

Diver Attachment to Structures by Means of a Weak Link



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AODC 058

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1 Introduction

With the increasing complexity of operational requirements and the sophistication of techniques used, the necessity is recognised of divers being able to secure themselves to a structure in order to be able to carry out certain tasks. The availability is therefore required of a safe and reliable weak link device which has been appropriately evaluated and will break or release at a predetermined load.

Trials were carried out on behalf of AODC by the National Hyperbaric Centre and Comex UK to identify a suitable device(s). A report has been prepared (Ref. 1), the conclusions of which are reflected in this guidance note.

Apart from the specific 'touch and close' type fastening materials quoted in this note, the other proprietary brand names used are purely for convenience in identifying the type of equipment referred to.

2 Design Requirements of a Weak Link

In order to meet the required standard of safety a weak link device must be capable of:

- a) supporting a fully equipped working diver in water;
- b) breaking/releasing reliably on application of an appropriate load, considered to be in the region of 70 kg;
- c) withstanding environmental conditions, e.g. mud, water, grease etc.

Any weak link should be used in conjunction with a device capable of manual release under tension by the diver such as a Gibbs clip.

3 Devices Tested

3.1 Unsuitable Options

The suitability was investigated of various devices to act as weak links such as cordage, welding rods, Gibbs clips, 'Carabino' or 'Carabineer' clips, cable ties (Ty-wraps) and ascenders or 'Jumar' clips, none of which was able to meet all of the design requirements.

3.2 Touch and Close Type Fastening

Initial trials with a 'touch and close' type fastening indicated that this material produced consistent results on application of various loads and in various conditions, i.e. wet, dry and lubricated with a mixture of oil and water. The two proprietary brands presently available are 'Cosmolon' and 'Velcro', the former being the brand used in the trials. Both brands of fastening are manufactured to BS 7271 which guarantees performances over 5000 shearing cycles (Ref. 1, Appendix A).

Quantitative tests were conducted using 24 mm wide 'Cosmolon' of varying lengths. Results indicated that the load required to effect release of the device is governed by the length of the contact closure area of material used, at the given width of 24 mm. The desired breaking load of 70 kg was therefore achieved using a contact closure length of 70 mm i.e. an area of 16.8 cm² (Ref. 1, Table I).

A device designed to the above specification (see sketch at Appendix I) was tested in a variety of different conditions i.e. wet, dry and oily water. Consistent results were achieved in all cases (Ref. 1, Table II).

The device will break or release at a predetermined load and will permit release by means of the mating surfaces being pulled apart by the diver himself in an emergency or during his emergency recovery. It is important, however, that the device is used correctly in order to maintain its integrity and effectiveness for as long as possible, i.e.:

- a) it should be attached to a clip capable of manual release under tension (such as a Gibbs clip) and this assembly incorporated into the diver's preferred rigging arrangement;
- b) once incorporated, the diver should use the Gibbs-type clip and not the weak link device to release his rigging arrangement under normal circumstances. There should be no need to separate the mating surfaces of the weak link, thus preserving the integrity and effectiveness of the touch and close fastening material;

On-site testing has demonstrated that if it is used incorrectly and is continually opened and closed underwater, the mating surfaces will deteriorate due to clogging of the latter by marine growth, thus rendering it ineffective.

3.3 Spiral Wound Chromium-Plated Spring Rings

These rings, also known as 'key rings', are readily available in various diameters. Under test some types were found to give a consistent and predictable failure response (dependent on manufacture etc.). A standard type ring of 37 mm diameter was found to fail under a steady load of around 35 kg and two such rings used in parallel repeatedly demonstrated failure at a load between 70-80 kg.

However, there will be variations in rings of different manufacture and of similar manufacture but different batch and this could obviously affect their performance. A contractor who wishes to use this system should therefore ensure that each batch is sample tested before use to establish that the required results can be obtained.

'Key rings' used in accordance with the above on one offshore location during a diving season were found to be an effective weak link.

4 Conclusions

4.1 Touch and Close Type Fastening

A device constructed of 'Cosmolon', of width 24 mm, with a contact closure surface of length 70 mm (i.e. an area of 16.8 cm²) as demonstrated in Appendix 1, will provide a safe, reliable, and cost-effective method of attaching a diver to structures and ensuring his release in an emergency when used in accordance with the guidance given in paragraph 3.2. Guidance for issue to divers on use of the device is given at Appendix 2.

While a device constructed of 'Velcro' was not tested, there is no reason to suppose that it would not be equally effective given that the same contact closure area of material is employed ('Velcro' is manufactured in a different range of widths to 'Cosmolon'). Similar tests to those carried out on 'Cosmolon' (Ref. 1) should, however, be performed prior to use.

4.2 'Key Rings'

Because of the wide variation in quality and size of spiral wound chromium plated spring rings, it is not possible to make a specific recommendation. However, two standard rings of 37 mm diameter used in parallel have been demonstrated to produce the required results (Ref. 1). If tested in accordance with Ref. 1 and used in accordance with paragraph 3.3 above, these will provide a practical option for a weak link attachment which, in an emergency, will fail due to deformation.

4.3 Application

The diver should incorporate the chosen system into his own preferred rigging arrangement in conjunction with a device capable of manual release under tension such as a Gibbs clip, which also allows the attachment to swivel.

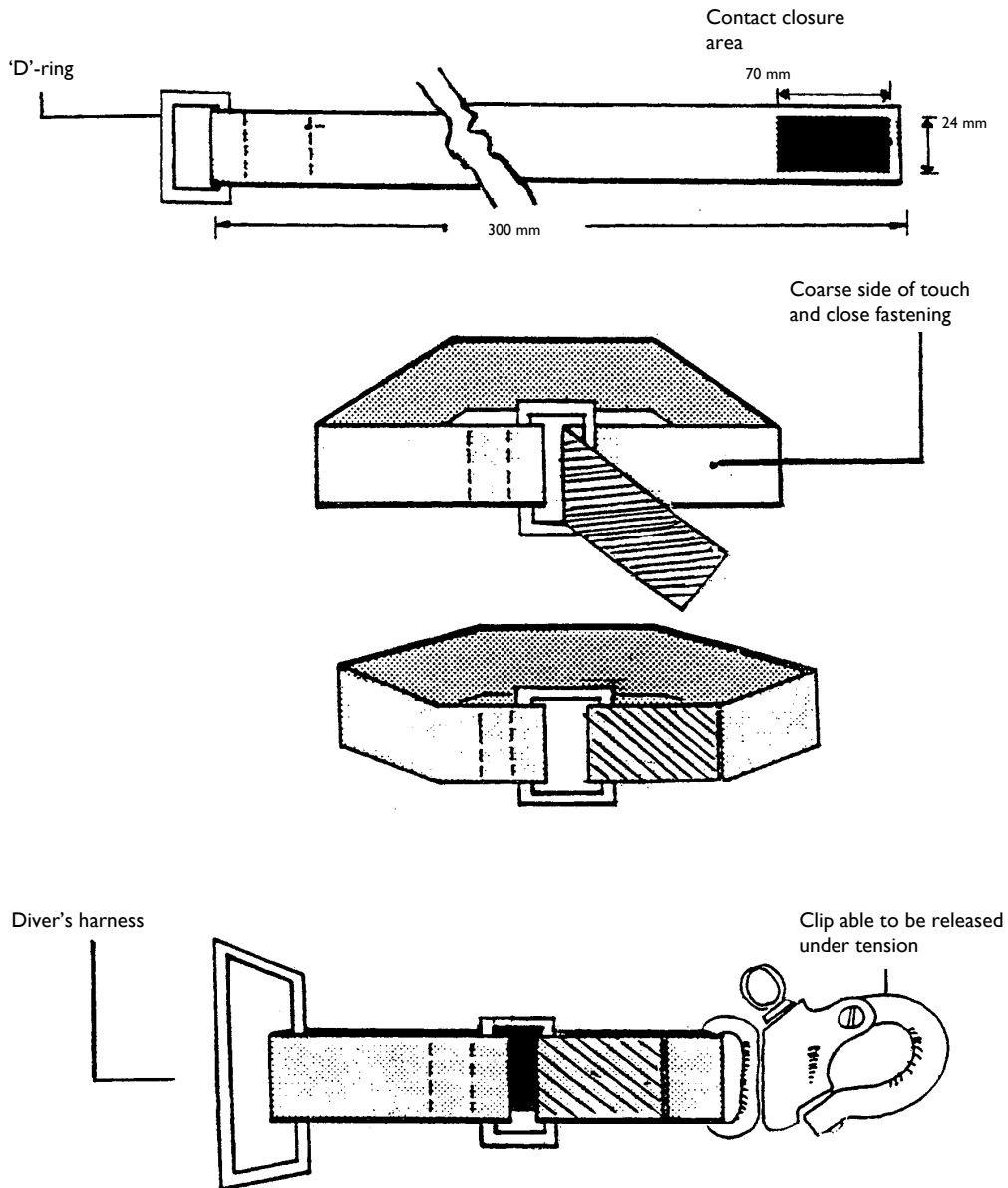
5 Other Methods of Safe Diver Attachment

It is acknowledged that there may be other equally suitable methods of diver attachment which have not been explored by AODC. Before use, however, any other method used should have been demonstrated to comply with the principles contained in this guidance note.

References

- 1 *Report on trials to identify a method of safe diver attachment to structures by means of a weak link.*

Touch and Close Fastening Weak Link Device



Weak Link Assembly

To be incorporated into the diver's preferred rigging arrangement by means of a clip suitable for releasing under tension **not** by opening

Weak Link Attachment – Emergency Release

Guidance for Divers

This note is intended for distribution to work sites for divers' information.

Touch And Close Type Fastening – 'Cosmolon'/'Velcro' Device

A device constructed of Cosmolon/Velcro in accordance with guidance note AODC 058 is regarded as a safe and reliable weak link device which will break or release at a predetermined load and will permit release by means of the mating surfaces being pulled apart by the diver himself in an emergency or during his emergency recovery.

It is important, however, that it is used correctly in order to maintain its integrity and effectiveness for as long as possible, i.e.:

- ◆ it should be attached to a clip capable of manual release under tension (such as a Gibbs clip which will also permit it to swivel) and this assembly incorporated into the diver's preferred rigging arrangement.
- ◆ **Once incorporated, the diver should use the Gibbs-type clip and not the weak link device to release his rigging arrangement under normal circumstances. There should be no need to separate the mating surfaces of the weak link, thus preserving the integrity and effectiveness of the touch and close fastening material.**

On-site testing has demonstrated that if the device is used incorrectly and is continually opened and closed underwater, deterioration of the mating surfaces will occur due to clogging of the latter by marine growth, thus rendering it ineffective.

'Key Rings'

Two rings 37 mm in diameter, of appropriate quality as tested, should be used in parallel to produce the required results. The diver should incorporate the rings into his rigging arrangement in the same way as indicated above.