiques 1/"

with the following footnote: 1/

"1/ Samples of new or existing organic peroxides may be transported and shipped as directed by the competent authorities.	1/ Les échantillons de peroxydes organiques nouveaux ou existants peuvent être transportés et chargés selon les instructions des autorités compétentes."

Page 245

A footnote to be added to title

"1. GENERAL PACKING REQUIREMENTS APPLICABLE ..."

"*/ In the case of organic peroxides of division 5.2, special packaging requirements are detailed in Annex 2, Appendix 2."

Page 387

The existing text of "II. CONTROLLED TEMPERATURE REQUIREMENTS" should be replaced by the following:

"1. The recommendations concerning the refrigeration of certain specified organic peroxides are based on the assumption that the temperature in the immediate surroundings of the package does not exceed 55°C during transport and that this temperature only prevails during a relatively short time per 24 hours.

2. Since the maximum ambient temperature will be experienced only for a brief period on any day, a self-acceleration decomposition temperature test at a lower temperature than the theoretical maximum, but for a prolonged period is appropriate. The test is carried out at 50°C for at least 168 hours.

3. If the organic peroxide does not show evidence of self-accelerating decomposition at this temperature, temperature control is not required.

4. If the organic peroxide shows signs of self-accelerating decomposition at 50°C, temperature control is required for

(a) those with a "E" mark

(b) those which react violently during the test.

5. Other organic peroxides are then tested at 45°C for at least 168 hours. Those which are stable at this temperature are exempt from temperature control. Those which are unstable at this temperature are subject to temperature control.

6. The SADT temperature for organic peroxides is to be determined by conducting the tests at 5°C intervals. The control temperature is derived as follows:

	SADT	Control temperature
A	20°C. or less	Deduct 20°C from SADT
B	Over 20°C to 35°C.	" 15°C " "
C	Over 35°C	" 10°C " "

7. The self-accelerating decomposition temperature (SADT) is defined for the purpose of organic peroxides as the lowest temperature at which self-accelerating decomposition may occur in the package used in transport. This should be determined in any suitable manner such as to be representative of the commercial packaging used.

8. Organic peroxides, listed with an E mark, and reacting violently, in the tests for the determination of the thermal stability (different from SADT tests), should be stable at 50°C for a period of at least 7 days to be acceptable for transportation without temperature control. Those organic peroxides listed without an E mark, and reacting only mildly in the tests for the determination of the thermal stability, should be stable at 45° for a period of at least 7 days to be acceptable for transportation without temperature control.

9. The temperature of those organic peroxides for which no controlled temperature is indicated must not at any time reach a value at which the substance will come to a self-accelerating decomposition under the transport conditions.

10. The organic peroxides for which a controlled temperature is indicated should be carried under conditions of adequate refrigeration such that the temperature of the immediate surroundings of the package(s) as indicated is not exceeded. In some climatic regions the competent authority may indicate that during a specified season artificial refrigeration may be dispensed with.

11. When a journey is to take place in a country in which a higher temperature in the immediate surroundings of the package(s) is to be expected, the competent authority should indicate adequate measures to control the temperature in the immediate surroundings of the packages of those organic peroxides which will come to a self-accelerating decomposition at this higher temperature.

12. Liquid air or liquid oxygen must not be used as a refrigerant.

The refrigeration temperature must be selected so as to avoid any dangerous separation of phases."

Page 389

A footnote to be added to title "IV. PACKAGING"

"1/ In the case of organic peroxides, the different levels of package testing may, at the discretion of the competent authority, be relaxed."

Add the following sentence to paragraph 5:

"Vented packages shall be clearly marked to indicate that they should be stowed upright."

Page 390

Add the following sentence after first sentence of paragraph 8:

"However the hydraulic pressure test where specified for the packaging type used shall be omitted."

Add a sub-paragraph to paragraph 8:

"In the case of packagings requiring leak testing where these packages require to be vented in use, the leak test will be carried out with a non-vented closure fitted."

Add a second sub-paragraph to paragraph 8:

"In the case of the stacking test the maximum heigh to be taken into consideration is 3m in all cases."

Page 391

After 5.2.0/2090, insert additional entry as follows:

"Less than 35% with finely ground starch is exempt".

Page 392

5.2.0/2093 - Under column (4), add:

"50 ****/

with the footnote:

"**** / Under conditions laid down by the competent authority and providing that steps have been taken to achieve the safety equivalency of 35% water and 65% TBHP."

Page 393

5.2.0/2109 - Delete entry.

Page 395

5.2.0/2153 - Under column (3), replace: "temperature of -10°C" by "-15°C".

Page 396

5.2.0/2144 - Under column (2), add "E".

Page 398

Add new item:

"5.2.0/2254 Samples, organic peroxides 1/"

with the footnote:

"1/ Samples of new or existing organic peroxides may be transported and shipped as directed by the competent authorities."

Page 401

Packaging No. 27, add the following footnote after 125 kg:

"1/ For substance 5.2.0/2135 the maximum contents of the whole package is 545 kg."

Page 403

Packaging No. 48, add the following footnote after 100 kg:

"1/ For substance 5.2.0/2131 the maximum contents of the whole package is 220 kg."

Annex 5

REPORT OF THE SPECIAL WORKING GROUP ON HAZARD INFORMATION SYSTEMS

1.0 Introduction

1.1 The special working group on Hazard Information Systems (HIS), comprising the Rapporteurs or observers or their advisers from Canada, the Federal Republic of Germany, the Netherlands, the Union of Soviet Socialist Republics, the United Kingdom and the United States of America and of representatives of CEFIC, IATA, ICS, IMCO, IRU and OCTI, met at Geneva on 8 and 9 August, as requested by the Group of Rapporteurs.

1.2 The objective of this group was to develop a statement of principles and criteria concerning HIS for consideration by the Group of Rapporteurs and the Committee of Experts. The ultimate objective of this statement is to develop a recommendation for a HIS that would be generally used during the transportation of dangerous goods throughout the world by railway, highway, air or marine transportation services for all types of commodities and consignments with certain exceptions to be decided by the Committee.

1.3 The special group is pleased to report the following:

2.0 General

2.1 Hazard Information Systems can be designed to meet a variety of needs. For example two types of needs can be distinguished: the need for action-oriented guidance or instruction and the need for general information dissemination. The former type of need is met by a system designed to provide precise and specific "do this" or "use that" instructions, whereas the latter provides much more generalized instructions. Inevitably, the former system tends to be briefer or more concise - particularly in the reference or interpretative documentation.

2.2 The circumstances in which a HIS is expected to function are also variable. Again two types of circumstances can be distinguished - on the one hand, where high level emergency response organizations are generally available, and on the other where emergency response may have to be undertaken by a range of agencies having differing levels of sophistication, training and resources. Obviously, the HIS for the former set of circumstances can be more precise and of the "action" type. The HIS most suitable for the second set of circumstances has to be more general, with less specific instructions which allow for tolerance and will enable "response" improvisation.

2.3 In fact, a combination of these needs and circumstances tended to crystalize the group into three groups - those whose support was given to the "action" type of need responding in the "high level" ERO circumstances; those whose support was given to the "general information" type of need responding to the "low level" ERO circumstances; and inevitably those who supported the interim position. The question as to which system should be recommended was not resolved.

2.4 Superimposed above this problem lay another unresolved issue. In this instance the issue concerned the application of the HIS to "bulk" goods or to all goods including packaged goods. The supporters of the former group correctly argued that bulk goods tend to create the major incidents which individually provide more serious hazards. The proponents of the second course argued that in total terms the many and frequent minor incidents involving packaged freight probably resulted in a much greater economic loss overall and caused more suffering and injury. It was also discussed, but not resolved, whether a system designed to meet the needs of "bulk" incidents could adequately meet the needs of the "packaged" incidents.

2.5 Two proposals for discussion were presented:

2.5.1 that the United Nations recommendation respecting the HIS should comprise the display of the United Nations label and the United Nations commodity number and any one or more of the Hazchen, ADR or US HI codes.

2.5.2 that the United Nations recommendation respecting the HIS should call for:

2.5.2.1 a general "low level" HIS based upon an abbreviated (perhaps 2 digit) code and a supporting information system giving general guidance to emergency response personnel and others, with the information system to be prepared by individual countries, if desired, in their own languages and technical terms and meeting the needs of their EROs, according to general recommendations drafted by the Committee. This system would be applicable to all consignments for which the display of danger labels is recommended by the Committee and the abbreviated code could be displayed in the lower portion of these labels.

2.5.2.2 For certain dangerous goods (perhaps whole packaging groups of selected classes) and for goods shipped in bulk the United Nations commodity number should be displayed on the package on a supplementary orange label and on the vehicle on a supplementary orange placard. Individual countries or groups of countries based upon their own needs or upon international agreements may specify that an additional HIS shall be displayed above the United Nations number on the supplementary label or placard. Where this supplementary HIS is so required, then for any consignments entering those countries, the country making the requirements shall appoint an agency to affix the supplementary HIS code in the designated place wherever it does not already appear.

2.6 With these divergent views more clearly defined as a result of the two days' discussions, the group concluded (except as noted) that the following principles were valid for the design of a HIS. It was not possible to rank these principles, and the order in which they are recorded does not indicate their relative importance.

3.0 Principles

3.1 The HIS should be capable of implementation and use throughout the world.

3.2 The HIS should be capable of application, or should provide the general basis for a HIS application, in all of the major modes of transport - railway, highway, air and marine.

3.3 The HIS should be equally applicable to all types of consignments and commodities with certain exceptions to be decided by the Committee.

3.4 The essential elements of the HIS should be present in documentation, labelling and placarding in order to provide continuity.

3.5 The HIS should provide a basic warning to the public and to transportation workers to remove themselves and any injured persons to a safe place and to notify the appropriate emergency response organization.

3.6 The HIS should include as an integral part the recommendations with respect to labelling.

3.7 The HIS should include the United Nations commodity number in order that complete information will be available.*/

3.8 The HIS should include, in all cases, an abbreviated code to provide guidance for countermeasures in incidents by the ERO and perhaps skilled transportation workers.

3.9 The HIS abbreviated code for reasons of multilingual applicability should be non-alphabetic (i.e. numerical or numerical/symbolic).**/

3.10 The first digit of the abbreviated code should correspond to the United Nations class number.***/ ****/

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*/ The Rapporteur from the United States of America expressed concern over the use of the United Nations serial number for a HIS, particularly as regards the present state of serial number assignments and providing serial number information to the EROs.

**/ The Rapporteur from the United Kingdom recognizes that it may be generally desirable to avoid using Latin characters in a HIS code recommended for international adoption but there may be overriding need for the avoidance of confusion in communications to adopt a combination of letters and figures.

***/ The Rapporteur from Canada said he could not support the use of the United Nations class number as the first digit of the abbreviated code because the United Nations class system confused physical and hazard properties of substances. He believed that that unnecessarily restricted the viability of a two-digit system as a system for the rational grouping of materials for the purposes of disseminating hazard information, including countermeasure instructions.

****/ The Rapporteur from the United Kingdom wished to be noted as opposing the principle.

3.11 The HIS should be displayed in such a manner as to be uniquely identifiable.

3.12 The HIS should be usable for training procedures and for operational control measures by shippers and transporters.

3.13 The HIS should present (according to the level of sophistication of the system selected for recommendation) the optimum amount of information retainable and transmissible to the ERO for its appropriate response to the immediate problem.

3.14 Depending upon the level of sophistication for the HIS ultimately selected, the HIS should be capable of functioning without reference to a high order ERO in some types of instances.

3.15 The cost of the HIS, relative to its potential benefit, should be low enough to encourage its use.

3.16 Where possible, the HIS should assist the ERO in determining the need for personnel evacuation or withdrawal.

3.17 In addition to these general principles the special group arrived at the following specific conclusions.

4.0 Specific conclusions

4.1 Regardless of the level of sophistication of the ERO selected for recommendation, the HIS will require reference to some secondary or interpretative information to support the minimal information presented on the label(s) and/or placard(s).

4.2 Depending on the full coverage of the HIS to all or only some commodity groups or types of consignments, some modifications might be necessary to the United Nations labelling recommendations:

4.2.1 For presentation of an abbreviated code for all consignments consideration could be given to including that code in the lower half of the label.*/

In this case, where the United Nations commodity number is also to be shown it alone could be displayed in an appropriate supplementary manner.**/

4.2.2 Alternatively the abbreviated code could always be shown on a supplementary label with, as required, the United Nations commodity number.

4.2.3 Alternatively a new overall multi-area label/placard could be recommended providing definite individual areas for a reproduction of the United Nations label.

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*/ The Rapporteurs from the United States of America and Italy indicated their preference for this approach over those in 4.2.2 and 4.2.3, since the label is the focal point of attention.

**/ The Rapporteur from the Union of Soviet Socialist Republics was of the opinion that it should also be possible to indicate this number in the lower half of the label.