

Goldfish Nozzle Manipulator

Background

The WesDyne Goldfish nozzle manipulator is a submerged remotely operated vehicle (ROV), combined with a scanner unit, for nozzle inspections in reactor pressure vessels (RPVs).

The Goldfish can be equipped with different nondestructive examination (NDE) inspection end-effectors, as well as repair or machining tools. The Goldfish can, without plant support, move to the nozzle and secure a correct and safe position in the nozzle via a self-centering locking device.

Description

The Goldfish is designed for inspection of all large nozzles above the core of BWRs or in/outlet nozzles in PWRs. Inspection areas include nozzle-to-shell weld, inner radius, nozzle bore, nozzle-to-safe end and safe end-to-pipe welds.

The Goldfish was introduced into the field in 2000 and has since performed several inspections, both as a single unit and as part of a triad of manipulators for vessel in-service inspections during a single outage. The layout and dimensions of the Goldfish are dependent on which end-effectors and probe setups are used.

The design of the Goldfish concept also lends itself to other activities such as act as a carrier for repair tooling or non-nozzle inspection equipment, this due to the design of exchangeable scanner units that attach to the main ROV.

Technical Data

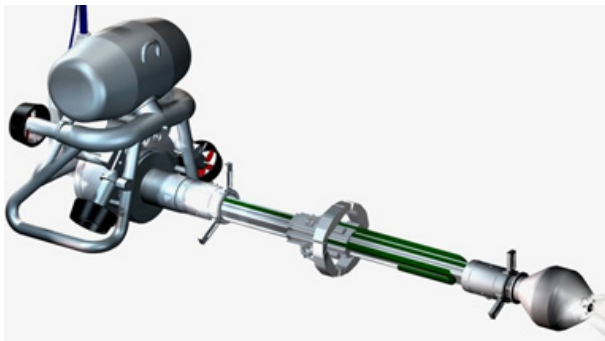
Weight (in air)	100 – 130 kg (depending on choice of end-effectors) Neutrally buoyant in water
Operational depth	1 – 30 m
LxWxH (example)	2740x949x1009 (mm)
Thrust	4x210 N
Scanning speed (linear)	100 mm/s (axis Z and R)
Scanning speed (circumferential)	50 mm/s (at R=60 mm) >150 mm/s (R= 150 mm)
Min Ø (I.D. nozzle)	138 mm (current configuration)
Max Ø (I.D. nozzle)	550 mm (current configuration)
Max radius (nozzle to shell welds inspections)	750 mm (current configuration)
Probes (nozzle to pipe or nozzle to shell welds)	8 pcs of UT/ET probes (procedure dependent)
Surveillance camera(-s)	Monochrome fixed focus
NDE techniques	Ultrasonic test (UT) Eddy current test (ET) Visual test (VT)

Benefits

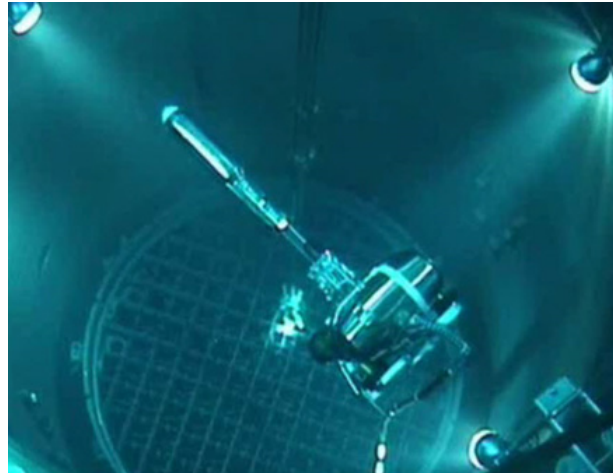
- The Goldfish manipulator has several advantages over comparative systems. The Goldfish:
- Is lightweight and easy to handle
- Is fast to position and center in the nozzle (typically less than 5 minutes from refueling floor to in nozzle position)
- Allows for parallel operations/activities in the RPV during inspection
- Able to perform ultrasonic (UT), eddy current (ET) and visual (VT) inspection in parallel

Experiences

Since developed by WesDyne in 2000 the Goldfish system have inspected well over 100 nozzle objects during outages in at Swedish BWR plants with great success.



Goldfish manipulator with BWR nozzle end effector



Goldfish moving into position in parallel with fuel movement preparations

WesDyne is the nondestructive inspection branch of Westinghouse and a leading supplier of mechanized nondestructive examination (NDE) products for all inspection needs worldwide. As such providing turnkey and one-off-type solutions with a focus on the nuclear market. WesDyne's expertise spans all aspects of remote and mechanized inspections, from problem analysis and solutions generation to development and manufacturing to field deployment of personnel and equipment. Inspection capabilities cover all key NDE areas such as ultrasonic, visual, eddy current, magnetic particle, dye penetrant and X-ray.

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WesDyne Sweden
Kemistvägen 5, P O Box 121
SE-183 22 Täby
Sweden

www.wesdyne.com
www.westinghousenuclear.com