



Hong Kong Institute of Utility Specialists
Non – profit Making Organization

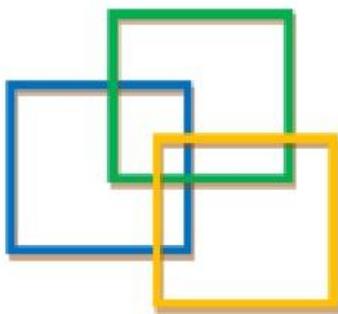
Method Statement

For

Conduit Condition

Evaluation

(CCTV and Man Entry Survey)



Publisher:



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Foreword

It's been more than ten years now since the disastrous landslip that occurred in Kwun Lung Lau on Hong Kong Island on 23 July, 1994. Since 1995, the Government of HKSAR has awarded tens of millions of dollars in contracts related to detection of leakage from buried water carrying services (BWCS) both on slopes and on the roads throughout the territory. As expected, this sequence of events generated an increasingly large pool of "Utility Specialists (US)", with most working almost independently, devoid of any standardized surveying methods, quality requirements (on survey results) and the "registration" of operation personnel in the market before the establishment of HKIUS in 2002.

In view of the availability of the multitude of method statements, specifications, training manuals, and the contracts documents produced for the vast number of underground utility survey contracts (by government and private projects), the following sections try to provide a comprehensive set of method statement, by addressing the following topics in general and where the abbreviation can be found in the Appendix:

- (1) Standard Operation Procedure
- (2) Standard Report Format
- (3) Standard Safety Precaution

You are welcome to take reference to this method statement for your contract and in case you need further information, please send an e-mail to info@hkius.org.hk or call Ir Dr. King Wong.



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If any error or mistake is found in this method statement, please kindly contact us.

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1. Scope of the Works

1.1 Scope of Work

To inspect by utilizing Closed Circuit Television (CCTV) for sewers and drains, which are in service.

A CCTV inspection is designed to ascertain the condition of the water main to provide data assessing:

- (1) The structural integrity of the pipeline system
- (2) The service condition of the pipeline system
- (3) The possible cause and effect of any extraneous water infiltration/ex-filtration to/ from the pipeline system
- (4) The location and extent of the expedient connections to the pipe line system.

1.2 Lighting, Signing and, Guarding

Site works are not commenced until permits regarding the Lighting, Signing and Guarding of Roadwork's or Footway works have been issued in compliance with the Code of Practice for Lighting and Guarding published by the Highways Department. The Company will comply with all statutory regulations and enactments and particular specific instructions from our clients.

1.3 Test Devices

The following Test Devices will be utilized on site:

Marconi Resolution Chart No.1 or its derivatives is used in Monitor and Camera Test

Calibrate Cable for 30-50m

Distance Measurement accuracy up to + 1% or 0.3m whichever is larger.

Details can be referred to Clause 2 in this method statement.

1.4 Expanded Operational Procedures for CCTV Operation

On arrival at site, the Crew Leader (O/MHKIUS) (who is well trained and has acquired certificates issued by the relevant authorities with at least 3 years relevant experience) will determine the most logical approach for the inspection. In normal circumstances, the inspection will be undertaken in a downstream direction, however this is not always the case.

In some circumstances, it may not be possible to mobilize the equipment at the desired start point, therefore a downstream start point will be chosen and the inspection will be carried out upstream.

Having decided on the start point, the Crew Leader (O/MHKIUS) will deploy the vehicle in close proximity to the start point. The exit and entry manhole covers will be removed to allow for venting of the pipe. The two areas will then be secured using the current code of practice for guarding & signing of open manholes (roadwork's).

The crew will place the camera, cable drum at the start point and connect the cables. Whilst this is under way, the Crew Leader (O/MHKIUS) will be inputting the inspection header information onto the monitor screen and loading the video tape/disc into the video recorder. The following information will be displayed:

Page 1: Date of survey
Starting time of survey
Location of survey
Direction of travel of tractor
Use of the sewer/drain/conduit
Name of company
Name of qualified operator
Project and client reference
Node (From MH to MH) Reference number

Page 2: ST No. to FH No.
Pipe Size
Pipe Material
Pipe Duty
Direction of Survey i.e., upstream/downstream Camera's chainage
Node reference numbers
Name/code of operator and company

Page 1 information will be at the beginning of the tape/disc only.

Page 2 information will be at the beginning of each survey. No mixed information will be on any one tape / video disc unless specified by the customer. This means that foul water and storm water will be on separate video tape/disc.

The crew will, by now, have connected the camera unit to the main cable and mounted the camera on the skid / tractor. The Crew Leader (O/MHKIUS) will now test the camera, camera lights, camera focus and the tractor unit to ensure all are in working order, and also undertake the relevant tests.

If the camera is to be winched through the pipeline, the crew will have passed the towing line through the pipe from the U/S, D/S access point and connected this to the camera skid.

The pipe diameter will have been measured and the camera height adjusted on its mount to ensure that the camera lens is in the centre of the pipe axis.

When all tests have been completed, the camera is inserted into the pipe run and the slack is taken out of the main cable. The Crew Leader (O/MHKIUS) will then reset the meter counter to zero at the point where the survey will start. The camera cable turning a counter wheel on the cable drum activates the meter counter. This transmits a signal to the control unit and the counter is displayed on the monitor screen. As the camera moves along the pipe, the counter increases in 10cm increments to an accuracy of within 5% of the length.

The Crew Leader (O/MHKIUS) adjusts the light and focus to show the best picture on the monitor. He then informs the crew that the inspection is about to commence and activates the video recorder and the tractor unit. The camera then travels along the pipe at an average speed of 10 / 15cm per second, this being the optimum speed that facilitates the identification and recording of all faults by the Crew Leader (O/MHKIUS).

The Crew Leader (O/MHKIUS) will note all defects and will take photographs of major faults by utilizing digital "Video print" photography and each photograph is numbered consecutively for each survey.

At the end of each survey, the Crew Leader (O/MHKIUS) will end the survey by entering information that should be entered on page 3, stating the manhole number and the total drainage measured on the counter. This procedure is used for each survey, a survey being from MH to MH. At the commencement the next survey the meter counter is reset to zero.

On completion of the full survey, the video tape/disc is brought back to the office where the information is compiled into a report using either computerised operations or the standard report format. The format is defined in the HKCCEC-Hong Kong Conduit Condition Evaluation Codes-The Code of Practice on Conduit Condition Evaluation Using CCTV in Hong Kong, UTI, 2009 of UTI and compatible with Manual of Sewer Condition Classification published by the UK Water Research Council. The computer version displays the same information but in a different layout.

All photographs are printed and inserted behind the relevant page in the report, thus providing the client with an instant view of the pipe defects, thus eliminating the need to view the video tape/disc. The digital file of will be enclosed in an envelope at the back of the report. For "Video print" photographs the video tape is the negative.

In normal circumstances, CCTV inspection is used for pipe diameters up to and including 2100mm. We may use the pull-in for pipe diameter up to and including 150mm, use 4-wheel tractor for pipe diameter bigger than 150mm and up to 450mm, use big tractor for pipe diameter bigger than 450mm and up to 750mm, roller shall be installed on the camera for pipe diameter bigger than 750mm.

For pipelines over this size or under abnormal circumstances, In Conduit Photography (ICP) by Man-Entry Survey will be introduced which has higher risk, need more qualified operators and so higher in cost.

2. Methodology

2.1 Monitor Test

The following procedures are recommended for testing the monitor:

- (1) Select the under scan mode on the CCTV monitor so that the edge of the raster scan can be clearly seen at the top, bottom, left and right of the screen. If the monitor does not have under scan, then it will need to be modified by a qualified technician.
- (2) Play a standard Monitor Test Tape on a good quality video recorder (4 or 6 heads) or digital device and display it on the monitor screen.
- (3) Ensure that the full centre circle is visible and that the edges of the test chart coincide with the edge of the raster image on the monitor.
- (4) While playing the Monitor Linearity Test section of the test tape mark the position of the centre cross and the centre of the four “bow ties” with a chinagraph pencil.
- (5) Measure the distance between the centre and all the “bow ties” marks with a transparent plastic ruler and ensure they are all within 5% of each other. If the marks are still not within this range, the linearity of the monitor will need to be adjusted by qualified technician. Repeat the test until the required tolerance is achieved.
- (6) For other display device, testing may follow the manufacturer’s instruction.

2.2 Camera Test

The Camera can be tested using the following steps:

1. Place the camera in a proprietary Test Chart Box and view the Test Chart (Marconi Resolution Chart Number 1). The chart should be evenly illuminated from the rear. Illumination should be provided by a source compatible with the camera lighting being used, e.g. Quartz Halogen (3,200K), White L.E.D. (5,600K),
2. With the monitor in the under scan mode, position the camera so that the edges of the Test Chart coincide with the edge of the raster image, they must now be in equal position at the top, bottom, left and right of the screen. The camera is now centered on the Test Chart.
3. Check that all five shades of grey can be clearly seen on the grey scale; shade 1 should be white and is the background within the centre circle. Adjustment of the monitor brightness and contrast controls may be required.
4. Check the resolution by viewing the line wedges and line blocks, adjust the camera focus to give the best view. The resolution should meet the requirement of the specification (normally between 320 and 450 lines).
5. Check the color bars, the blue, red, magenta, green, cyan and yellow sections can be clearly seen with no tinting or smearing on their edges. Adjustment of the monitor color/ chroma level control may be required.

6. Record a section at the start of each new VHS tape of the camera viewing the Marconi Resolution Chart Number 1, as set up above.
7. Record details of the camera checks in a picture quality form/log book.

2.3 Camera Cable Calibration

The calibration of the distance measurement system, which is usually a measurement wheel on the cable, should be checked on a daily basis. The recommended test procedure is described below:

- (1) Ensure that the cable is fully wound onto the cable drum with the end of the cable passing through the measuring wheel.
- (2) Set the counter to zero
- (3) Pull the cable off the drum until the counter indicates exactly 10m.
- (4) Measure the length of the cable that has been pulled off the drum with a standard tape, and record this length on the linear measurement audit form/ log book.
- (5) Repeat Steps (3) and (4) four times, pulling 10m off the cable drum each times until a total of 50m (minimum 30m)has been checked and recorded.
- (6) Check that the error on the distance measurement is within the tolerance allowed in the specification (usually +/- 1% or 0.3m, whichever is the larger).
- (7) File the completed forms/ log book for further audits.

2.4 Measuring the Focal Distance of the Camera

The captured image is actually referring to a position a certain distance in front of the camera's lens, the distance is defined as the "focal length" of the lens. This length depends on the type of the camera used and the size of the sewer/ drain. The distance shall be worked out before commencing the survey.

To calculate the distance, the following procedure is recommended:

- (1) Hold a tape equivalent to the largest dimension of the cross-section of the pipe to be surveyed in front of the lens, e.g. for a circular pipe this will equal to the diameter, for other shapes this will equal to the largest dimension. The tape should be held vertically unless horizontal dimension is the largest.
- (2) View the tape through the camera. Adjust the position of the tape until the screen can just view the whole length of the tape.
- (3) The distance of the tape from the rear of the camera is then measured.

2.5 Measuring Length/ Distance in the Sewer/ Drain

Distance can also be determined by attaching/ drawing a half of a meter (in 10mm increments) on a short length of rod and placing it in the pipe in front of the camera, and prior to the commencement of the survey.

Focus the camera on the rod and record in the video after the recording of the Marconi Resolution Chart Number1.

This will assist the operator and the client to determine distance and size on the monitor.

This can be helpful when come across some conflicts to the degree of defect, especially when classifying open and displaced joints.

3. Field Procedures

3.1 Planning for the Inspection

Obtaining all relevant information from client or asset owner.

3.2 Preparation

Prepare the equipment. And preparing high pressure water jetting (HPWJ) if client requests or depends on conduit condition.

3.3 Inspection

Inspection should be carried out by certified worker and monitor by utility specialist

3.4 Record

On site recording is required.

3.5 Report

Report should be checked by utility specialist before submitting to client.

Details can be referred to Work Procedure For Conduit Condition Evaluation(CCTV and Man Entry Survey), HKIUS.

4. Survey requirement

4.1 Safety Program and Confined Spaces

Working in Confined Spaces can be hazardous so strict observance of all safety procedures is paramount. Crew Leaders shall undertake a risk assessment and fully brief all team members to ensure that they all know the tasks they are to perform, in accordance with the Factories and Industrial Undertakings (Confined Spaces) Ordinance 1989 (amended year 2000).

Personnel

Persons who are required to enter confined spaces should be given a medical examination before commencing employment and, if possible, at reasonable intervals thereafter.

If any of the following disabilities are found, the person should, where possible, be given other work and not enter confined spaces.

- (1) Fits, blackouts or fainting attacks.
- (2) Heart disease or disorder.
- (3) High blood pressure.
- (4) Asthma, bronchitis or shortness of breath, on exertion.
- (5) Deafness.
- (6) Meniere's disease or disease involving giddiness/loss of balance.
- (7) Claustrophobia or other nervous or mental disorders.

Entry Into Confined Spaces

Legal Definition

A '**Confined Space**' means any place in which, by virtue of it's enclosed nature, there arises a reasonably foreseeable **specified risk**, and without limiting the generality of the foregoing, includes any chamber, pit, well, sewer, tunnel, pipe, flue, boiler, pressure receiver, hatch, caisson, shaft or silo in which such risk arises.

A 'Specified Risk' means a risk of:

Serious injury to any person at work arising from a fire or explosion;

The loss of consciousness of any person at work arising from an increase in body temperature;

The loss of consciousness or asphyxiation of any person at work arising from gas, fumes, vapour or the lack of oxygen;

The drowning of any person at work arising from an increase in the level of liquid; or

The asphyxiation of any person at work arising from free flowing solids or the inability to reach respirable environment due to entrapment by a free flowing solid.

Qualifications and Experience of **Competent Persons** and **Certified Workers**:

Under the Factory and Industrial Undertakings Regulations a Competent Person means a person:

- (1) Who has reached the age of 18 years: and
- (2) Who is either:
 - a. A Safety Officer registered under the Factories and Industrial Undertakings (Safety Officers and Safety Supervisors) Regulations; Or
 - b. A person who holds a certificate issued by a person whom the Commissioner has authorised to certify persons as being competent to prepare Risk Assessment Reports; And
- (3) Who has at least one years relevant experience, after obtaining the registration or certification. Referred to in paragraph (b)(i) or (ii) in assessing risk to the safety and health of workers working in confined spaces.

Under the same regulations a **Certified Worker** means a person:

- (1) Who has attained the age of 18 years, and
- (2) Who holds a certificate issued by a person whom the commissioner has authorised to certify workers as being competent to work in a confined space:

This Regulation applies to work in an Industrial Undertaking:

- (1) That takes place within a confined space; and
- (2) As required by the Regulation, that takes place within the immediate vicinity of, and is associated with work occurring in a confined space.

Source: (CAP 59AE Factories and Industrial Undertakings (Confined Space) Regulation).

4.2 Potential Dangers

The purpose of this section is to draw attention to the more common hazards likely to occur in sewers and manholes. It is not a complete list of dangers. If there are any doubts to the safety of a confined space, **DO NOT ENTER**. Do not be forced to undertake any tasks considered as dangerous and always contact your safety officer for further advice. The Company will always support your decision for you not to proceed.

Fall hazard

Due to the fact that sewers are old, sometimes badly constructed and often subject to damage from sewage, it is **unwise to assume** that a sewer **checked yesterday is safe today**.

Manhole ladders and step irons should be regarded with suspicion as they can fail unpredictably under load. Each rung and step iron should be tested prior to weight being placed upon it. Safety harnesses, lifelines and man winches (where required) must be used. Ensure the top man has a firm grip on the rope as you descend, do not allow slack to build up in lines or wires.

Atmospheric Hazard

the atmosphere in a sewer can become potentially dangerous due to the presence of components that are toxic or flammable or through a deficiency or excess of oxygen.

These conditions may arise from the decomposition of deposited solids or from a variety of less predictable occurrences such as leakages from gas mains, the discharge of trade effluents and spillages of petrol or chemicals, some of which may individually be harmless but when mixed can be very dangerous.

Even after a manhole has been tested and found to be safe the atmosphere can gradually or suddenly change for the worse. An unusual smell, dizziness, nausea, throat or eye irritation can be an indication that something is wrong. Should this happen, or should the gas monitor alarm sound, the sewer should be evacuated immediately and further investigations undertaken.

Flood Hazard

a sudden rush of water may occur caused by a rainstorm in an area away from the working site.

The rapid release of a large volume of water from a swimming pool, reservoir etc. This can be caused by the failure or unauthorized operation of valves, penstocks, and stanks, etc.

Therefore it is important to always check local weather conditions and warn colleagues of any rainfall.

Ensure that all valve gear is locked off with a sign stating that men are working in the Pipe. Temporary or old penstocks and stanks should be inspected prior to entry.

Also listen out for the unexpected sound of rushing water or a surge of wind, which may indicate a sudden inflow of water.

It is important, especially during sewer traversing to be aware that flows may rise slowly. Thus depth checks should be undertaken at regular time intervals.

Chemical Hazard

Clients should warn contractors of licensed discharges into sewers and watercourses, which may pose a hazard to health. However, it should not be assumed that where no warning has been issued no hazard exists. Indeed all flows should be treated as suspect as chemicals, which are innocuous on their own, may become noxious when combined together in sewer. Any unusual substances should be investigated and the sewer should not be entered until it is proven safe to do so.

Some symptoms, caused by hazardous chemicals, are irritated eyes, nose, skin and lungs. Difficulty may be experienced in breathing and you may also feel dizzy or sick.

Should you have any of these symptoms or generally feel unwell, leave the confined space immediately and make further inquiries and report the incident to your Safety Officer. **DO NOT RE-ENTER UNTIL THE CONFINED SPACE HAS BEEN PROVEN SAFE.**

The preparation kit includes utility drawings; all necessary permits for field works and safety precaution procedures will be issued to the survey team before the commencement of field works.

Safety equipment such as bright colored barricades, road signs, personal protective equipment (PPE) and gas detectors are equipped on the working vehicle.

5. Quality Assurance and Quality Control

5.1 CCTV Report

- (1) Check that the cover accurately displays the contents of the file
- (2) Check that the summary contains all the surveys within the section and agrees with the cover.
- (3) Check that the drainage schedule displays all the surveys within the section
- (4) Check that all depths and levels are entered on the drainage schedule
- (5) Check that the defects summary agrees with the relevant survey sheet
- (6) Check that the correct defect code has been used
- (7) Check that all header information on drainage schedule and defects summary are consistent
- (8) Check that the correct 8 figure Grid Reference is used to identify manholes.
- (9) Check that all pipe sizes and materials agree on all forms and drawings
- (10) Check that all spelling is correct
- (11) Check that the floppy discs contain all information within the file and ensure that these are secured in the file prior to submission.
- (12) Check that there is a photograph for each defect reported on the report sheet
- (13) Check that all photographs are clear and give a clear representation of the fault
- (14) Check that the correct information has been endorsed on the photograph sheet
- (15) Check that all negatives are present and presented with the master copy of the report
- (16) Check that any amendment to the report that results in conflicting information on the video tape/disc, is identified on the bottom of the report
- (17) Check that photograph negatives are all present and correctly identified and incorporated in the master copy of the report.

5.2 Drawing (CCTV Inspection & Manhole Survey)

- (1) Check that all access points noted on the base plan have been incorporated in the report. If not, give reasons why.
- (2) Check that all Manholes are joined by either Category: A, B or C indicator Lines and that the correct Category has been used.
- (3) Check that the correct direction of flow has been marked.

- (4) Check that the correct MH numbers have been marked.
- (5) Check that the Pipe size is marked on each section of pipe run and that the size is correct.
- (6) Check that all missing manholes have been deleted.
- (7) Check that all buried manholes are present but annotated as 'BURIED'.
- (8) Check that double, triple and quadruple runs are clearly marked i.e. (3 x 450 or 2 x 375) etc.
- (9) Check that the information box is complete and contains the correct information.
- (10) Check that all borders are present.
- (11) Check that all coordinates are marked on all sides of the drawing.
- (12) Check that all grid intersection points are marked.

5.3 MES Photographs / Photograph Sheets

- (1) Check that the photograph shows clearly the start manhole number / finish manhole number.
- (2) Check that there is a photograph for each 5m of pipe.
- (3) Check whether there are either defect photographs or general photographs for each 5m of pipe if no defect is found.
- (4) Check that the photographs are of good quality and that they clearly illustrate the pipe condition.
- (5) Check that the photographs are correctly affixed to the photograph sheet.
- (6) Check that each photograph on the photograph sheets are numbered and run sequentially with the chainage on the photographs.
- (7) Check that all information on the photograph sheets is correct and corresponds with the report.

5.4 Video Tape / Disc

- (1) Check that video tape/disc labels correspond with the video film and the report folder flysheet.
- (2) Check that the tape/disc number and area are endorsed both on the video box and on the video tape/disc.

References

- (1) 16/WSD/97, Leakage Detection of Buried Watermains Affecting Slopes - Stage I, Water Supplies Department
- (2) Chapter 398 OCCUPATIONAL SAFETY AND HEALTH COUNCIL ORDINANCE
- (3) Code of Practice on Monitoring & Maintenance of Water Carrying Services Affecting Slopes, ETWB (2006), Hong Kong SAR Government.
- (4) Constitution, Hong Kong Institute of Utility Specialists (2011).
- (5) Course Note, Conduit Condition Evaluation Course for Operators, Engineers / Surveyors and Managers, UTI, 2007.
- (6) DC96/19, Investigation of Sewers and Drains Behind and Adjacent Fill Slopes and Retaining Walls, Drainage Services Department.
- (7) Factories and Industrial Undertakings Ordinance (Cap. 59). Laws of Hong Kong (www.legislation.gov.hk), the Government of HKSAR.
- (8) King Wong(2009), Hong Kong Conduit Condition Evaluation Codes(HKCCEC) The Code of Practice on Conduit Condition Evaluation using CCTV in Hong Kong, 4th Edition,UTI
- (9) HKHA161/95, Detection of Leakage from buried water carrying services in the vicinity of slopes 'and retaining walls within the lands 'maintained by Housing Authority.
- (10) Particular Specification for Conduit Condition Evaluation, HKIUS, 2011.
- (11) Sample report for Conduit Condition Evaluation, HKIUS, 2011
- (12) Work procedures for Conduit Condition Evaluation, HKIUS, 2011
- (13) WRC (2001). Sewage Rehabilitation Manual,4th Edition, Water Research Council, Swindon
- (14) WRC (2004). Manual of Sewer Condition Classification, 4th Edition, Water Research Council, Swindon.
- (15) WRC “Model contract document for sewer condition inspection”
- (16) WRC “Model Contract Document for Manhole Location Surveys and the Production of Record Maps”
- (17) 黃敬博士工程師, 郭啟業先生-如何利用非破損方法(管內閉路電視(CCTV)檢測)以改善城市管道狀況

Appendix**A1 Abbreviations**

Company/ Organization	
Code	Description
BD	Buildings Department, HKSARG
CEDD	Civil Engineering and Development, HKSARG
DSD	Drainage Services Department, HKSARG
EMSD	Electrical and Mechanical Services Department, HKSARG
EPD	Environmental Protection Department, HKSARG
HA	Hong Kong Housing Authority, HKSARG
HKIUS	Hong Kong Institute of Utility Specialists, HKSARG
HKURC	Hong Kong Utility Research Centre
HyD	Highways Department, HKSARG
LandsD	Lands Department, HKSARG
LD	Labour Department, HKSARG
PolyU	The Hong Kong Polytechnic University
UTI	Utility Training Institute
WRc	Water Research Centre
WSAA	Water Services Association Australia
WSD	Water Supplies Department, HKSARG
WTI	Water Training Institute
Others	
Code	Description
%	Percentage
BMP	Bitmap (Picture Format)
BWCS	Buried Water Carrying Service
CCE	Conduit Condition Evaluation

Company/ Organization	
CCE(CCTV & ME)	Conduit Condition Evaluation(Closed Circuit Television & Man- Entry)
CCES	Conduit Condition Evaluation Specialists
CCTV	Closed Circuit Television
CD	Compact Disc
CL	Cover Level
COP	Code of practice
CP	Competent Person
DN	Nominal Diameter
DP	Design Pressure
DVD	Digital Versatile Disc
e.g.	Exempli Gratia
GIS	Geo-Information System
EPR	Environmental Protection Requirements
etc.	et cetera
GL	Ground Level
H	Height
HKCCEC	Hong Kong Conduit Condition Evaluation Codes
HPWJ	High Pressure Water Jetting
hr	Hour
Hz	Hertz
ICG	Internal Condition Grade
ID	Internal Diameter
IDMS	Integrated Data Management System
IL	Invert Level
ISO	International Standards Organization
JPEG	Joint Photographic Experts Group (Picture Format)

Company/ Organization	
kHz	Kilo- Hertz
kPa	Kilopascal
m	Meter(s)
ME	Man Entry
MHICS	Manhole Internal Condition Survey
mm	Millimetre(s)
Mpa	Megapascal
MPEG	Motion Picture Experts Group (Video Format)
MS	Method Statement
MSCC	Manual of Sewer Condition Classification, UK
OHSAS	Occupational Health and Safety Assessment Series
PPE	Personal Protective Equipment
ppm	Parts per million
PS	Particular Specification
PSI	Pound Per Square Inch
QA/ QC	Quality Assurance/ Quality Control
Ref.	Reference
RMSE	Root Mean Square Error
RPUS	Recognized Professional Utility Specialist
RTO	Recognized Training Organization
SCG	Service Condition Grades
SOPs	Safe Operator Procedures
SPF	Sun Protection Factor
SPG	Structural Performance Grade
SRM	Sewer Rehabilitation Manual
STP	System Test Pressure
TTA	Temporary Traffic Arrangement

Company/ Organization	
US	Utility Specialist
VHS	Video High Speed
W	Width
WLD	Water Leakage Detection
WO	Works Order
WP	Work Procedure

A2 Requirements for Personnel Carrying Out Inspection

Training and Experience Requirements for Personnel Carrying Out Inspection (HKIUS standard, 2011)			
Title	Role	Minimum Training Requirement	Qualification
Project Leader	Responsible for contract administration and preparation, checking and certifying of reports for compliance with the technical specification.	<ul style="list-style-type: none"> ➤ At least 35 hours of CPD every year ➤ At least 14 hours for refreshment training in every three years ➤ Relevant training in RTO (e.g. PolyU, UTI) for surveys and data collection ➤ Has attended training courses for relevant survey/detection methods, and Possesses a valid training certificate for relevant survey/detection methods used 	Either: M/FHKIUS, RPUS plus CP, CW or MHKIE/ R.P.E. plus CP, CW and relevant training in RTO (e.g. PolyU, UTI) for surveys and data management
Deputy Project Leader	Responsible for assisting project leader and acting the post of project leader when project leader temporary not with the team	<ul style="list-style-type: none"> ➤ At least 35 hours of CPD every year ➤ At least 14 hours for refreshment training in every three years ➤ Relevant training in RTO (e.g. PolyU, UTI) for surveys and data collection ➤ Has attended training courses for relevant survey/detection methods, and Possesses a valid training certificate for relevant survey/detection methods used 	Either: M/FHKIUS, RPUS plus CP, CW or MHKIE/ R.P.E. plus CP, CW and relevant training in RTO (e.g. PolyU, UTI) for surveys and data management
Team Leader	Responsible for works arrangement and data processing including checking of raw data for quality and consistency.	<ul style="list-style-type: none"> ➤ At least 35 hours of CPD every year ➤ At least 14 hours for refreshment training in every three years ➤ Relevant training in RTO (e.g. PolyU, UTI) for surveys and data collection ➤ Has attended training courses for relevant survey/detection methods, and Possesses a valid training certificate for relevant survey/detection methods used 	M/FHKIUS, RPUS, CP, CW
Crew Leader	Responsible for supervising the field works and site safety.	<ul style="list-style-type: none"> ➤ At least 35 hours of CPD every year ➤ At least 14 hours for refreshment training in every three years ➤ Relevant training in RTO (e.g. PolyU, UTI) for surveys and data collection ➤ Has attended training courses for relevant survey/detection methods, and Possesses a valid training certificate for relevant survey/detection methods used 	O/MHKIUS, CP, CW
Operators	Responsible for operating equipment and carrying out inspection and survey.	<ul style="list-style-type: none"> ➤ At least 35 hours of CPD every year ➤ At least 14 hours for refreshment training in every three years ➤ Relevant training in RTO (e.g. PolyU, UTI) for surveys and data collection ➤ Has attended training courses for relevant survey/detection methods, and Possesses a valid training certificate for relevant survey/detection methods used 	AMHKIUS, CP, CW