n@vigator
by Germanischer Lloyd

Dear Sir or Madam,

New GL rules for underwater technology set the technological standard for diving systems and simulators, manned submersibles and unmanned and underwater working machines. Especially the oil and gas industry is set to meet the technical challenges of exploitation in great water depths.

New maximum sulphur oxides and particulate matter regulations apply starting from January 1, 2010 in European territorial waters. GL has issued a guidance on maintaining engine and boiler safety when using Low Sulphur Distillate Oils (LSDO) to assist shipoperators to fulfil legal and operational requirements for safe passages.

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New Standard: Rules for Underwater Technology

On November 1, 2009 GL's amended and revised "Rules for Underwater Technology" came into force.

Germanischer Lloyd (GL) has upgraded and extended its "Rules for Underwater Technology". The revision of the rules reflects the growing demand for sophisticated regulations covering subsea innovations, in particular down to depths of 6.000 metres or more.

In the field of underwater technology GL is focussing on the technical safety and reliability of all kinds of diving systems, submarines, submersibles, underwater vehicles and underwater equipment. The underwater technology rules, consisting of three comprehensive chapters, came into force on 1 November and apply to all underwater technology contracted for construction on or after that date.

A copy of the rules including annexes is available in English and German language on GL's website:

www.gl-group.com/infoServices/rules/pdfs

The three new chapters of Underwater Technology are dealing with equipment for manned or unmanned subsea use as well as onshore operation and simulation. The first chapter covers "Diving Systems and Diving Simulators". The second chapter focuses on "Manned Submersibles" while the last deals with "Unmanned Submersibles (ROV, AUV) and Underwater Working Machines".

The requirements for the certification of underwater working devices and underwater working machines are laid down in a separate section. It provides all involved stakeholders such as manufacturers, owners and operators a comprehensive guideline for safe and reliable underwater working equipment.

GL issued its new rules in order to assist operators in a challenging subsea environment. In combination with the state of art regulations GL also provides in-depth consultancy services in respect to pre-design and quality management reviews, project support and operational performance.

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"We help our customers to develop new equipment"

What are UUVs and how does GL help offshore exploration? Harald Pauli, GL's head of department of pressure vessels and underwater technology, has the answers.

n@vigator: Mr Pauli, what do you do at GL?

Harald Pauli: I am the head of the department of pressure vessels and underwater technology. We do the preliminary design analysis for all pressure vessels for maritime use on ships, from the filter via compressed air cylinders to large liquid gas tanks according to our classification rules. We support the field sales team in specialised matters. In the area of underwater technology we see ourselves as full-service providers, i.e. we cover almost all areas of manned and unmanned underwater technology. One example of this is the testing, certification and classification of military submarines or civil submersibles for research, tourism and underwater assignments.

The public is aware, for example, of the MIR submersibles that have gone down to the 'Titanic' or to the WWII wreck of the 'Bismarck'. Russian Prime Minister Putin has also gone down in one of these this year in Lake Baikal. In addition we certify diving facilities in offshore use for the oil and gas industry. Furthermore, we have a very large pressure chamber division. Pressure chambers can be divided into medical pressure chambers for hospitals in which certain diseases are treated and the pressure chambers for divers.

n@vigator: Do you also have anything to do with a diver's personal equipment?

Pauli: Yes, we are a notified EU body for 'personal protective equipment'. There we deal with diving equipment that the diver wears and the 'life-saving appliances', i.e. such equipment for in-water use. Here we test the highest safety category that only includes equipment where there is mortal danger if they fail. As you can easily imagine, when diving that is almost always the case, particularly at great depths.

n@vigator: But do people have to dive in great depths for underwater operations?

Pauli: Underwater operations with unmanned vehicles are becoming increasingly common, therefore we have also greatly expanded this area. AUV and ROV are the key terms. ROVs are remotely operated vehicles, i.e. underwater vehicles operated by remote control. The project 'ROV Kiel 6000' by the Leibniz Institute of Marine Sciences at the University of Kiel (IFM-GEOMAR) may be familiar. This vehicle was constructed by an American manufacturer and we certified it. That is an investment of millions and for that the buyer wants to get exactly what they have ordered and paid for, of course. In this respect we were able to give them confidence.

n@vigator: What are AUVs?

Pauli: They are 'autonomous underwater vehicles'. They work independently underwater. At the moment we are working on an order for an AUV that operates at a depth of 6,000 metres. A further order has a military background but there the diving depth is not as great.

n@vigator: A depth of 6,000 – there it becomes critical even for unmanned vessels with respect to the ambient conditions. What does an AUV do at depth?

Pauli: The oil and gas industry, for example, works at greater and greater depths. Please consider that the extraction of oil and gas with conventional technology will not get easier in the future. The offshore deposits in shallow coastal waters are declining, but there are still large deposits at greater water depths. For this, in part completely new technology must be developed. For the project at depths of 6,000 metres and more it is an overriding question of resources under or on the seabed, for example manganese nodules or other ores of great purity.

More and more seabed prospecting at these depths is carried out with 'UUVs', i.e. unmanned underwater vehicles. This is the source of great potential for the future. We help our customers develop new equipment as they are often in the dark. For a lot of equipment there are still no guidelines, sometimes not even a development pathway. Suitable bodies of regulations have to be developed. There is a constant flow of new findings.

n@vigator: How do you create the test conditions? Are there pressure chambers that are so large that they can put pressure of 400 bar or more on a complete UUV?

Pauli: As a rule parts or components of a UUV are pressurised individually and then their functions are tested. Distributed throughout the world, there are pressure chambers that can accept the larger components. Furthermore, in reality a whole UUV can however also be tested. For that there is a pressure chamber available in St Petersburg that can accommodate whole submersibles and simulate depths of up to 10,000 metres. Here, for example, we tested the MIR submersibles under a pressure of 720 bar. If I have even larger systems then all that remains is a submersion test at real depth.

n@vigator: What do water depths of up to 6,000 metres mean for the technical equipment?

Pauli: The first challenge is the pressure. As known it increases under water every ten metres by one bar. So at 4,000 metres depth, that is the working area that is most often demanded at the moment, 400 bar acts on the equipment. For comparison, you inflate your car tyres with 2.5 bar. So all systems, all moving parts must be exposed to enormous pressure. Articulations and bearings must also function perfectly under this load. One delicate point is of course the seals, that are exposed to this pressure and must also continue to do what their name indicates, i.e. seal tightly. Then added to that is the medium of water. At a depth of 4,000 metres, absolute darkness reigns, residual light zero. But you must always have the work input of the UUV under control. In real terms that means: you must see what the robot is doing. That means considerable energy input for headlamps, cameras and controls. How do you get energy at depth?

n@vigator: I assume you would get it by cable, wouldn't you?

Pauli: Yes, for most applications you would. In the meantime, however, there are also energy stations on the seabed that can be tapped by the UUVs – like a petrol station. ROVs working like this are called Hybrid-ROVs. But even these stations have to, of course, be built first in the deep sea and then controlled reliably.

Hydrographic exploration with AUVs

"ABYSS", the autonomous underwater vehicle of the German research institution IFM-GEOMAR is undergoing GL certification.

The AUV is designed to perform hydrographic exploration in all parts of the ocean in depths up to 6,000 metres. The "REMUS 6000" type AUV is able to carry a payload to great depths in order to measure ocean water characteristics such as conductivity, temperature or chemical composition. It can also map and image the seabed with bathymetry, side scan, magnetics, gravimetry and photography.

The vehicle contains two lithium-ion battery packs allowing for operating and mapping of up to 24 hours. The torpedo-like system is able to work on different tasks during one specific mission which requires an installation of different sensors. The AUV can be operated from all large- to medium-sized research vessels.

The vehicle is deployed by using a hydraulically powered launch and recovery system (LARS) with a turnable system to allow operation via the stern or the side of the vessel. This untethered and unmanned vehicle completes the range of 6,000-m depth-rated systems which are classified respectively certified by GL like, "MIR I" and "MIR II" manned submersibles and the "KIEL 6000" tethered ROV.

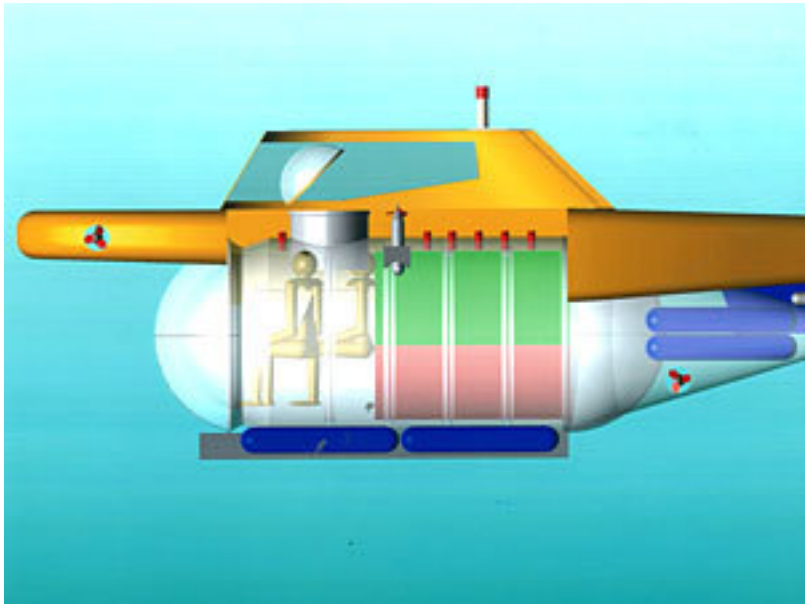
High technology, but subsea: GL certifies submersibles

Up to 50 sister vessels could be built according to GL rules: The construction of three boats already started.

GL is charged with the new building classification of ‘CQ3’, a three-person submersible by Dutch company U-Boat Worx B.V. The construction of three boats has already started. The final sea trial has been performed successfully at the end of this summer. Beside that series, a two-person version, ‘CQ2’, is intended to be built with GL as well.

The Spanish group ICTINEU Submarines will build the ‘Ictineu 3’ with GL. This submersible is also designed for three people. Equipped with two manipulators and an acrylic spherical shell window of 1.40 m in diameter, it is suitable for a maximum diving depth of 1,200 m.

After the first drawing and system approvals by GL, the constructional phase has started. First, metallic heads of the spherical pressure hull have been constructed under surveillance of GL in Italy.



A further project is the new ‘Lula 2’, a research submersible designed for 1,000 m diving depth to be built by the Rebikoff Foundation. GL’s first step was the pre-design verification including extensive calculations of the pressure hull.

The project manager has motivated German companies to manufacture the main parts for his sub. GL is involved on this occasion not only as a third party, but also as an advisor for advanced technical solutions. The completion of the submersible with GL class is scheduled for the beginning of 2011.

InWaterTec: fifth offshore exhibition and conference

Ocean, Environment and Economy, Marine Mineral Resources and Underwater Installation - all about the main subjects of the conference in Kiel, Germany.

The ‘InWaterTec’ conference focused on the three subjects ‘S1 – Ocean, Environment and Economy’, ‘S2 – Marine Mineral Resources’ and ‘S3 – Underwater Installation’. It is a forum for systemic solutions, products and services. For the fifth time since 2001, a wide spectrum of novel developments of maritime technologies for the industry and research will be presented in the capital of the northern German state of Schleswig-Holstein.

While GL experts had already participated in recent years, this year GL has joined the organising team for the first time. Co-organisers are Maritime Cluster Management Schleswig-Holstein and the German Association for Marine Technology. For Daniel Engel, head of department of MC-M, the conference was a good opportunity to explain the vast variety of services for the offshore industry, the combination of experience in offshore operations, renewables and shipping. In cooperation with the Kiel Earth Institute, GL had organised a CO2 session covering all relevant technical questions of CO2 storage and CO2 emission reduction in the marine environment.

Ralf Plump, GL’s head of department for environmental research, has presented a paper called ‘Greenhouse Gas (GHG) emissions from shipping: actual status and discussion at IMO with regard to UNFCCC outlook and action plans for shipping worldwide’. The United Nations Framework Convention on Climate Change (UNFCCC), which will meet in Copenhagen later this year, has requested IMO and its committee for environmental issues, MEPC (Maritime Environmental Protection Committee), to come up with proposals to combat ship-related emissions.

A major element in reducing GHG in ship operations is to increase the energy efficiency of ships respectively to reduce the fuel consumption per transported mass, per transported ‘unit (container)’ or per operation time needed, for instance for offshore supply vessels, etc. Developed ‘tools’ are the energy efficiency design index (EEDI) for new ships. For ships in operation, the ship energy efficiency management plan (SEEMP) was established. The SEEMP provides an approach for monitoring ship and fleet efficiency performance and includes the energy efficiency operation indicator (EEOI).

Another presentation by Ralf Plump and Torsten Mundt has focussed on alternative fuels and practical approach. In October 2008, IMO/MEPC fixed a schedule towards usage of ‘cleaner fuels’ to be used in the shipping industry, especially to lower emissions from ships concerning sulphur, nitrogen oxides and particular matters. These requirements could end in a worldwide usage of distillates (diesel oil) instead of residual fuels from 2020 on. An alternative is to replace fuel oil by

alternative fuels like LNG (liquid natural gas) and so-called biofuels for ships.

Head of Department of MC-MP, Harald Pauli, explained the examination procedures of underwater vehicles based on GL rules for underwater technology. He gave an overview with regard to the examinations and tests required to gain a certificate, including drawing approval and material/part examinations, leading to the tests of subsystem assemblies and factory acceptance testing of the complete system.

Last but not least, Dr H. Brun and Dr R. Surma gave a talk called ‘Support for Deep-Sea-Mining Projects’. The growing demand for raw materials, energy carriers and the constantly decreasing amount of appropriate onshore resources means exploration of resources in the deep sea is necessary. Different resources in the deep sea like gas hydrates, natural gas, oil, ore muds and manganese nodules will be explored.
Both speakers describe current projects, required vehicles and equipment for the investigation and exploration of resources in the deep sea. They present applicable possibilities of the most different devices and machines for investigation, sampling and exploration.

More than 380 participants attended the fifth conference in early October, while more than 60 companies and institutions showcased their product portfolios. Maritime Cluster Management Schleswig-Holstein, the German Association for Marine Technology and Germanischer Lloyd as organisers of InWaterTec 2009 attracted researchers and decision makers from economics, natural and social sciences as well as politics and public authorities for the event.

For more information, please visit: www.inwatertec.de

Putin dives to the bottom of Lake Baikal in a GL-classed research sub

In August 2009 Russian Prime Minister Vladimir Putin dived to the bottom of the world’s deepest lake, Lake Baikal. He did this with the Mir-1 research submersible, classed by GL.

For his dive, the premier was accompanied by submersible pilot Dr. Viktor Nishcheta and Dr. Anatoly Sagalevich, head of the Deep Manned Submersibles Laboratory of the Shirshov Institute of Oceanology of the Russian Academy of Sciences.

The Mir-1 and Mir-2 deep-diving submersibles involved in research in Siberia’s Lake Baikal performed 52 dives last summer. They resumed work in June to monitor the southern part of the lake, near Cape Tolsty, with plans to conduct research in the lake’s central and northern parts as well.

Both submersibles are classed by GL, having successfully passed their class renewal in June 2009 which had been carried out by Harald Pauli, GL’s head of department of pressure and underwater technology, and underwater technology expert Karsten Hagenah.

New sulphur limits in marine fuel

Guidance for vessel owners and operators for maintaining engine and boiler safety and availability.

An in-depth guidance on maintaining engine and boiler safety when using Low Sulphur Distillate Oils (LSDO) has been drafted by GL to assist ship operators to fulfil legal as well as operational requirements for safe passages.

The guidance informs about the forthcoming new regulations in the territorial waters of the European Union and the coast of the U.S. State of California. Both legal entities have announced new limits on sulphur content of fuel oils that come into force 2010-01-01 or 2012-01-01 (Phase II) respectively.

GL has issued the guidance because the switch to low sulphur fuel oil before entering port or territorial waters could in fact cause major propulsion or engine failures.

GL’s guidance on maintaining engine and boiler safety when using LSDO concentrates on fuel tank capacity and

arrangements, service tank arrangement, fuel oil supply system, main propulsion and auxiliary engines, main and auxiliary boilers, in particular boiler burner and burner control systems.

The guidance points out that there is a potential need for Inspection/Approval/Certification before using LSDO. Since it is the sole responsibility of the operator to ensure that his vessel is suited for operation on the fuels required by e.g. the EU Directive 2005/33/EC, GL recommends to contact equipment manufacturer or associated system provider prior to the operation of any equipment with LSDO. It is safety critical whether the pumps, engines, boilers and burners are ready to handle and burn LSDO. In case the use of LSDO requires modifications of the equipment and systems class approval and survey have to be conducted in order to ensure safe operation.

Click **here** for GL's guidance on maintaining engine and boiler safety when using LSDO.
