Part 6 Monitoring and Leak Detection of Storage Tank Systems

Section 6.1 Scope

6.1.1 This Part applies to monitoring and *leak detection* for a *storage tank system*.

Section 6.2 General Requirements

6.2.1(1) A *storage tank system* shall be tested for *leaks* in conformance with Sections 6.2 and 6.3:

(a) at the time of final installation:

(i) for an *underground storage tank system*, final installation shall be when final surface materials have been installed and prior to being put into service; or

(ii) for an *aboveground storage tank system*, final installation shall be before the *storage tank system* is put into service; and

(b) whenever a *leak* is suspected in the primary or *secondary containment* of the *storage tanks, piping, containment sumps* or related components.

6.2.2 A *line-leak detector* shall be designed, built, and *approved* in conformance with ORD-C107.12-1992, "Line Leak Detection Devices for Flammable Liquid Piping."

6.2.3 Manual or electronic dip or inventory reconciliation shall be in conformance with Section 8.3.

6.2.4(1) Statistical inventory reconciliation shall be in conformance with:

(a) EPA/530/UST-90/007, "Standard Test Procedures for Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods"; and

(b) EPA 510-B-95-009, "Statistical Inventory Reconciliation."

6.2.5 An automatic tank gauge system with a precision *leak detection* capability shall be designed, built, and *approved* in conformance with ORD-C58.12-1992, "Leak Detection Devices (Volumetric Type) for Underground Storage Tanks".

6.2.6 A continuous in-tank *leak detection* system shall conform to good engineering practice and shall meet the requirements of a *precision leak detection test*. (See Appendix B, Note B6.2.6.)

6.2.7(1) High-technology *secondary containment* monitoring shall continuously monitor the *interstitial space* and include the use of an automatic device designed, built, and *approved* in conformance with:

(a) ORD-58.12-1992, "Leak Detection Devices (Volumetric Type) for Underground Storage Tanks", or

(b) ORD-58.14-1992, "Leak Detection Devices (Nonvolumetric Type) for Underground Storage Tanks",.

6.2.8 Visual *leak detection* procedures shall be performed in conformance with Sentence 8.4.1(3).

6.2.9(1) A *pressure liquid media leak detection* test shall be in conformance with the requirements of a *precision leak detection test* and:

(a) the test device shall be third-party performance certified; and

(b) testing technicians shall be trained in the care and use of the test device

6.2.10(1) A *static liquid media leak detection* test shall be in conformance with the following requirements:

(a) leak rate shall not exceed 0.38 L/h;

(b) the duration of the test shall be a minimum of 1 hour;

(c) there shall be no visual evidence of a *leak*; and

(d) the test fluid shall exceed the elevation of *piping* and electrical conduit openings installed in sumps at the time of the *leak detection* test.

6.2.11(1) A high-pressure inert gas or vacuum *leak detection* test for *piping* shall be in conformance with the following procedures, as applicable:

(a) a high-pressure decline test using an inert gas or a vacuum test may be used as a *leak detection* test for *piping* systems that are in use and that have a volume of less than 1,000 L;

(b) whenever permitted by the equipment design and installation, product contained in the *piping* system shall be drained prior to conducting the high-pressure inert gas or vacuum test procedure;

(c) pumps, dispensers or other auxiliary equipment connected to the *piping* that cannot be subjected to the pressure of the test shall be isolated from the test procedures to prevent equipment damage;

(d) a test pressure or vacuum shall, as applicable:

(i) be more than 350 kPa (gauge) or 1.5 times the maximum operating pressure, whichever is greater;

(ii) not exceed 700 kPa (gauge), except when the *piping* system is designed for such pressures; and

(iii not exceed the equipment manufacturer's design limitations.

(e) stabilization is required after pressurization or vacuum is achieved;

(f) a *piping* system with a volume of less than or equal to 500 L shall have the pressure or vacuum maintained for a period of at least 60 min after stabilization;

(g) a *piping* system with a volume of greater than 500 L but less than or equal to 1,000 L shall have the test pressure or vacuum maintained for a period of at least two hours after stabilization;

(h) a *piping* system with a volume greater than 1000 L shall be tested using a procedure acceptable to the *authority having jurisdiction* (See Appendix B, Note B6.2.11 (1) (h); and

(i) a *piping* system shall be considered to be *leaking* when pressure variations that occur after stabilization and within the test time period are greater than two percent of the test pressure or vacuum.

6.2.12(1) A low-pressure inert gas or vacuum *leak detection* test for *piping* shall be conducted in conformance with the following procedures, as applicable:

(a) a low-pressure decline test using an inert gas or a vacuum test may be used to conduct a *leak detection* test on the *secondary containment* of double-wall tanks and double-wall pipe;

(b) product contained in the *secondary containment* system shall be drained prior to conducting the low-pressure decline or vacuum test procedure;

(c) a test pressure or vacuum shall, as applicable:

(i) be between 20 kPa and 35 kPa; and

(ii) not exceed the equipment manufacturer's design limitations;

(d) stabilization is required after pressurization or vacuum is achieved;

(e) *secondary containment* shall have the test pressure or vacuum maintained for a period of at least two hours after stabilization; and

(f) a *piping* system shall be considered to be *leaking* when pressure variations that occur after stabilization and within the test time period are greater than two percent of the test pressure or vacuum.

6.2.13(1) A *precision leak detection* test shall be in conformance with (See Appendix B, note B.6.2.13(1)):

(a) ORD-C58.12-1992, "Leak Detection Devices (Volumetric Type) for Underground Storage Tanks;" or

(b) ORD-58.14-1992, "Leak Detection Devices (Nonvolumetric Type) for Underground Tanks."

Section 6.3 Leak Detection Interlocks and Alarms

6.3.1(1) Subject to Sentence (2), an automatic *leak detection* device, including a high-technology *secondary containment* monitoring device and precision line *leak detection* device, shall be electrically interlocked in such a manner that:

(a) when the automatic *leak detection* device is activated, product flow shall be shut off; and

(b) except for on-*site* maintenance activities, when the automatic *leak detection* device is turned off or bypassed for more than one minute, product flow shall be terminated.

6.3.1(2) When an electrical interlock as specified in Sentence (1) is not possible, the *authority having jurisdiction* shall be notified whenever the *leak detection* device or method indicates a *leak*. (See Appendix B, note B.6.3.1(2))

6.3.2 A suction pump shall be equipped with a single check valve installed directly below the suction pump and *piping* shall slope so the contents of the pipe will drain back to the storage tank if the suction is broken.

6.3.3 A *leak detection* alarm shall be located where the staff routinely work and in a place where such alarms can be readily heard and seen.

Section 6.4 Monitoring Wells

6.4.1 When more than one monitoring well is necessary to monitor an installation effectively, the monitoring wells shall be numbered so that all monitoring and testing results can be easily correlated to a specific monitoring location.

6.4.2 A monitoring well shall be equipped with a liquid-proof cap.

6.4.3 A monitoring well shall be distinguished from a fill pipe and marked in conformance with CPPI (1995), "Using the CPPI Colour-Symbol System to Mark Equipment and Vehicles for Product Identification"

6.4.4 A monitoring well shall be secured to prevent unauthorized access and tampering.

6.4.5 A monitoring well located in a traffic area shall be cut off at ground level and/or properly *protected* from vehicles.

6.4.6 A monitoring well installed within the *interstitial space* shall not penetrate the *liner*.

6.4.7 A damaged monitoring well shall be repaired or replaced within 30 *days* after discovery of the damage.

6.4.8 A monitoring well shall be checked for liquid product and/or vapours at least monthly.

Section 6.5 Groundwater Monitoring Wells

6.5.1(1) When a vertical groundwater monitoring well is to be used, a professional hydrogeologist or other person authorized by the *authority having jurisdiction* shall:

(a) assess the *site* and establish the number and positioning of the monitoring wells so that product releases from any portion of the *storage tank system* that routinely contains a *petroleum* or *allied petroleum product* will be detected; and

(b) ensure compliance with the requirements of this Section.

6.5.2 The product stored in a *storage tank* shall be immiscible in water and shall have a specific gravity of less than one.

6.5.3 The hydraulic conductivity of the soil between a *storage tank system* and the monitoring wells shall not be less than 0.01 cm/s. (See Appendix B, note B 6.5.3)

6.5.4 The monitoring wells shall intercept the excavation zone of an *underground storage tank* or be as close as technically possible.

6.5.5 A monitoring well shall be a minimum of 50 mm in diameter.

6.5.6 Subject to Sentence 6.5.11(1), if a monitoring well is to be used as a recovery well, the screened zone shall extend at least 1.5 m into the water table and at least 1.5 m above the groundwater surface, as determined at the time of installation.

6.5.7 Subject to Sentence 6.5.11(1), the screened portion of a monitoring well shall be a minimum of 3.0 m in length and shall be factory slotted with a slot size of 0.25 mm or as *approved* by the *authority having jurisdiction*.

6.5.8 The area around the screened portion of a monitoring well shall be surrounded by a filter pack. (See Appendix B, note B.6.5.8)

6.5.9 Subject to Sentence 6.5.11(1), the filter pack shall extend to 0.5 m above the top of the screened portion of monitoring wells.

6.5.10 Subject to Sentence 6.5.11(1), the outside of a monitoring well shall be sealed from the ground surface to the top of the filter pack using bentonite, grout, or other material with equivalent performance.

6.5.11(1) Where the groundwater surface is less than 2.5 m from the ground surface, a professional hydrogeologist or other person authorized by the *authority having jurisdiction* shall determine the length and position of:

(a) the screened portion of a well;
(b) the filter pack; and
(c) the bentonite, grout, or other material with equivalent performance seal.

6.5.12 A monitoring well shall be installed with a cap or plug at the bottom of the screened section of the well.

6.5.13 A monitoring well shall be constructed of flush joint, threaded, or bell and spigot Schedule 40 PVC or equivalent. (See Appendix B, note B.6.5.13)

6.5.14 A continuous monitoring device or a manual method shall detect a minimum of 3 mm of free product on top of the groundwater surface in the monitoring well.

Section 6.6 Vapour Monitoring Wells

6.6.1(1) Where vapour monitoring is to be used, a professional hydrogeologist or other person authorized by the *authority having jurisdiction* shall:

(a) assess the *site* and establish the number and positioning of the monitoring wells so that product releases from any portion of the *storage tank system* that routinely contains a *petroleum* or *allied petroleum product* will be detected; and
(b) ensure compliance with the requirements of this Section.

6.6.2 The product stored or tracer compound placed in the *storage tank system* shall be sufficiently volatile to result in a vapour level that is detectable by the monitoring devices.

6.6.3 The measurement of vapours by the monitoring device shall not be rendered inoperative by the groundwater, rainfall, soil moisture, or other known interferences so that a *leak* could go undetected for more than 30 *days*.

6.6.4 The level of background contamination shall not interfere with the method used to detect *leaks* from the *storage tank system*.

6.6.5 A vapour monitor shall have its performance validated by a third-party testing organization in conformance with ORD-C58.14-1992, "Leak Detection Devices (Nonvolumetric) for Underground Tanks".

6.6.6(1) A vapour monitor shall be designed and installed to detect any significant increase in concentration above the background level of:

(a) the *petroleum* or *allied petroleum product* stored;

(b) a component or components of the *petroleum* or *allied petroleum product*; or

(c) a tracer compound placed in the *storage tank system*.

Section 6.7 Frequency and Method

6.7.1 The reference letters in Table 2 represent the *leak detection* and monitoring methods specified in Tables 3 through 9.

6.7.2(1) Tables 3 through 9 specify the frequencies and methods of *leak detection* and monitoring that shall be used upon installation and, as applicable (See Appendix B, note B.6.7.2(1)):

(a) for in-service monitoring;

(b) for periodic *leak detection* testing; or

(c) if a leak is suspected.

Table 2 - Leak Detection and Monitoring Methods

Abbreviation	Leak detection and Monitoring Method Description[1][2]
ATG	Automatic tank gauge with monthly *precision leak detection* test
CITLD	Continuous in-tank *leak detection* system with monthly *leak detection* test (results are limited to an evaluation of the *storage tank* only)
CITLDS	Continuous in-tank *leak detection* system with monthly *leak detection* test (results provide an evaluation of the *storage tank* and *piping* system)
ELLD	Electronic line *leak detection* device
HPVLDT	High-pressure inert gas or vacuum *leak detection* test
HTSCM	High-technology *secondary containment* monitoring
IR	Manual dip and inventory reconciliation; electronic dip and electronic inventory reconciliation; or electronic dip and manual inventory reconciliation in conformance with Section 8.3
LPVLDT	Low-pressure inert gas or vacuum *leak detection* test
MLLD	Mechanical line *leak detection* device
OWM	Observation well vapour or groundwater monitoring (monthly)
PLDT	*Precision leak detection test of a storage tank* (See Appendix B, note B.6.2.13(1))
PLMLDT	*Pressure liquid media leak detection test*
SIR	Statistical inventory reconciliation (monthly reporting)
SLMLDT	*Static liquid media leak detection test*
SVCV	Single, vertical check valve
VLD	Visual *leak detection* (weekly)

[1]See Section 6.2 for definition and performance requirements of the prescribed methods.
[2]See Appendix B, note B.6.3.2(1)

Table 3 – New Underground Storage Tanks

Containment	Final Installation Leak Detection	In-service Monitoring	Periodic Leak Detection	Leak Suspected
Double-wall tanks	PLDT	SIR; VLD; ATG; HTSCM; CITLDS; or CITLD	Not required	PLDT

Table 4 – Aboveground Storage Tanks

Containment	Final Installation Leak Detection	In-service Monitoring	Periodic Leak Detection	Leak Suspected
Double-wall tanks	VLD	HTSCM; or VLD	Not required	VLD[1]; PLDT; or LPVLDT[1]
API Std 650-98 *(within approved secondary containment)*	API 650 standard	IR and VLD; or HTSCM	API 653	PLDT; or API 653
API Std 650-98 *(within non-approved secondary containment)*		IR and VLD	API Std 653-01; or PLDT (annually)	PLDT; or API Std 653-01
Single wall vertical tanks *(within approved secondary containment)*	VLD	IR and VLD ; or HTSCM	API Std 653-01	PLDT; or API Std 653-01
Single-wall vertical tanks *(within non-approved secondary containment)*		IR and VLD	API Std 653-01; or PLDT (annually)	PLDT; or API Std 653-01
Horizontal tanks	VLD	IR and VLD	Not required	VLD[2]; or PLDT

[1]on the interstice only
[2]where entire system including *piping* is visible

Table 5 - Underground Piping

Containment	Final Installation Leak Detection	In-service Monitoring	Periodic Leak Detection	Leak Suspected
Single-wall (greater than 75mm)	PLMLDT; or HPVLDT	OWM	PLMLDT; or HPVLDT (every year)	PLMLDT; or HPVLDT
		CITLDS; or ELLD	Not required	
Double-wall	PLMLDT; or HPVLDT and LPVLDT	ELLD; Sensor; CITLDS; or SVCV[1]	Not required	PLMLDT; or HPVLDT

[1]Suction style system only

Table 6 - Aboveground Piping

Containment	Final Installation Leak Detection	In-service Monitoring	Periodic Leak Detection	Leak Suspected
All types	PLMLDT; or HPVLDT	VLD	Not required	PLMLDT; or HPVLDT

Table 7 – Turbine, Transition and Dispenser Sumps

Containment	Final Installation Leak Detection	In-service Monitoring	Periodic Leak Detection	Leak Suspected
Dispenser Sumps	SLMLDT	HTSCM; or VLD	Not required	SLMLDT
Turbine and transition sumps	SLMLDT		VLD (annually) [1]	SLMLDT

[1]In conformance with Clause 8.4.1(4)(g)

Table 8 - Existing Single-Wall Underground Storage Tanks

Type	In-service Monitoring	Periodic Leak Detection	Leak Suspected
Steel without CP[1]	IR; and OWM or SIR	PLDT (annually)	PLDT
Steel with CP[1]; or FRP[2];	IR	PLDT (every 2 years)	
	IR; and OWM or SIR	PLDT (every 5 years)	
	ATG; or CITLDS	Not required	
	OWM and SIR	Not required	

[1]CP - *Cathodic protection*
[2]FRP - Fibreglass-reinforced-plastic

Table 9 – Existing Single-Wall Underground Piping

Type	In-service Monitoring	Periodic Leak Detection	Leak Suspected
Steel without CP[1]	IR; and OWM or SIR	PLMDT; or HPVLDT (annually)	PLMDT; or HPVLDT
Steel with CP[1], plastic, or FRP[2]	IR; and OWM or SIR	PLMDT; or HPVLDT (every 2 years)	
	CITLDS; or OWM and SIR	Not required	
	SVCV[3]; or ELLD[4]	Not required	

[1]CP - *Cathodic protection*
[2]FRP - Fibreglass reinforced plastic
[3]Suction style system only
[4]Pressure Piping