

Nondestructive Examination Services

T-crawler

Background

Traditionally, inspections of obstructed objects in nuclear reactors were performed using manipulators based on large structures and/or rails. This approach rendered parallel activities in the vessel impossible because of the large structures and, as such, had a negative effect on the critical path. To reduce the need for such cumbersome equipment **WesDyne**[®] developed a smaller stand-alone family of robots capable of maneuvering in the reactor. The T-crawler concept is one such solution, designed specifically for inspections in narrow spaces as first introduced in 2006.

Description

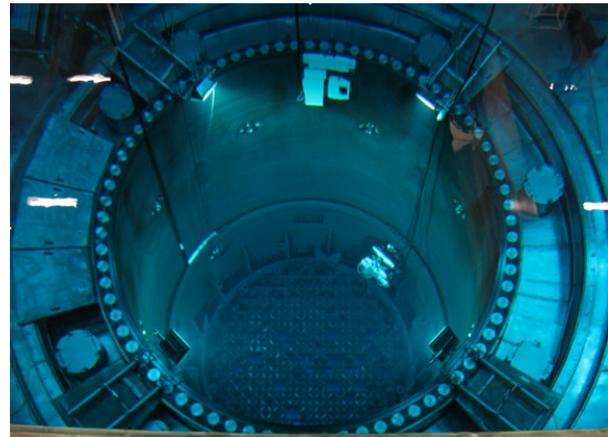
The T-crawler robot performs inspection tasks in narrow gaps between internal components (such as jet pumps) and the vessel wall or simply in the reactor vessel.

The T-crawler is engineered for easy handling, with a high degree of modularity and a thin structure suitable for inspection of the entire reactor vessel inner surface. This equipment can “walk” along the vessel wall all the way down into a reactor.

The robot is attached to the vessel wall near the inspection area by four suction cup assemblies. The robot consists of a horizontal curved beam, a straight vertical beam, a hinge unit and a scan unit. The curved horizontal beam has a trolley that holds and moves the vertical beam.

Scanning in both the vertical and horizontal directions is possible without moving the manipulator from its position on the vessel wall. The robot is adaptable for a large number of vessel dimensions. Current configurations are designed for vessel diameters in the range of between four and six meters. Several types of extensions are available for hard-to-reach welds/ areas as well as core shroud/shroud support inspections.

Although the manipulator is independent from any fixed reference points its positioning system has been qualified with a local accuracy of ± 3 mm.



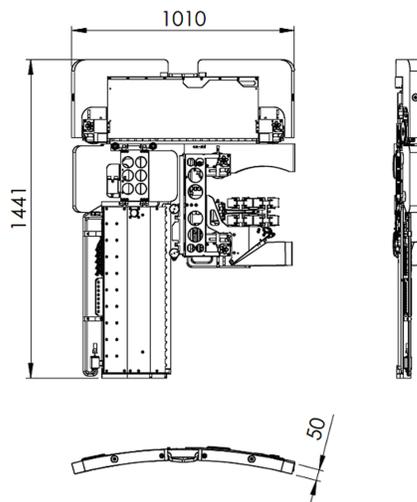
Two T-crawlers and one Goldfish robot performing parallel vessel and nozzle inspections at a customer site in 2007

Technical Data	
Weight (typical)	25 kg
HxWxT (example)	1,441x1,010x50 mm
Operational water depth	1-30 m
Horizontal stroke	400 mm
Vertical stroke	500 mm
Scanning speed	0-75 mm/s
Suction cups	4
Ejectors	4
Water pump system	80-120 bar 400V/16A 50 – 60 Hz
Depth measurement gauge	1 + 1 reference
Cables for UT signals	RG 178
Cables for ET signals	RG 178
Probe array (example)	8 probes (40x40x25 mm housing)
Positioning probes (UT)	Ø0.25" 5-10 MHz
Operator interface software	WILMA and T-control

Benefits

Compared to other vessel inspection systems, the T-crawler system has several advantages:

- Allows for parallel activities in the RPV during the inspection
- Lightweight, does not require a crane or lifting device



Renditions of the T-crawler robot

- Quick setup and tear down at the refueling floor (ideal for unexpected local inspections or repeat inspection of small local area)
- Small footprint at the refueling floor (typically 4x4 m)
- Easy to handle, requires only a small crew on-site
- No need for a separate rail system or other installations in the RPV
- Modular design, easily exchangeable end-effectors and probe setups
- Uses qualified control system and software
- Compatible with all major nondestructive inspection data collection systems

WesDyne is the nondestructive inspection branch of Westinghouse and a leading supplier of mechanized nondestructive examination (NDE) products for all inspection needs worldwide 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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