

Underneath today's city streets exists a labyrinth of underground water, sewer, gas, electric and telecommunication lines. As urban populations increase, the quantity and complexity of underground utilities rises and so the need for a non-destructive detection technique rises for tracing the location and identification of the pipelines.

The article below describes one such innovation to address the emerging need for tracing and identifying the water pipelines, which can be polyethylene or metallic, underground or above the ground surface. WATER TRACKER is a Piezo electric actuator based product and result of strong technical co-operation between 2 French SME companies, MADE S.A. (www.made-sa.com) and CEDRAT TECHNOLOGIES S.A.



Fig. 1: WT 230L sound emitter.*

OBJECTIVE

WATER TRACKER is a system designed and developed for TRACKING and IDENTIFYING polyethylene water pipes using a technique based on propagation of complex acoustic waves. The same equipment also allows identification of a PE or Metallic pipe among a bunch of pipes with an equivalent technique. Because of the dedicated sensors and a tailored signal analysis, it enables tracking the direction of the underground pipes from the surface. The method of injection and analysis of the signal is the subject of a patent.



Fig. 2: WT 230L sound emitter connected to a pipeline under test.*

STRUCTURE

The architecture of the device is composed of 2 parts.

> A SOUND EMITTER:

The WT 230L sound emitter is composed of an APA 230L – Amplified Piezo Actuator manufactured by CEDRAT TECHNOLOGIES and is used as resonant Piezo transducer (fig. 1). This Piezo transducer vibrates at the desired frequency generating acoustic waves so called signals that propagates in the water, causing the tube and the surrounding environment to vibrate (fig. 2).

> A HAND HELD RECEIVER:

The receiver (fig. 3) comprising of an acquisition unit, set on the ground which receives and analyses the vibrating signals generated by the Piezo-electric transducer.

CHARACTERISTICS & ADVANTAGES

- **Detection range:** Water tracker emission-detection range is typically larger than 100m.
- **Environment:** Water tracker can function with same efficiency in urban and noisy environments,

*Courtesy Made SA (France)

automatically traces the optimal frequency for the specific network at startup.

- **Life time:** Water Tracker sound emitter, heart of the unit being a Piezo device, it has inherent characteristics of high life span, high accuracy and good repeatability rates.

REMARKS

The WT 230L is a successful transducer developed by CEDRAT TECHNOLOGIES which demonstrates that:

- APA® can be used at resonance for generating high vibrations or high sound level,
- **APA®** can be integrated in structures with customized housing,
- **APA®** can be used to realize low frequency high power transducers in a very compact size

The past experience of CEDRAT TECHNOLOGIES in Sound and Acoustic wave generation, like Sonar and Industrial ultrasound treatment etc., was of great help to realize the Water Tracker. The design and prototyping of this transducer, capable of transmitting low frequency high power acoustics waves in the ambient water medium, allowed accurate and highly reliable pipeline tracing and identification. Other acoustic sources may be developed using its technological know-how.

CEDRAT TECHNOLOGIES also manufactures variety of other Piezo and Magnetic actuators and transducers for different applications in Space and Aeronautic industry, Machine tool industry, Automotive and Medical Industry etc. Those actuators are standard and can be custom fabricated as per customer requirements.

This collaboration with MADE SA shows that CEDRAT TECHNOLOGIES can develop customized solutions not only for large organizations but also for SMEs (noting that CEDRAT TECHNOLOGIES is a certified Contract Research Organization).



Fig. 3: Signal receiver and analyzer.*

PERFORMANCE OF THE WT230L SOUND EMITTER

REFERENCES	UNIT	WT230L
> Notes		
Technological baseline		APA230L
Hydrostatic pressure capability	Bar	<10
Emission frequency	kHz	<1
Vibration amplitude	µm p-p	100
Electromechanical coupling factor	A	30%
Excitation voltage	Vms	<10
Dimensions	mm ³	<100 x 200 x 300
Mechanical interface		TBD
Electrical interface		TBD

*Courtesy Made SA (France)