



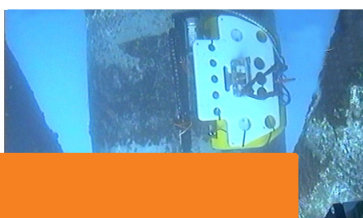
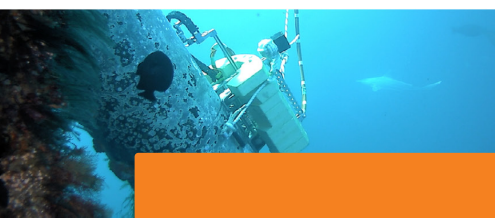
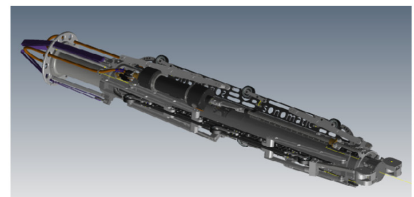
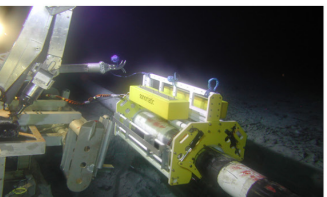
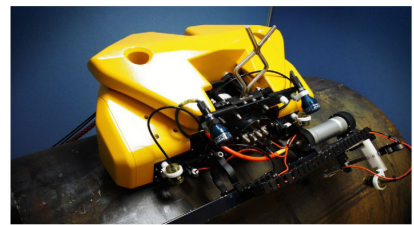
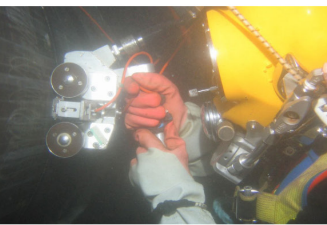
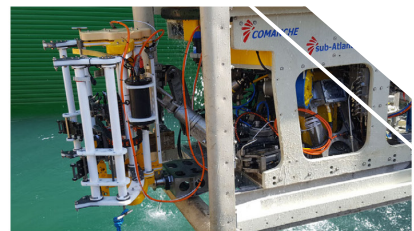
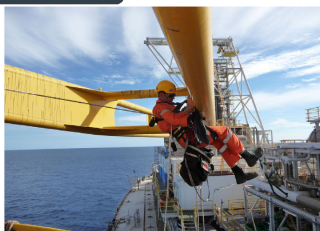
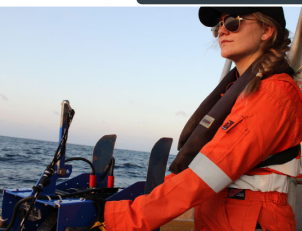
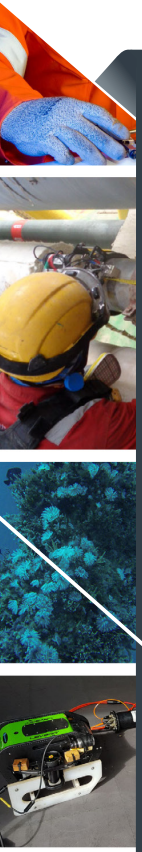
SONOMATIC

DATA SHEET

STORAGE TANK CLEANING
AND INSPECTION ROBOTIC
TECHNOLOGIES

THE PURPOSE

This document is composed to assist our clients and the supply chain with a high-level understanding alongside the benefits and services associated with our storage tank cleaning and inspection robotic technologies.



STORAGE TANK CLEANING AND INSPECTION ROBOTIC TECHNOLOGIES

Sonomatic bring over thirty years of experience in the inspection of Tanks and Vessels under the API 653 and API 575 Standards. This is inclusive of more than 5 years of experience developing and deploying Robotic Cleaning and Inspection Systems to clientele worldwide. We run a fleet of more than ten different robots that are designed to be optimised for different applications. We have this many robots as we have found that trying to make one robot fit all tanks did not work well. The robots are proven, having been through validation trials and are ready for use in Crude, Condensate, Class II Fuels and Water. Robots are available to enter through 3.5 inch nozzles upwards and range in weight from 20 Kgs to 500 Kgs. Sonomatic's inspection approach provides 100% coverage of the tank floor by means of Acoustic Emission (AE) testing supported by Franscan PAUT and SRUT testing and performed prior to in-service ultrasonic inspection. This approach allows the focussing of the tank robot deployed UT system into areas of the tank floor that have been highlighted as areas of interest by the AE and SRUT inspection technologies.

Effective cleaning is essential for reliable ultrasonic inspection.
Cleaning system options depending on specific requirements:

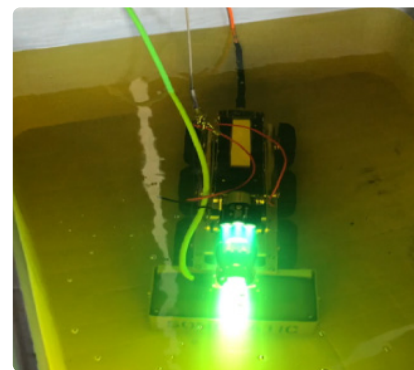
- ✔ Scraper/brushes ahead of probes.
- ✔ Suction ahead of probes.
- ✔ Filter and discharge clean fluid ahead of probes.
- ✔ Heavy sludges removed by pumping out of tank.

Services:

- ✔ Desludging (and Waste Management).
- ✔ Comprehensive in-service inspection.
- ✔ Tank shell and roof.
- ✔ Annular plate.
- ✔ Shell to floor welds.
- ✔ Advanced robotic UT tank floor inspection.
- ✔ Internal Visual Inspection (dependent on product type).
- ✔ Settlement Survey.

Different robots according to tank and product type:

- ✔ Hydraulic for heavy hydrocarbons.
- ✔ Electric for light hydrocarbons/water.
- ✔ Manual Inspection Tools for light hydrocarbons/water.
- ✔ ROV Visual and UT Swimmer for water.
- ✔ Cleaning Robots with PAUT Probes, Vacuum Brush and Auger.
- ✔ Cleaning Robots with Water Jet Auger & 6" Vacuum Tube.
- ✔ Sludge and Sediment Cleaning Robots.
- ✔ Cleaning Robots with PAUT Probes, ATEX Camera And 2" Vacuum Suction Pump.



ONLINE TANK INSPECTION & CLEANING HYDRAULIC ROBOTS



Online Tank Inspection, Sludge, Treatment & Removal Robot Class 1 Tanks Crude/Condensate Etc. 20-inch manway.

2 off.

ONLINE TANK INSPECTION & CLEANING ELECTRIC ROBOTS



Online Tank Inspection Robot for Water and Class II Tanks. Manways 14, 20 and 22. ULTRASOUND AND VIDEO OPTIONS

3 off.


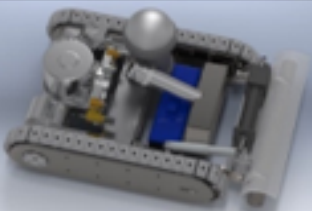



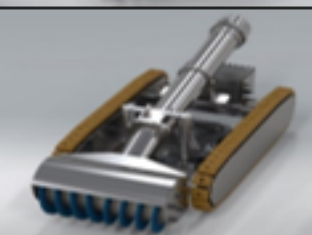
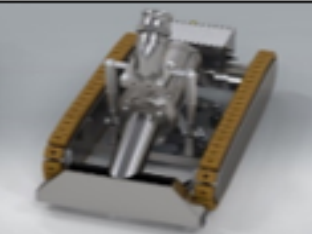
ONLINE TANK INSPECTION VIDEO AND UT SWIMMING ROBOTS



Online Tank Inspection Robot for Water

2 off.

ONLINE TANK INSPECTION MANUAL ROBOTS FOR TANKS OF VARIOUS SIZES (WATER, #2 FUEL OIL, KEROSENE, #6 FUEL , BUNKER C, INTERMEDIATE PROCESS PRODUCTS) SLUDGE CLEANING OPTIONS AVAILABLE			
	Manual Robot 3.5" ACCESS POINT	1 off.	
	Manual Robot 6" ACCESS POINT	1 off.	
	Manual Robot 14" ACCESS POINT	1 off,	
	Manual Robot 16" ACCESS POINT	1 off.	
	Manual Robot PAUT 16" ACCESS POINT	1 off.	

ONLINE TANK CLEANING ROBOTS WITH UT OPTIONS		
ROBOT	DESCRIPTION	NO. OF ROBOTS
	VR700MkV The Sludge Cleaning Robot	1 off.
	VR600-24 Cleaning Robot with PAUT Probes, ATEX Camera And 2" Vacuum Suction Pump.	1 off.
	SKORPION 4020 Cleaning Robot with PAUT probes ATEX 1cm NAV on the left & ATEX ECA camera on the right	1 off.
	SKORPION 4020 Cleaning Robot with Water Jet Auger & 6" Vacuum Tube	1 off.
	SKORPION 4020 Cleaning Robot with PAUT Probes & 4" Vacuum Tube	1 off.
	SKORPION 4020 Cleaning Robot with PAUT Probes, Vacuum Brush and Auger	1 off.
	SKORPION 4020 Cleaning Robot with PAUT Probes & 22c Pump	1 off.

ROBOT SYSTEM UT CALIBRATION AND VALIDATION

The ability to examine storage tank floors whilst the asset remains in service (on stream) is an ongoing challenge in the NDE industry, Sonomatic has been committed to developing inspection technologies for use in this sector.

The recent development of an ultrasonic 'phased array' multiplexer inspection system for use on the robotic tank inspection system has led to the requirement for Sonomatic Ltd. to validate the systems performance. API Standard 653 Annex G outlines the qualification process for carbon and low alloy steel tank floor examinations for above ground storage tanks, this standard was used as a guideline to assess the performance of the 5MHz 128 Element Phased Array system used in the inspection of Crude Oil storage tanks.

Images represent the API Plates examined, a composite image of the UT data showing detection of the artificial flaws, machined in the API plate and data set showing near through thickness flaws detected.

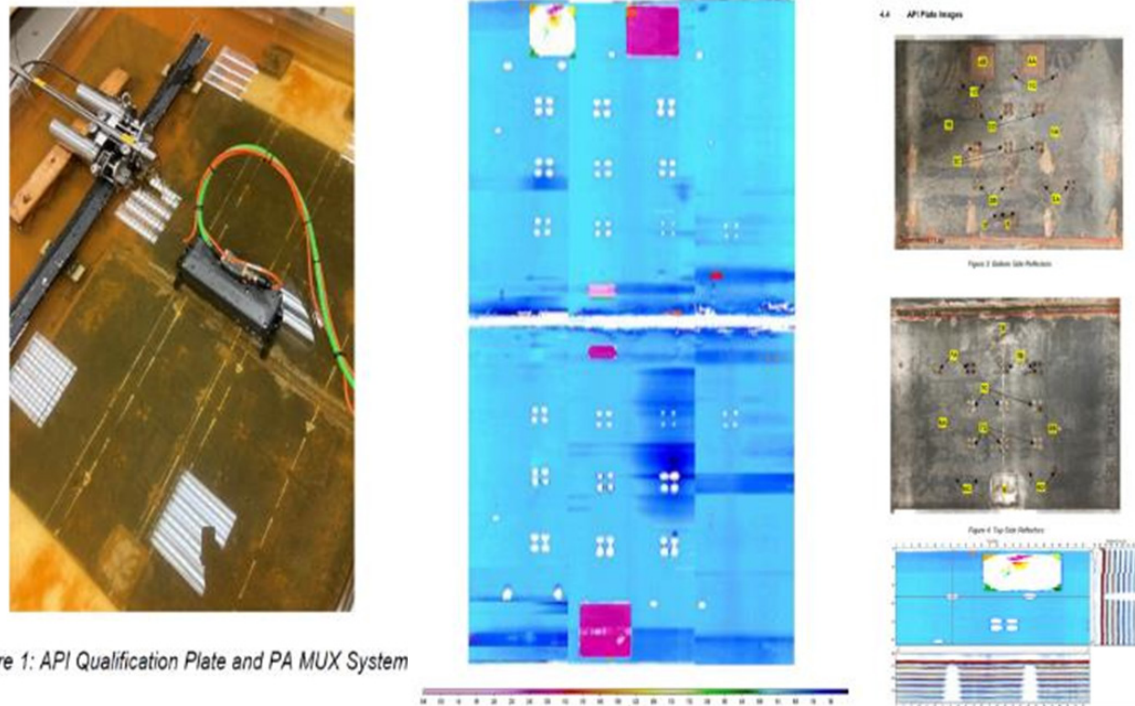


Figure 1: API Qualification Plate and PA MUX System

ROBOT SYSTEM CERTIFICATION

The storage tank inservice Robotic floor inspection system has been inspected and certified to meet the requirements of Div 1 CEC/NEC subject to following strict safe operating procedures and applying risk mitigation such as utilising a nitrogen purge system to make the environment inert and flammable gas free.



QA AND HS&E

Sonomatic operate under an integrated QHSE management system and are committed to the highest quality and safety of service provision | ISO 9001: 2015: 00007140 | ISO 14001:2015:00037371 | ISO 45001:2018:00037372 | ISO 17020: 2012: 4276 | Achilles FPAL Verified: 076712 | SEQual 1988 | British Safety Council Member: S0388440 |



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