



## Application note

# Gas Spheres

### Key inspection activities:

- Ultrasonic wall thickness testing
- Visual inspection
- Corrosion inspection

### Gas sphere inspection

Gas storage spheres present many challenges for inspectors. Due to physical restrictions and other constraints, inspecting these spheres can be a rigorous task that can put not only inspectors at risk, but also the stability and health of the structures as well. Because of these dangers, inspectors must follow strict procedures to complete a safe and absolute inspection of gas storage spheres. Challenges include:

- **Visibility:** The top manway (standard 24 inches in diameter) combined with the large vessel cavity makes it difficult to see everything from a single perspective. Necessitating external lighting and confined space entry.
- **Unique shape:** In addition to visibility issue, the unique shape of gas spheres makes inspections uniquely challenging. Workers are often unable to reach all surfaces needing inspection within the gas storage sphere using internal scaffolding or ropes. This often leads to incomplete inspections.
- **Confined spaces:** Avoidance of confined space entry is imperative for companies as they attempt avoid risks and prioritize the safety of their workers. Complex scaffolding set up inside gas spheres creates hazards that puts inspectors in danger.
- **Corrosion:** Any type of liquid that gets into a gas storage sphere will cause corrosion. Gaseous substances in the spheres often react quickly with any liquid present. Once corrosion begins it is a long and complicated process to fix. The repair process can take anywhere from 18-24 months to complete.

## Additional concerns

There are numerous environmental and safety agencies throughout the world who have specific safety and maintenance requirements. While inspection and maintenance requirements vary through different territories, the implications of improper care are consistent.

- **Compressed Gas Association (USA):** Pamphlet P-1-1965, written by the Compressed Gas Association, details that the United States requires all personnel handling compressed gasses to ensure that they are equipped with immediate use self-contained breathing apparatus's that have been approved by the U.S Bureau of Mines.
- **OSHA:** According to 29 CFR 1910.269, a module released by OSHA, inspectors must analyze the inside surface area of gas storage spheres very carefully. Good visibility is required to distinguish the severity of corrosion. Inspectors also need to check for bulges in the sphere shape and potential signs of fire damage. Also keeping an eye out for burns, gouges, and other signs of damage.
- **Implications of nitrogen purging:** Nitrogen purging is used to cleanse the spheres to displace hazardous material. It can take quite a while after the nitrogen purging to be complete before inspectors to be able to enter the spheres. If inspectors enter too soon, the low-oxygen environment can cause asphyxiation and can lead to dizziness, nausea, and even unconsciousness. Additionally, emergency breathing devices are kept on standby for those who enter the sphere.
- **Corrosion Ramifications:** Corrosion can have negative impacts on the structure of the equipment, but it can also lead to deadly situations. Corrosion weakens the structure of the spheres and can cause the spheres to leak. Many materials that are housed within the spheres are hazardous and highly flammable. There have been large and small incidences in the past, in places such as France, New Mexico, Norway, etc. Many people have died due to corrosion that was not properly addressed. Corrosion that goes unnoticed has the potential to have widespread consequences that go beyond the boundary of the site in which the spheres are held.

## Solution

A well-known oil and gas company, that utilizes gas storage spheres, wanted to improve its inspection efficiency, safety, and compliance through a new solution. Waygate Technologies worked together with the customer to create an inspection solution featuring a combination of products. These products not only met the company's inspection requirements, but also exceeded their expectations.

The inspection technology consisted of a BIKE Platform with a TZI Inspection camera and LIDAR System in addition to an Everest Ca-Zoom HD camera with add-on lights. This innovative combination allowed for the company to efficiently inspect its gas storage spheres. The time savings and safety enhancements of this combination allowed for the company to maximize its time and money resources. Investing in quality products and innovative technology helped this company maintain its reputation for high safety standards and efficient operations.

The localization and mapping capabilities that the 3D LOC technology has made a drastic difference for inspection efficiency. This state-of-the-art technology is equipped with full 3D spatial awareness and is completely integrated with the BIKE. Additionally, there is a 3D interactive robot control connected to the BIKE. While the BIKE is in the inspection site, all inspection data gets geo tagged and automatically sent to its digital twin. Not only did utilizing the BIKE and 3D LOC technology reduce inspection time but also allowed for an operator view during inspection and a full, automatically generated and uploaded, detailed report.

## Solution benefits

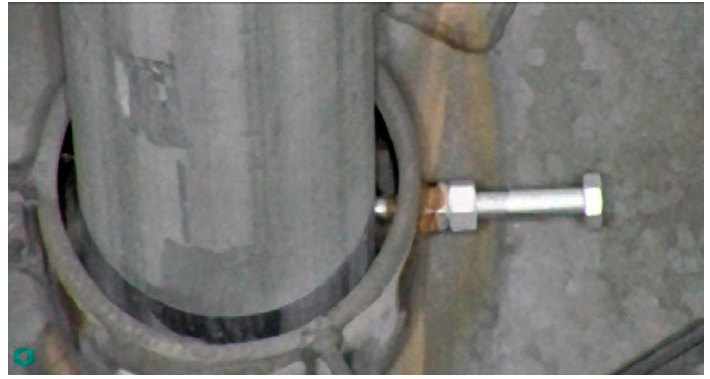
- **Superior image quality:** The Everest Ca-Zoom HD camera boasts a 30x optical zoom and HD resolution, enabling clear and detailed visualization of items from far away. The image quality aids in being able to identify damage and spot corrosion.
- **Ultrasonic testing:** The BIKE can be fitted with innovative ultrasonic technology onboard that allows inspectors to gauge wall thickness and find any loss of wall thickness.
- **Reduced inspection time:** The PTZ functionality allows for remote control and precise positioning, significantly reducing inspection time compared to traditional methods. The capabilities of the BIKE allow for quick but thorough inspections and can reach locations that are inaccessible to humans.
- **Improved safety:** The BIKE, with its magnetic capabilities remove the need for personnel to enter the vessel. OSHA has strict restrictions on who can enter a compressed gas storage sphere, requiring that each plant have a detailed emergency plan which requires inspectors to be equipped with person protective equipment and be armed with emergency breathing devices. Utilizing the BIKE and other technology eliminated the need for personnel to enter, therefore reducing safety concerns significantly.
- **Cost savings:** The BIKE reduces unnecessary expenditures by capturing damages and enables the company to take corrective stops before the corrosion becomes severe. The company can be proactive and work to further advance its efficiency goals.

## Conclusion

The customer was thoroughly impressed with the inspection and the delivered results. The benefits that inspectors experience, demonstrates the effectiveness of the BIKE in addressing the challenges of gas storage sphere inspections. Its superior image quality, data collection capabilities, user-friendliness, and safety benefits make it an ideal tool for ensuring thorough, efficient, and safe inspections, ultimately improving compliance, reducing costs, and enhancing overall operational efficiency. Due to the success from the gas storage sphere inspections, the customer is now actively using robotics to test surface breaking defects affecting carbon steel and stainless- steel clad vessels.

## Technology used

- BIKE Platform with TZ1 Inspection camera and LIDAR System for navigating and geotagging
- PTZ HD30 with add-on lights



Picture taken from approx. 9 meters.



Additional lights from LED Lenser P18R mounted to the Everest Ca-Zoom HD30 provide extra 5000 lm.