

Marking and Colour Coding of Gas Cylinders, Quads and Banks for Diving Applications



The International Marine Contractors Association (IMCA) is the international trade association representing offshore, marine and underwater engineering companies.

IMCA promotes improvements in quality, health, safety, environmental and technical standards through the publication of information notes, codes of practice and by other appropriate means.

Members are self-regulating through the adoption of IMCA guidelines as appropriate. They commit to act as responsible members by following relevant guidelines and being willing to be audited against compliance with them by their clients.

There are two core activities that relate to all members:

- ◆ Safety, Environment & Legislation
- ◆ Training, Certification & Personnel Competence

The Association is organised through four distinct divisions, each covering a specific area of members' interests: Diving, Marine, Offshore Survey, Remote Systems & ROV.

There are also four regional sections which facilitate work on issues affecting members in their local geographic area – Americas Deepwater, Asia-Pacific, Europe & Africa and Middle East & India.

IMCA D 043

This guidance supersedes AODC 016 Rev. 1 published in March 1994, which is now withdrawn.

www.imca-int.com/diving

The information contained herein is given for guidance only and endeavours to reflect best industry practice. For the avoidance of doubt no legal liability shall attach to any guidance and/or recommendation and/or statement herein contained.

Marking and Colour Coding of Gas Cylinders, Quads and Banks for Diving Applications

IMCA D 043 – November 2007

1	Scope	1
2	Objective	1
3	Application	1
4	Comment	1
5	Marking, Labelling and Colour Coding	1
	5.1 Individual Cylinders	2
	5.2 Portable Quads	2
	5.3 Large Gas Storage Banks.....	2
6	Gas Suppliers Quads	2
7	Gas Sampling	2

Appendices

1	Diving Industry Commonly Accepted Colour Coding	3
2	Gas Mixtures for Medical or Inhalation Purposes	4
3	Some Typical Examples of Quads and Banks	5
4	A Typical Example of a Cylinder Labelling System	6

1 Scope

This guidance addresses the marking and colour coding of diving gas cylinders, quads and banks containing gases which:

- i) may be supplied direct to the diver;
- ii) may not be supplied direct to the diver but are manufactured to diving quality standards for incorporation into breathing mixtures.

It does not apply to pipework.

2 Objective

Colour coding is used primarily to identify the hazard associated with the contents of a cylinder. Individual cylinder labelling is the primary means of identifying the contents of the cylinder. The objective of this guidance is to enable anyone working with gas cylinders to be able to clearly identify the nature of the contents by means of the relevant markings on the cylinder or quad and/or from the connection point of large banks where the contents are not visible to the operator.

3 Application

This guidance is applicable internationally, but national regulations/standards will normally prevail.

4 Comment

There are many national standards, codes, guidance and information sheets pertaining to the marking and colour coding of gas cylinders which may be used in diving operations. Some examples are BS EN 1089-3:2004, IMO Code of Safety for Diving Systems, British Compressed Gases Association TIS 6, HSE Diving Information Sheet No. 3 but many more national standards are in existence i.e. USA, Russia, China, Japan etc. It would be impossible for any standard or guidance to be exhaustive and cover all gases and gas combinations. This guidance attempts to summarise, at Appendix 1, the requirements of the relevant standards and in addition provides some practical advice on their interpretation and application. Whilst no chemical symbols exist for gas mixtures (as opposed to compounds), those used in Appendix 1 are accepted throughout the industry. Some typical examples of quad and bank configurations are shown at Appendix 3.

5 Marking, Labelling and Colour Coding

The guidance given in this section should be applied in line with Appendix 1 and Appendix 2.

Identification colours should be marked on the cylinder shoulders where possible. The cylinder body may be colour coded for other purposes, e.g. high visibility. However, the use of a colour on the cylinder which allows misinterpretation of the hazard should be avoided.

Individual cylinders should be appropriately labelled to identify the contents (see Appendix 4).

Cylinders, quads and banks should be:

- i) marked with the chemical symbol of the gas they contain and, where the gas is a mixture, the percentage by volume, quoting percentage of oxygen first;
- ii) marked with the words "DIVING QUALITY" in the case of gases for incorporation into breathing mixtures. This is to differentiate them from gases for other uses;
- iii) colour coded as appropriate to their method of use as defined in sub-sections 5.1-5.3.

Where two-colour and three-colour combinations are used on quads and banks, it is important that all the colours are incorporated as compactly as possible as personnel operating valves are of necessity in very close

proximity to the unit and therefore have a limited field of vision. Colours should, therefore, be applied to the frames in short (8in/20cm maximum) alternating bands (see Appendix 3 Figure 1B).

5.1 Individual Cylinders

Gas cylinders to be used individually must be marked and colour coded as appropriate. The latest test date stamped on the cylinders should be highlighted with a small patch of distinctive colour.

5.2 Portable Quads

Units which are formed of a number of cylinders securely packaged together are commonly called 'quads' (see Appendix 3 Figure 1). In general, quads are made up of cylinders containing the same gas in which case only the outer layer of cylinders need be fully colour coded. Where colour coding involves two or more colours, these may be marked on the quad frame instead of the cylinder shoulder. Where quads comprise cylinders containing different gases such as for therapeutic use, each cylinder must be marked and colour coded as appropriate.

In order to differentiate between air and nitrox quads, which have the same colour coding, the outer layer of cylinders should be marked with "AIR DIVING QUALITY" or "% OXYGEN and % NITROGEN DIVING QUALITY", as appropriate.

5.3 Large Gas Storage Banks

The two typical types of large storage banks in common use are indicated below together with the method of marking which should be applied.

5.3.1 Where the cylinder shoulder is visible but the body is not (see Appendix 3 Figure 2):

Each cylinder shoulder must be marked and colour coded as appropriate. Where a large bank is used to house cylinders containing the same gas, it may be appropriate to mark and colour code the frame instead of the cylinder shoulders.

5.3.2 Where cylinders are completely encapsulated within the framework and only the valves/connection points protrude through the 'face' of the bank (see Appendix 3 Figure 3):

There should be a round 'flag' of at least 8in/20cm diameter painted in quarters or thirds with the appropriate colour coding, immediately adjacent to the valve/connection point of each cylinder.

6 Gas Suppliers Quads

It is appreciated that shoulder and body painting, even of outer layers, may not be practical due to the need for rapid turnaround. As an alternative, therefore, the marking and colour coding may be applied to the quad frame in line with this guidance.

7 Gas Sampling

Sampling of all gases must be carried out prior to the commencement of, and during, diving operations.

Gas cylinders and quads as received from the supplier should have a label attached and a purity certificate stating the composition of the gas they contain. However, it is stressed that analysis of gas as received from a supplier to a diving installation or site is the responsibility of a nominated and competent individual, and that the ultimate authority for establishing the exact contents of any gas cylinder, bank or unit before use rests with the relevant supervisor.





Diving Industry Commonly Accepted Colour Coding

Gas	Symbol	Typical shoulder colours	Cylinder shoulder	Quad upper frame/ frame valve end
Helium	He		Brown	Brown
Medical oxygen	O ₂		White	White
Oxygen and helium mixtures	O ₂ /He		Brown and white quarters or bands	Brown and white short (8in/20cm) alternating bands
Nitrogen	N ₂		Black	Black
Oxygen/helium/ nitrogen mixtures	O ₂ /He/N ₂		Black, white and brown quarters or bands	Black, white and brown short (8in/20cm) alternating bands
Air (breathing) Oxygen/nitrogen mixtures	Air N ₂ /O ₂		Black and white quarters or bands	Black and white short (8in/20cm) alternating bands
Carbon dioxide	CO ₂		Grey	Grey
Calibration gases ¹	As appropriate		Pink	Pink

Notes:

- ¹ The colour coding of cylinders containing calibration gases may vary from the above. In addition, some are marked with yellow shoulders for toxic contents and red shoulders for flammable contents. Labels and marking should be carefully checked before use.

Gas Mixtures for Medical or Inhalation Purposes

Gas type		Example cylinder shoulder colours	
Air or synthetic air $20\% \leq O_2 \leq 23\%$			White RAL 9010 Black RAL 9005
Helium/oxygen	He/O ₂		White RAL 9010 Brown RAL 8008
Oxygen/carbon dioxide	O ₂ /Co ₂		White RAL 9010 Grey RAL 7037
Oxygen/nitrous oxide	O ₂ /N ₂ O		White RAL 9010 Blue RAL 5010

Notes:

The above table taken from the British Compressed Gases Association TIS 6 shows example cylinder shoulders colour coded with concentric bands but this may alternatively be painted in quarters around the shoulder.

The colour codes shown in this table are generally for medical use and although they all may be seen on cylinders from gas suppliers, some are unlikely to be in general use in an offshore diving environment.

The colour codes in this table indicate the general nature of the gas and not necessarily the specific gas contained within. For example bright green indicates an inert gas and light blue indicates an oxidising gas.

Some Typical Examples of Quads and Banks

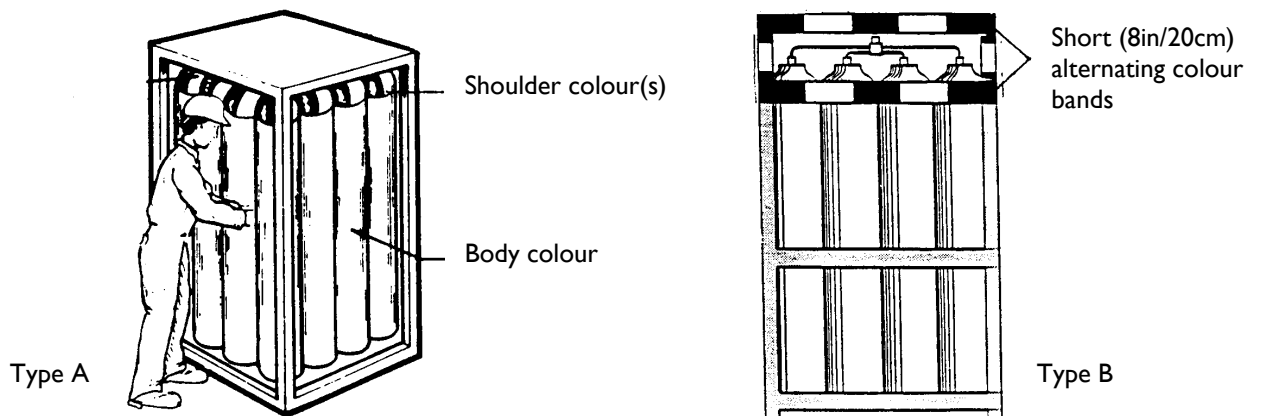


Figure 1 – Typical quads where body and shoulder are visible to operator

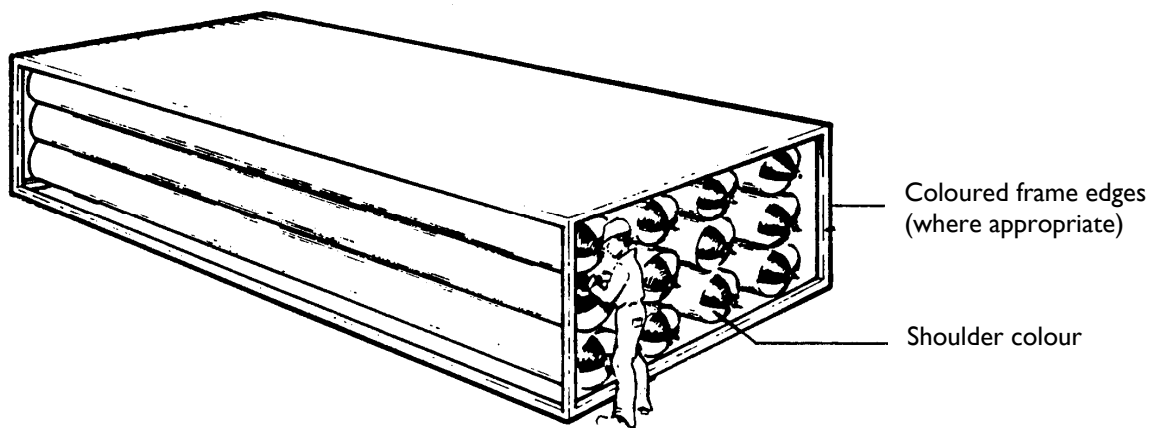


Figure 2 – Large bank where shoulder is visible to operator at valve position but body may not be visible

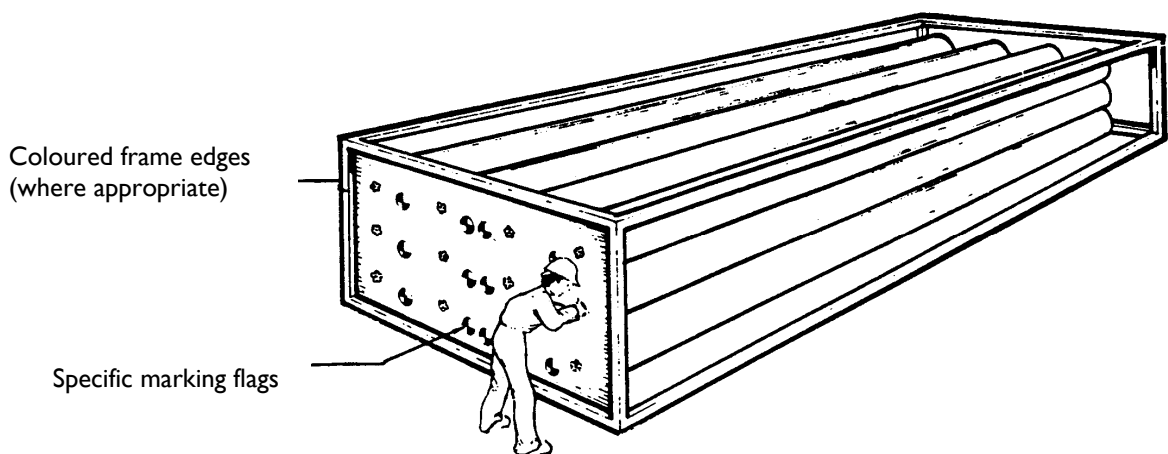
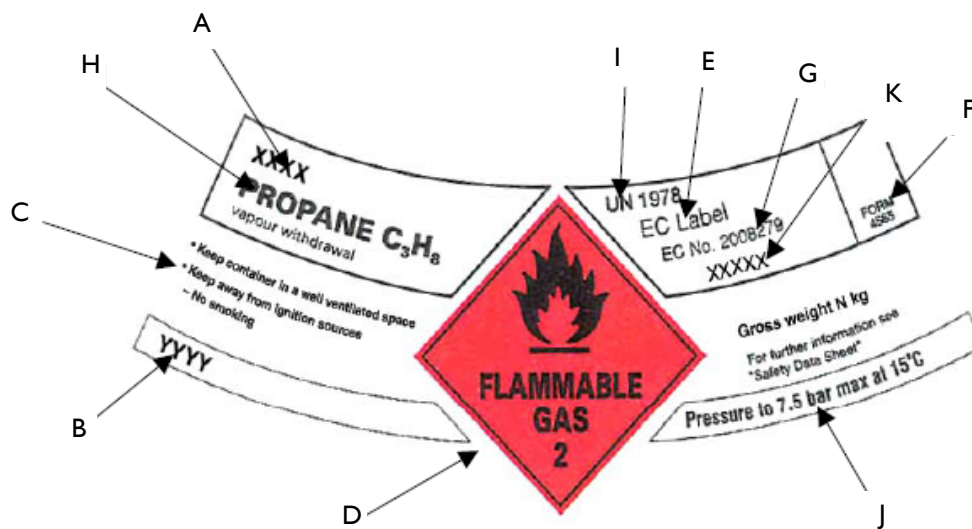


Figure 3 – Containerised or built-in banks where cylinder is not visible to operator (i.e. body or shoulder)

A Typical Example of a Cylinder Labelling System



- A Company name
- B Address of the company
- C Risk and safety phrases relating to the product
- D Hazard symbols
- E EC label (for pure substances only)
- F Revision number (gas company use to identify label revision)
- G EC number, if applicable
- H Product name
- I UN identification number and proper shipping name (given by product name)
- J Any additional company information
- K Emergency contact telephone number

The above label example is based on the British Compressed Gases Association TIS 6 – *Cylinder Identification Colour Coding and Labelling Requirements*.

Labelling systems and requirements may vary depending upon the region of operation.