

## Return to Diving after COVID-19

DMAC 33 Rev. 3 – February 2022

*Supersedes DMAC 33 Rev. 2, which is now withdrawn*

### 1 Introduction and Scope

This guidance covers the return to commercial offshore surface supplied and saturation diving after confirmed or suspected COVID-19. It also contains recommendations for the assessment of fitness for diving duties of asymptomatic offshore commercial divers during the ongoing COVID-19 pandemic. The assessment of asymptomatic divers is necessary to identify potential pulmonary changes in those who contracted the disease but were symptom free. It is recognised that the guidance may be of interest to other diving sectors (e.g. inland/inshore, military etc.).

### 2 Short-term and Long-term Health Effects of COVID-19

The severity of COVID-19 disease is highly variable – from asymptomatic infection to death. A recent review suggests that the fraction of asymptomatic patients may be as high as 40-50% (1). Although pulmonary infection (pneumonia) with ground-glass opacities visible in chest CT scans is well recognised (2), it has been reported that, particularly in severe cases, the central nervous system and the cardiovascular system may be involved as well (3, 4). Preliminary data suggest a high incidence of pulmonary embolism in patients hospitalised for COVID-19 (5). A high proportion (44-89%) of pulmonary CT changes has been reported in studies of patients with asymptomatic or mildly symptomatic COVID-19 disease (6-8). In a study of cardiopulmonary recovery after COVID-19, the authors found significant improvement of lung abnormalities in chest CT scans 100 days after diagnosis in patients with moderate, severe and critical disease (9). In this study radiological changes for non-hospitalised patients were minor. Overall, the findings suggest that there may be structural pulmonary changes in the absence of symptoms, but these changes are likely to improve over the course of a few months

### 3 Effects of COVID-19 on Fitness for Diving

In the acute phase of disease, symptoms like fatigue, malaise, dyspnoea and coughing will often preclude diving and will not be further discussed. The question arises as to the consequence for diving safety and infectivity once the diver is asymptomatic. Advice on these questions will be based on extrapolation of data and expectations based on the effects of similar infectious diseases. An example of such an assessment is the one published by the Belgian Hyperbaric Medicine Society (10). This statement discusses the potential consequences for fitness for diving after COVID-19 based on infectivity to other divers, pulmonary barotrauma, cardiac events, pulmonary oxygen toxicity and decompression sickness. The statement does not specify whether it is applicable to diving in general or whether it specifically addresses recreational or occupational diving.

It is the opinion of DMAC that the data on cardiac events, pulmonary oxygen toxicity and decompression sickness after COVID-19 is too scarce to support any guidance. If the chest CT is normal, the likelihood of contracting pulmonary barotrauma is probably very low in the occupational diving industry. The most significant effects of COVID-19 on divers' fitness are probably fatigue, impaired exercise capacity and infectivity. Our recommendations in section 5 below reflect this opinion.

## 4 Existing Guidelines on Fitness for Diving after COVID-19

The Belgian Hyperbaric Medicine Society calls for a minimum of two, preferably three months, of abstention from diving after COVID-19 (10). The Society recommends extensive pulmonary function testing, high resolution CT scans and cardiac evaluation before diving is resumed for divers who have been hospitalised for COVID-19. The University of California, San Diego, has issued [guidelines](#) for examination of recreational, scientific and commercial divers after COVID-19 (11). The guidelines detail requirements for clinical examination, exercise testing (with and without oximetry), chest X-ray, ECG, and echocardiogram. Similar [guidelines](#) have been issued by the US Physicians Diving Advisory Committee. The UK Diving Medical Committee (UKDMC) has published guidance on its [webpage](#) including a valuable [scorecard](#). It should be noted that UKDMC primarily supports recreational diving.

## 5 Recommendations for Assessment of Fitness for Commercial Diving during the ongoing COVID-19 Pandemic

DMAC advice is based upon the precautionary principle. We recommend caution and vigilance with respect to the as yet unknown consequences for diving health and safety that previous COVID-19 infection amongst divers may cause. The diving industry is international, and divers are recruited from areas where the proportions of people affected by COVID-19 in populations may be vastly different. As previously mentioned, a significant proportion of persons infected with COVID-19 remain asymptomatic but can still have pulmonary changes on CT scans. Asymptomatic carriers present virus RNA in the same order as symptomatic patients, but data suggest that asymptomatic carriers are less contagious than symptomatic patients (12, 13).

The risk of virus transmission from an infected person is generally considered low from 14 days after debut of symptoms AND at least 48 hours with no fever. PCR testing should not be used to assess infectivity once COVID-19 has been confirmed, as shedding of non-viable virus can continue for many weeks after cessation of infectivity (14). Therefore, the interpretation of a positive PCR result (and subsequent actions) must be discussed with the diving contractor's medical adviser, taking into account medical history, previous results, and other relevant factors.

All divers should be tested for the presence of SARS-CoV-2, as discussed in IMCA Information Note I563 (15). The timing of such testing should be as recommended by the company diving medical adviser. If applicable, the test method and test equipment should be recognised by the appropriate national regulatory authorities.

The diving contractor is advised to establish a screening procedure to identify divers potentially affected by COVID-19. The screening procedure suggested below would be in addition to any virus-testing (PCR or antigen) conducted. The screening procedure should be applied to all divers – saturation as well as surface oriented – independently of whether they have experienced COVID-19 infection. The reason for this is the high proportion of asymptomatic cases of COVID-19 observed. The contractor's diving medical adviser should supervise the screening, assess the screening results and establish requirements for medical contingency related to the screening. It is advised that screening should take place during mobilisation before each diving project. For surface-oriented diving, the need for repeated tests should be assessed individually by the contractor's diving medical adviser.

The further extent of screening and required medical examinations will depend on the likelihood of COVID-19 short term health effects. For this purpose, we have divided divers into three groups:

1. Asymptomatic divers with no evidence of SARS-CoV-2 infection.
2. Asymptomatic divers with positive SARS-CoV-2 virus test and divers who have suffered COVID-19 with mild symptoms only. Chest x-rays or CT scans in this group are normal or not taken.
3. Divers with moderate or severe symptoms of COVID-19. This includes (but is not limited to) all divers who have been hospitalised with COVID-19, divers who have received supplemental oxygen treatment, divers who have shown signs or symptoms of hypoxemia, any cardiac or neurological symptom, and divers with changes in chest x-rays or CT scans secondary to COVID-19.

**For all divers (Group 1, 2 and 3) we recommend:**

- Testing of physical fitness capacity should be considered before each mobilisation for surface supplied divers in group 1 based on a risk assessment including factors such as COVID-19 vaccine status and national disease incidence. The test should be mandatory for group 2 and 3 surface supplied divers. For saturation divers whose access to medical review is limited once mobilised, we suggest that the test is performed pre

deployment/mobilisation for each of the groups 1, 2, and 3. The purpose of the test is to identify health effects of asymptomatic and symptomatic COVID-19 disease. IMCA D 061 (16) provides details of such tests, e.g. the Chester Step Test (CST), however it is expected that a maximal exercise test would have a higher sensitivity of detection of symptoms and hypoxemia.

- The diver should be monitored for SpO<sub>2</sub> during the test, if possible. Exercise testing should not take place if resting SpO<sub>2</sub><95%. In this case medical guidance on further examination is required.
- The test should be supervised by a trained medic, respiratory technician, nurse or physician and the results should be assessed by the diving contractor's medical adviser.
- The diving contractor's medical adviser should consider referral to a specialist in pulmonary medicine if a decrement of >4% in SpO<sub>2</sub> is observed (17) or if there is a significant decrease in physical capacity compared to previous tests.

**For divers in group 2** we recommend:

- Divers who have suffered COVID-19 with no or mild symptoms only should observe a seven days absence from diving after the cessation of fever and respiratory symptoms.
- Divers in group 2 may return to diving after the seven day period of absence provided they have two negative antigen test results 24 hours apart and provided they pass the physical fitness pre-deployment/mobilisation test discussed above.
- The diver should be reviewed by a Medical Examiner of Divers (MED) before resumption of diving. The extent and nature of the review is left to the discretion of the MED, but clinical examination is recommended for those who have exhibited mild symptoms.
- When a diver in group 2 has been reviewed as described above and considered fit to dive, later screening should be done as per group 1 guidance.

**For divers in group 3** we recommend:

- All divers should be assessed by specialists in pulmonary medicine and cardiology. This should be done in close cooperation with the diving medical examiner or the diving medical adviser.
- The diver's medical fitness for diving should be reassessed by a Medical Examiner of Divers. The examination should comply with the appropriate standard for medical examination and assessment of working divers, and a new certificate of medical fitness should be issued.
- A chest X-ray or CT should be completed in all cases when previous imaging has identified structural changes secondary to the infection, or the diver wants to return to diving earlier than 3 months after being asymptomatic. Abnormal findings on the CXR should be followed up with a chest CT.
- A pulmonary function test, as a minimum including conventional dynamic spirometry, should be completed. Any clinically relevant deterioration from previous measurements should be reviewed by a specialist in pulmonary medicine.
- When a diver in group 3 has been examined as described above and considered fit to dive, later screening should be done as per group 1 guidance.

## **6 Participation in Commercial Offshore Diving Operations after Vaccination for COVID-19**

Several vaccines have been developed and have been proven to prevent COVID-19 effectively. As of 1 December 2021, the World Health Organization (WHO) has validated 8 COVID-19 vaccines for emergency use listing. Data from phase 3 studies of the vaccines (18-20) indicate that they are effective and generally well tolerated. However, mild to moderate local side effects are common, specifically local reactions at the injection site and systemic effects like fatigue, headaches and chills. Systemic side effects are more common after dose 2 of the vaccine. The median onset of systemic side effects was 1-2 days after injection and duration generally 1-2 days. More serious side effects have been reported, but these are very rare. As with all other vaccines, there is a small risk of serious allergic reactions immediately after vaccination. There have also been reports of [blood clotting](#) and [inflammatory heart conditions](#) that may be linked to vaccinations. In the Norwegian Medicines Agency report on suspected adverse

reactions to COVID-19 vaccines published on September 2021, the frequency of serious side effects is 3.7 cases per 10,000 vaccinations (20). This is probably a high estimate, as it is based on reports of possible, not confirmed, side effects.

Side effects after vaccination may temporarily reduce the work ability of the diver and may also be confused with symptoms of decompression illness. The risk of side effects should therefore be considered carefully for divers participating in offshore diving operations shortly after vaccination. In the Position of the Belgian Society for Diving and Hyperbaric Medicine on Diving and COVID-19 Vaccination (21), the authors recommend divers to consider a waiting period of 7-14 days after vaccination before engaging in diving activities. We have found no evidence to support this as a general recommendation. Based on the available safety data for the vaccines, we consider an abstention period of 2-3 days after vaccination to be sufficient for offshore diving. A similar abstention period has been suggested by the Italian Diving and Hyperbaric Medical Society (22).

Vaccination will significantly reduce the risk of severe COVID-19 infection and may also reduce human to human transmission of the SARS-CoV-2 virus. DMAC has issued a [Position Statement on COVID-19 Vaccination and the Offshore Energy Diving Community](#) recommending strongly that offshore divers and diving personnel follow national guidelines for vaccination.

It should be noted that although COVID-19 vaccination significantly reduces the risk of infection, it does not eliminate it. The [SARS-CoV-2 Omicron variant](#) identified Nov 2021 is associated with higher transmissibility than previous variants. It should be noted that persons who have been vaccinated, or have had COVID-19 with previous variants, are still capable of contracting and transmitting the virus. All divers and diving contractors are therefore urged to maintain compliance with preventative measures, and to continually monitor for symptoms of COVID-19 disease.

## 7 References

1. Ma Q, Liu J, Liu Q, Kang L, Liu R, Jing W, et al. Global Percentage of Asymptomatic SARS-CoV-2 Infections Among the Tested Population and Individuals With Confirmed COVID-19 Diagnosis: A Systematic Review and Meta-analysis. *JAMA Network Open*. 2021;4(12):e2137257-e.
2. Lai CC, Liu YH, Wang CY, Wang YH, Hsueh SC, Yen MY, et al. Asymptomatic carrier state, acute respiratory disease, and pneumonia due to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2): Facts and myths. *J Microbiol Immunol Infect*. 2020.
3. Asadi-Pooya AA, Simani L. Central nervous system manifestations of COVID-19: A systematic review. *J Neurol Sci*. 2020;413:116832.
4. Guzik TJ, Mohiddin SA, Dimarco A, Patel V, Savvatis K, Marelli-Berg FM, et al. COVID-19 and the cardiovascular system: implications for risk assessment, diagnosis, and treatment options. *Cardiovascular Research*. 2020.
5. Grillet F, Behr J, Calame P, Aubry S, Delabrousse E. Acute Pulmonary Embolism Associated with COVID-19 Pneumonia Detected by Pulmonary CT Angiography. *Radiology*. 2020;201544.
6. Bandirali M, Sconfienza LM, Serra R, Brembilla R, Albano D, Pregliasco FE, et al. Chest Radiograph Findings in Asymptomatic and Minimally Symptomatic Quarantined Patients in Codogno, Italy during COVID-19 Pandemic. *Radiology*. 2020;295(3):E7-E.
7. Parry AH, Wani AH, Yaseen M, Shah NN, Dar KA. Clinicoradiological course in coronavirus disease-19 (COVID-19) patients who are asymptomatic at admission. *BJR|Open*. 2020;2(1):20200033.
8. Uysal E, Kiliçer A, Cebeci H, Özer H, Demir NA, Öztürk M, et al. Chest CT findings in RT-PCR positive asymptomatic COVID-19 patients. *Clinical imaging*. 2021;77:37-42.
9. Sonnweber T, Sahanic S, Pizzini A, Luger A, Schwabl C, Sonnweber B, et al. Cardiopulmonary recovery after COVID-19: an observational prospective multicentre trial. *Eur Respir J*. 2021;57(4).
10. Société Belge de Médecine Hyperbare et Subaquatique. Position of the Belgian Society for Diving and Hyperbaric Medicine (SBMHS-BVOOG) on Diving after COVID-19 pulmonary infection [18.10.2021]. Available from: <http://www.sbmhs.be/2020%200412%20Position%20of%20the%20BVOOG.pdf>.
11. Sadler C, Alvarez Villela M, Van Hoesen K, Grover I, Lang M, Neuman T, et al. Diving after SARS-CoV-2 (COVID-19) infection: Fitness to dive assessment and medical guidance. *Diving Hyperb Med*. 2020;50(3):278-87.
12. Buitrago-Garcia D, Egli-Gany D, Counotte MJ, Hossmann S, Imeri H, Ipekci AM, et al. Occurrence and transmission potential of asymptomatic and presymptomatic SARS-CoV-2 infections: A living systematic review and meta-analysis. *PLoS Med*. 2020;17(9):e1003346.

13. Lee S, Kim T, Lee E, Lee C, Kim H, Rhee H, et al. Clinical Course and Molecular Viral Shedding Among Asymptomatic and Symptomatic Patients With SARS-CoV-2 Infection in a Community Treatment Center in the Republic of Korea. *JAMA Intern Med.* 2020.
14. Cevik M, Tate M, Lloyd O, Maraolo AE, Schafers J, Ho A. SARS-CoV-2, SARS-CoV, and MERS-CoV viral load dynamics, duration of viral shedding, and infectiousness: a systematic review and meta-analysis. *The Lancet Microbe.* 2020.
15. International Marine Contractors Association. Novel Coronavirus (COVID-19) - Guidance for Diving Contractors IMCA; 2021. Report No.: IMCA Information Note No 1563 - May 2021. Accessed:17.10.2021 from: <https://imcaweb.blob.core.windows.net/wp-uploads/2021/06/1563.pdf>.
16. International Marine Contractors Association. Guidance on Health, Fitness and Medical Issues in Diving Operations. IMCA; 2018. Report No.: IMCA D 061.
17. Forman DE, Myers J, Lavie CJ, Guazzi M, Celli B, Arena R. Cardiopulmonary exercise testing: relevant but underused. *Postgrad Med.* 2010;122(6):68-86.
18. US Food and Drug Administration. Vaccines and Related Biological Products Advisory Committee Meeting December 10, 2020. FDA Briefing Document. Pfizer-BioNTech COVID-19 Vaccine 2020 [18.10.2021]. Available from: <https://www.fda.gov/media/144245/download>.
19. US Food and Drug Administration. Vaccines and Related Biological Products Advisory Committee Meeting December 17, 2020. FDA Briefing Document. Moderna COVID-19 Vaccine 2020 [18.10.2021]. Available from: <https://www.fda.gov/media/144434/download>.
20. Norwegian Medicines Agency. Reported suspected adverse reactions to COVID-19 vaccines as of 14.09.2021. 2021. Accessed:18.10.2021 from: <https://legemiddelverket.no/Documents/English/COVID-19/20210917%20Reported%20suspected%20adverse%20reactions%20coronavirus%20vaccines.pdf>.
21. Société Belge de Médecine Hyperbare et Subaquatique. Position of the Belgian Society for Diving and Hyperbaric Medicine on Diving and COVID-19 Vaccination 2021 [updated 18.10.2021. Available from: <http://www.sbmhs.be/2021%200326%20SBMHS%20-%20Vaccination%20COVID%20ENG%20final.pdf>.
22. Società Italiana di Medicina Subacquea ed Iperbarica SIMSI [The Italian Diving and Hyperbaric Society]. Raccomandazioni sulle ripresa delle attività iperbariche in soggetti sottoposti a vaccinazione anti COVID19 [Recommendations on the resumption of hyperbaric activities in subjects vaccinated for COVID-19] [26.1.2022]. Available from: [https://simsi.it/wp-content/uploads/2019/03/Vaccini\\_COVID\\_e\\_immersioni.pdf](https://simsi.it/wp-content/uploads/2019/03/Vaccini_COVID_e_immersioni.pdf).