

NASSCO
FORCE MAIN INSPECTION TECHNOLOGY SUMMARY

TECHNOLOGY	APPLICABLE DIAMETER RANGE	PIPE MATERIAL				PIPE STATUS DURING TEST			TEST CONDITIONS	
		Ferrous	Cementitious		Plastic	In-Service	In-Service	Out of Service	Parameter Tested	Comments
		CI/DI/Stl	PCCP	AC/RCP	PVC/ HDPE/ FRP	No Excavation	Excavation Required	Excavate, Open		
Screening Techniques/Technologies										
Video (CCTV, Scanning, etc.)	6" and Larger	Yes	Yes	Yes	Yes			Yes	Interior conditions, fine defects	Pipe must be drained, exposed and opened. Visual evidence of deterioration only, no structural assessment.
Borescope	All Diameters	Yes	Yes	Yes	Yes			Depends on Insertion Location	Insert borescope into hot tap	Visual evidence of deterioration only, no structural assessment.
Radar	External/Ground Surface	Yes	Yes	Yes	Yes			Yes	External test for bedding, voids, soil features	Used from the surface - data difficult to read and can be significant interference
	Internal (Pipe Penetrating Radar)			Yes	Yes				Internal test for voids in pipe and soil voids just outside pipe walls	Developing technology but promising results
Infrared Thermography	All Sizes	Yes	Yes	Yes	Yes			Yes	Detects leaks from the surface based on temperature differential	Used from the surface
Low Voltage Conductivity	6" and Larger		Yes	Yes	Yes			Depends on Insertion Location	Detects leaks	Measures the variation of electric current flowing through pipe wall openings. Requires full pipe. Insertion through 2" taps.
Acoustic Leak and Gas Pocket Detection	Internal Tethered	Yes	Yes	Yes	Yes			Depends on Insertion Location	Detects and locates leaks and gas pockets	Live insertion and retrieval through 2" taps. Primary focus in FMs is gas pockets
	External Correlators	Yes	Yes	Yes				Depends on Sensor Location	Detects leaks	Install accelerometers on exposed pipe, fittings. Used on water mains, not validated yet on force mains
	Internal Free Swimming	Yes	Yes	Yes	Yes			Yes	Detects and locates leaks and gas pockets	Live insertion through 4" taps, check valves, blind flanges, or other appurtenances. Retrieved at pressure/gravity transition, bar screens.
Soil Corrosivity Testing	All Diameters	Yes	Yes	Yes				Yes	External test of pipe to soil corrosivity potential	Determines potential for pipe wall corrosion based on soil/groundwater properties
Acoustic Pipe Wall Assessment	Surface Mount	Yes	Yes	Yes				Depends on Mounting Location	Average Remaining wall thickness	Developing technologies. Tools have been focused on the potable water sector as gas pockets attenuate signal.
	Internal	Yes	Yes	Yes	Yes			Yes	Wall stiffness measurements in 12" increments	
Magnetic Pipe Wall Assessment	8" and up	Yes						Yes	Identifies areas of stress in metallic pipes	Determines stress differential in metallic pipes indicative of cracking, pitting, corrosion, overloading, or material change
Direct Assessment Techniques/Technologies										
Broadband Electromagnetic/Pulsed Eddy Current	Internal Pig	Most Diameters	Yes					Depends on Insertion/Extraction Locations	Test for metallic pipe wall loss	Pipe must be drained, exposed and opened
	Localized Scan	All Diameters	Yes					Yes		Yes
Long Range Ultrasonic Guided Wave	Most Diameters	Yes						Depends on Sensor Location	External test for metallic pipe wall loss, pits, defects	Need access to exterior. Pipe must be continuous such as welded steel pipe. Joints and soil cover will attenuate signal.
Magnetic Flux Leakage (MFL)	Internal Pig	Most Diameters	Yes					Depends on Insertion/Extraction Locations	Test for metallic pipe wall loss, pits, defects	Pipe must be drained, exposed and opened
	Localized Scan	All Diameters	Yes					Yes		Yes
Electromagnetic	Remote Field Eddy Current (RFEC)	4" to 36"	Yes					Depends on Insertion/Extraction Locations	Test for metallic pipe wall loss	Can be conducted in live force mains with flow control
	Electromagnetic (PCCP)	Minimum 16"		Yes				Depends on Insertion/Extraction Locations	Test for wire breaks in PCCP	Can be conducted in live force mains with flow control
	Near Field Eddy Current	Minimum 16"	Yes					Depends on Insertion/Extraction Locations	Test for metallic pipe wall loss	Can be conducted in live force mains with flow control
Seismic Pulse Echo	Embedded Cylinder PCCP		Yes					Yes	Yes	Can be conducted from outside of concrete force main to test for thickness reduction (due to internal corrosion) or inside of large diameter pipelines
Ultrasonic	Handheld	All Diameters	Yes					Yes	Yes	Local only along pipe wall. Need access to exterior. Must be calibrated to material.
SONAR	6" and Larger	Yes	Yes	Yes	Yes				Yes	Internal test for ovality, gross defects, sediment
Laser Profiling/Scanning	8" and Larger	Yes	Yes	Yes	Yes				Yes	Internal dimensions, gross defects
Coupons or Sampling	All Diameters	Yes	Yes	Yes	Yes				Yes	Take coupons or pipe samples for analysis
Surface Mount Sensor Acoustic Monitoring System	Minimum 16"		Yes					Yes		Near real-time detection of wire breaks in PCCP
Acoustic Fiber Optic Monitoring System	Minimum 16"		Yes					Variable		Near real-time detection of wire breaks in PCCP
										Permanent installation

Developed by the NASSCO Pressure Pipe Committee