

Zoom Inspection of Pipelines
As provided by Inframatrix, LLC

1.0 General

- 1.0.1 This specification includes the requirements and procedures for video inspection of pipelines connected to the manholes via zoom technology using a truck mounted, telescoping mast and boom configured zoom camera.
- 1.0.2 The interior condition of the pipeline will be recorded in both directions; upstream and downstream. The camera will be remotely positioned to view the interior surface and current available cross sectional area of all pipes entering and exiting each manhole for a distance from the inspection manhole suitable for obtaining information to assess the current structural and O&M condition . This procedure facilitates a rapid screening process to identify immediate remedial needs and prioritize future activities to be performed on the pipe.
- 1.0.3 The crew consists of a supervisor who works inside the truck and a technician who works the back of the truck at the manhole/pipeline.

2.0 Equipment Requirements

2.1 Camera

- 2.1.1 The camera shall have an optical zoom range: 25X (minimum)
- 2.1.2 The camera shall have a digital zoom range: 1X through 12X (minimum)
- 2.1.3 The camera shall have a total effective zoom ratio: 300X (minimum)
- 2.1.4 The camera shall be designed with the ability to pan the camera head 360 degrees continuously, tilt mechanically 35 degrees up from horizontal, tilt mechanically 90 degrees down from horizontal and tilt optically 166 degrees
- 2.1.5 The camera shall have auto focus and auto exposure features. In addition, the camera shall be capable of remote, real time, operator manual override and adjustment of focus and camera aperture operations.

2.2 Lighting

- 2.2.1 The camera shall contain high intensity discharge (HID) integral lighting
 - 1. Four camera mounted HID spot lights shall provide a total output equivalent to 200 watts of halogen light
 - 2. One camera mounted HID flood light shall provide a total output equivalent to 50 watts of halogen light
- 2.2.2 External light heads – The camera design shall allow the attachment of integral external light fixtures to provide additional light as needed in larger diameter

pipelines. The external light attachments shall move in unison with the positioning of the camera assembly.

1. The external lighting will consist of two quick disconnect external light head assemblies, each assembly consisting of two light heads on each side of camera that are directional with the pan and tilt movements of the camera head.
2. The external light heads shall provide a total of 340 additional watts of light, 170 watts per light head assembly (minimum).

2.3 Truck Mounted Boom and Mast System

- 2.3.1 The truck-mounted mast shall be capable of positioning the camera 25 feet, or greater, below the surface of the road/ground.
- 2.3.2 The camera shall have the ability to be remotely raised and lowered using an electric winch controlling a self contained, telescoping mast assembly.
- 2.3.3 The boom and mast assembly shall provide sufficient horizontal (X – Y) positioning to optimize the camera alignment within the manhole.
- 2.3.4 The boom and mast assembly shall provide sufficient 360 degree mast pivot articulation to optimize the camera positioning within the manhole.
- 2.3.5 The boom and mast assembly shall provide sufficient locking capability to hold the camera steady in any desired position, without slipping or vibration, to assure clear and steady viewing and video recording during all camera operations.

3.0 Preparation

- 3.0.1 Assess traffic situation and implement traffic safety measures.
- 3.0.2 Use the appropriate field maps to locate and identify manholes. Access to the pipelines will be through the manhole which will typically also serve in naming the line inspected. If there is a change to the configuration of the manhole or connecting pipeline, mark corrections to the field maps provided. Also, note the change on a daily progress tracking log and the field data collection software.

4.0 Data Collection

- 4.0.1 Use the appropriate data collection software to capture and record information pertaining to the pipeline. The use of data fields and formats consistent with the PACP specification is recommended. At a minimum, the following information for each connecting pipeline should be included:
 1. Location of pipe using street name or physical location (park, railroad right-of-way, etc.)
 2. Pipeline identification number

3. Inspection date and weather condition
 4. Type of pipe (sanitary, storm, combined, etc.)
 5. Depth of pipe invert
 6. Shape, diameter and material of pipe
 7. Flow direction
 8. Deficiencies observed
 9. Presence and/or evidence of infiltration/inflow
 10. Type and approximate depth of debris
 11. Depth of flow
 12. Liner presence
- 4.0.2 Video inspections will be recorded on electronic media in MPEG format video files, named and indexed for easy GIS retrieval.
- 4.0.3 Photos of major observed defects will be captured in JPEG format.

5.0 Field Procedures

5.1 General

- 5.1.1 Remove manhole cover and move it away from traffic flow without impacting work area. If cover is defective, place so it can be viewed by camera and recorded. Notify the Owner if a manhole cover is broken or cracked.
- 5.1.2 Position the inspection vehicle and adjust the boom assembly to place the camera mast over the manhole for optimal camera orientation for pipeline inspection.
- 5.1.3 Position air blower at manhole opening to disperse steam or fog in pipeline.
- 5.1.4 If manholes are to be zoom inspected along with the pipelines, then refer to section 4.0 Data Collection and section 5.0 Field Procedures in the *Zoom Inspection of Manholes* specification.

5.2 Pipeline Connection at Manhole Wall Orientation

- 5.2.1 Lower the telescopic mast to where the camera is in the manhole channel, centered in the center of the pipe cross section to ensure maximum light illumination.
- 5.2.2 Position a surveyor's elevation rod into the manhole to record the pipeline diameters using the zoom camera.
- 5.2.3 The four camera mounted spot lights should be activated and operating.

- 5.2.4 Set the camera to auto-focus and auto-iris and begin recording. Wait until the Pipeline Identification Q-card has been recorded (first 6 seconds).
- 5.2.5 Begin the video inspection with an adequate view of the manhole wall and pipe junction to orient the viewer and assure that the initial length of pipeline is completely viewed

5.3 Interior of Pipeline

- 5.3.1 While still recording, carefully adjust and position the boom and mast assembly to position the camera lens and the four spotlights as close to the manhole wall and pipe junction as possible. This assures maximum pipeline illumination and optimizes the telephoto and focus capabilities of the camera.
- 5.3.2 Start telephoto zooming down the pipe in a slow steady manner, stopping for at least 5 seconds when a condition is encountered. If additional zooming and/or pan and tilt is used to closely view a defect or abnormality, back off zoom from the defect prior to repositioning camera to the center of the pipeline cross section to continue zoom inspection.
- 5.3.3 As the camera zooms further into the pipe, the auto function will reach its capacity and then the camera will need to be switched to manual mode for all settings as necessary. Maximize the zoom capability of the camera while manually adjusting the camera iris, focus and light intensity (if necessary) to capture the best possible images.
- 5.3.4 When the zooming inspection has reached the furthest possible point possible, the camera should be set to auto focus and iris. Gradually reverse the telephoto zooming, and gradually and steadily view backwards through the pipeline zoom back for a final condition overview
- 5.3.5 At the end of the zoom out, record the pipe for five seconds and then stop recording.
- 5.3.6 Rotate the camera head to the next pipe and repeat the process described in sections 5.2 and 5.3 until all main connecting pipelines are inspected.

5.4 Interior of Drop Connection

- 5.4.1 If a drop connection exists in a manhole, it is beneficial for it to be the last pipeline inspected, if possible. Start recording at the bottom of the connection to confirm that it actually is a drop and then while recording, elevate the mast to level it with the upper entry point of the pipeline and continue inspection as noted above in sections 5.2 and 5.3.

- 5.4.2 If a second drop connection exists, then lower the camera to the bottom and repeat the drop connection inspection as noted above.

5.5 Interior of Large Diameter Pipelines

- 5.5.1 The detachable exterior “sidelight” spot lights should be installed on both sides of the camera, be activated and operating when inspecting any pipeline 12 inches in diameter or greater. The “sidelights” should be used together with the four camera mounted spotlights.
- 5.5.2 For pipelines 24 inches in diameter or greater, the larger designed detachable exterior “sidelight” spot lights should be installed on both sides of the camera. These lights should be activated and operating together with the four camera mounted spotlights.
- 5.5.3 Large diameter pipe will require zooming a short distance into the pipe, stopping forward progress and slowly panning along the entire inside surface of the pipe.
- 5.5.4 Pause 5 seconds for any condition that should be noted.
- 5.5.5 Zoom into the pipe and repeat the panning of the inside surface as necessary. The panning will not be necessary when the entire circumference of the inside surface of the pipe is visible in the picture. However, care should always be taken to frame and pause 5 seconds to observe any conditions.

5.6 Equipment Removal

- 5.6.1 Upon completion of the pipeline inspection, raise the telescopic boom to remove the camera from the manhole and turn off lights once the camera is safely out of the manhole.
- 5.6.2 Remove loose dirt, stones and other foreign material from the mating surface of the rim before replacing the manhole cover. Replace manhole cover ensuring that the cover is seated properly. Adjust if necessary. If cover cannot be seated correctly, make a notation on log and inform Owner of location.
- 5.6.3 Secure camera and boom, pick up traffic control devices and proceed to next manhole/pipeline.
- 5.6.4 If a critical service (blockage) or structural (collapsing pipe) condition is found, notify Owner immediately of condition and location, and note on log.

6.0 Zoom Data Evaluation

6.0.1 Following the completion of the field data gathering, the videos shall be reviewed by qualified technicians to record the defects. Priority grades shall be assigned to all defects using the NASSCO PACP or other appropriate pipeline assessment grading system.

7.0 Related Specification

7.0.1 Refer to the Specification for *Zoom Inspection of Manholes* for zoom inspection of manholes.