	TECHNICAL SPECIFICATION		Nº I-ET-3010.00-1200-588-P4X-001
	CLIENT:		SHEET: 1 of 45
	JOB:		
	AREA:		
SRGE	TITLE: SAMPLE CONNECTIONS		INTERNAL
			ESUP

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DESIGN	ESUP	ESUP	ESUP	ESUP	ESUP	ESUP			
EXECUTION	PIVATTO	PIVATTO	PIVATTO	PIVATTO	PIVATTO	U5BP			
CHECK	OSVALDO	OSVALDO	OSVALDO	OSVALDO	OSVALDO	BXB2			
APPROVAL	ADRIANO	ADRIANO	ADRIANO	ADRIANO	JPAULO	UPU1			

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TITLE: **SAMPLE CONNECTIONS**

INTERNAL

ESUP

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1 OBJECTIVE

The objective of this Technical Specification is to define design criteria and give recommendations covering selection, constructability and ergonomics of the sample connections and collecting boxes to be specified during Basic and Detailed Design.

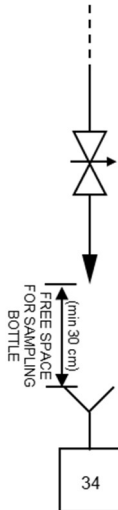
2 NORMATIVE REFERENCES

- API MPMS CHAPTER 8.1 - MANUAL OF PETROLEUM MEASUREMENT STANDARDS, CHAPTER 8 - SAMPLING SECTION 1 - STANDARD PRACTICE FOR MANUAL SAMPLING OF PETROLEUM AND PETROLEUM PRODUCTS
- API MPMS CHAPTER 14.1 - MANUAL OF PETROLEUM MEASUREMENT STANDARDS, CHAPTER 14 - NATURAL GAS FLUIDS MEASUREMENT, SECTION 1: COLLECTING AND HANDLING OF NATURAL GAS SAMPLES FOR CUSTODY TRANSFER, 7TH EDITION
- ASTM D3370 - STANDARD PRACTICES FOR SAMPLING WATER FROM FLOWING PROCESS STREAMS
- ASTM D4057 - STANDARD PRACTICE FOR MANUAL SAMPLING OF PETROLEUM AND PETROLEUM PRODUCTS
- DIN EN ISO 23874 NATURAL GAS - GAS CHROMATOGRAPHIC REQUIREMENTS FOR HYDROCARBON DEWPOINT CALCULATION (ISO 23874:2006)
- GPA STD 2166 - OBTAINING NATURAL GAS SAMPLES FOR ANALYSIS BY GAS CHROMATOGRAPHY
- I-ET-3010.00-1200-813-P4X-001 - GENERAL CRITERIA FOR FLOW METERING SYSTEMS
- NBR14883 08/2002 - PETRÓLEO E PRODUTOS DE PETRÓLEO - AMOSTRAGEM MANUAL

3 GENERAL NOTES AND DESIGN REQUIREMENTS

3.1 Liquid sampling takes place at two different locations:

- 1) From process pipe sending direct to drainage collector, as schematic below.

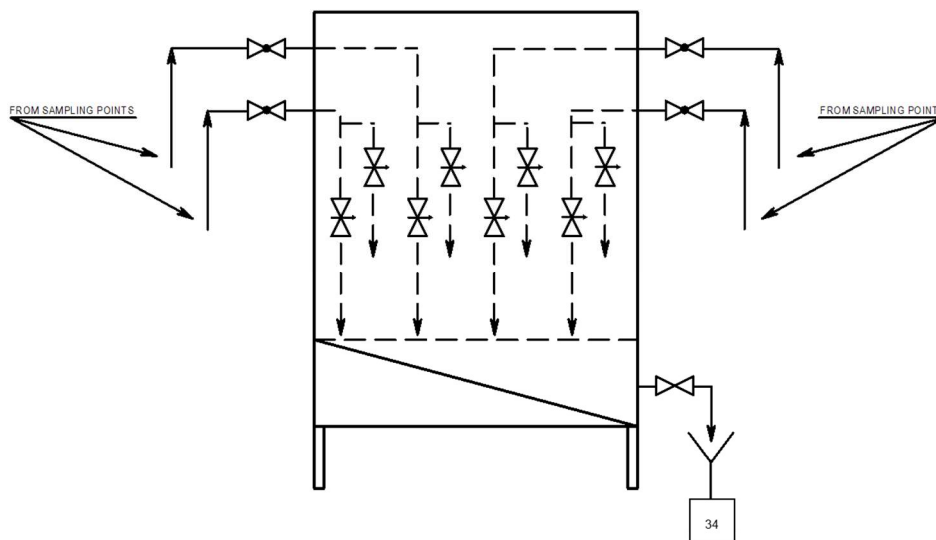


In this case, a clearance of 30 cm at minimum must be specified between the outlet of the liquid line and the drainage collector, allowing the handling of the sampling bottle.

Diameter of drainage collector shall be enough to collect the liquid and prevent liquid drip.

If the sampling point is located over grating floor it shall be installed a suitable drip tray to avoid liquid drip to the lower floor.

- 2) From process pipe sending to collecting boxes, as schematic below.



In this case, liquid is drained in the collecting box and routed to a drainage collector outside the collecting box. As sampling takes place inside the collecting box, no clearance is required for the drainage collector outside the collecting box and this distance shall be minimized in order to prevent liquid drip.



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- 3.2 Sampling of liquids that classify area and/or may release gas with ≥ 10 ppm_v H₂S content shall take place in collecting box type "B".
- 3.3 For selection of sample connection type, "high pressure" stands for pressure rating equal or upper to 300#. "Low pressure" stands for pressure rating lower to 300#.
- 3.4 For selection of sample connection type, "high temperature" stands for 60°C operating temperature and higher. "Low temperature" stands for operating temperatures lower than 60°C.
- 3.5 Material selection for sampling lines, valves and accessories shall be compatible to sampling application and design conditions of process line. For definition of the pressure rating of the pipe/tubing downstream the last sample connection valve, developed pressure drop shall be taken into account.
- 3.6 Sampling line length shall be as short as possible, preferably less than 4 meters. For produced water sampling, sampling line length shall not exceed 4 meters.
- 3.7 The diameters of the valves of sample connections must correspond to the lowest existing diameters of the pipe specification where the sample connections are installed.
- 3.8 Liquid sample connections shall not be installed on the bottom of a line, to avoid accumulated debris. Liquid sample connections shall preferably be located in vertical and ascending flow lines.
- 3.9 Probe tips shall be located in the central third of process pipe.
- 3.10 Sample cylinders, hoses, couplings, supports and other items required to sample collection with pressurized cylinders must be in contractors scope of supply. For sample cylinder specifications, see I-ET-3000.00-8222-941-PJN-001 - LABORATORY - EQUIPMENT.
- 3.11 Nominal working pressure of gas sample cylinders shall be 5000 psig according to I-ET-3000.00-8222-941-PJN-001 - LABORATORY – EQUIPMENT.
- 3.12 Sampler panels shall have adjustable clamping devices that allow the use of cylinders with different dimensions.
- 3.13 Flexible hoses connected to sample cylinders shall be 1 meter long at minimum.
- 3.14 The outlet diameter of sampling lines routed to sampling bottles must be compatible to the nozzle size of the sampling bottles used by the laboratory of the unit, which will be informed by PETROBRAS during Detailed Design phase.
- 3.15 All sample connections shall be tagged according to I-ET-3000.00-1200-940-P4X-001 - TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN.
- 3.16 Sample connections related to Fiscal Metering System points shall contain nameplate with tag of the meter (or skid) to which they serve.
- 3.17 Sample connections related to Fiscal Metering System points shall also follow I-ET-3010.00-1200-813-P4X-001 - GENERAL CRITERIA FOR FLOW METERING SYSTEMS.
- 3.18 Gas sampling connections related to Fiscal Metering Systems shall be located at a minimum distance of 5D downstream of any disturbance or pipe accident.



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3.19 Alternative arrangement for sample connections may be accepted, if it has the same functionality and previous approval of PETROBRAS.

3.20 All valves* related to sample connections applied on systems of gas, oil, mixed hydrocarbon phase (gas and liquid) and refrigeration unit shall comply with the low fugitive emissions requirement from ISO-15848, as stated in PIPING SPECIFICATION (project document issued by PETROBRAS).

* Exceptions are check valves and PSVs.

Application examples of low fugitive emissions requirement include:

FG - Fuel Gas

P - Process (non-corrosive hydrocarbon)

PC - Process (Corrosive Hydrocarbon)

3.21 All *Ministério do Trabalho e Emprego* (MTE) regulations (NRs) shall be followed.

4 CLASSIFICATION OF SAMPLE CONNECTIONS

Classification of sample connections is indicated below.

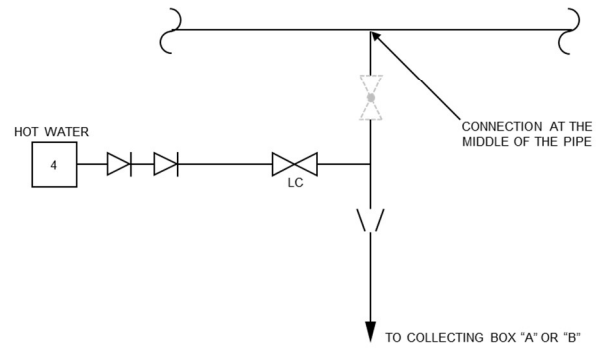
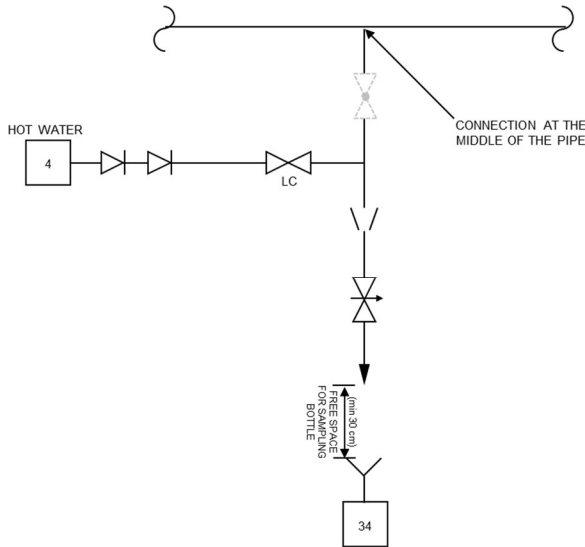
The schematics of sample connections indicate the first block valve next to the process pipe as gray and hatched. This block valve is the same represented in the Piping and Instrumentation Diagrams (P&IDs) and it is shown in this document for elucidative purpose. This block valve shall follow the same spec of the process pipe and be installed as close as possible to the process pipe.

4.1 SC1 - SAMPLE CONNECTION FOR LIQUIDS WITH TEMPERATURE LOWER THAN 60°C

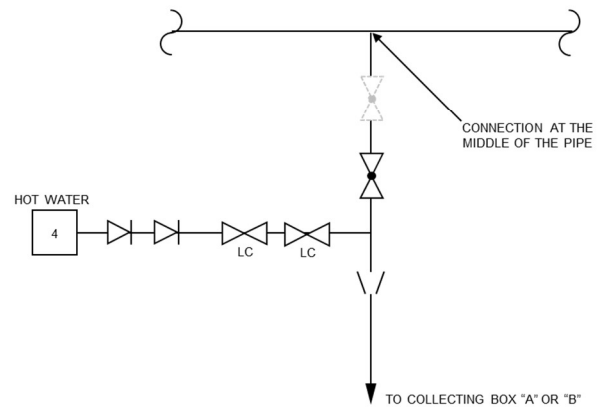
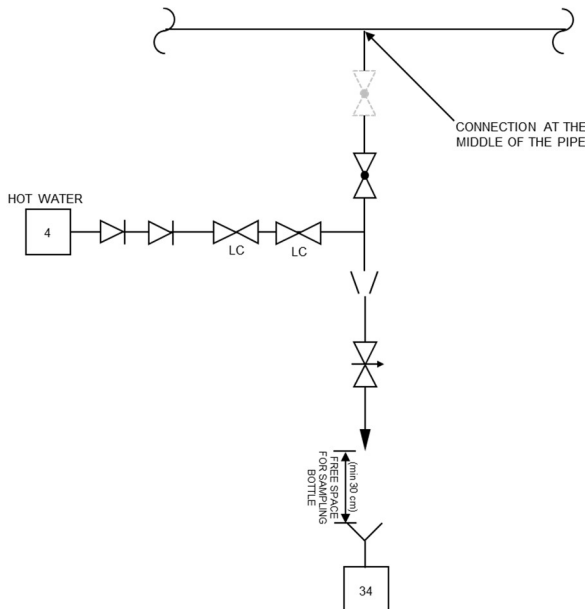
SC1 is not used for produced water, injection water, oil or streams with benzene ($\geq 1\%$ volume content).

Sampling of liquids that classify area and/or may release gas with ≥ 10 ppm_v H₂S content shall take place in collecting box type "B".

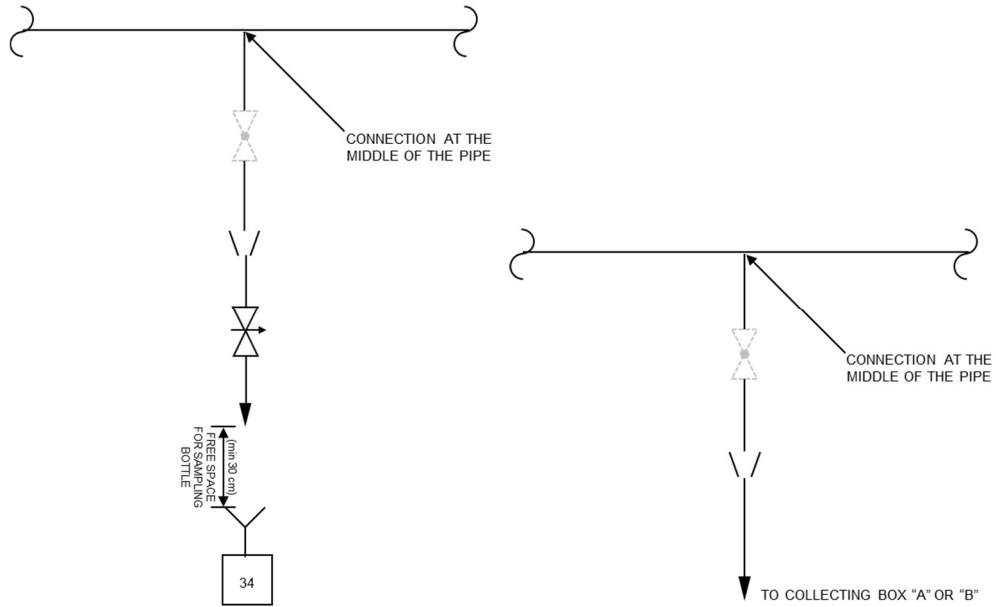
4.1.1 SC1 A1 - LOW PRESSURE; LOW TEMPERATURE; HOT WATER CLEANING REQUIRED



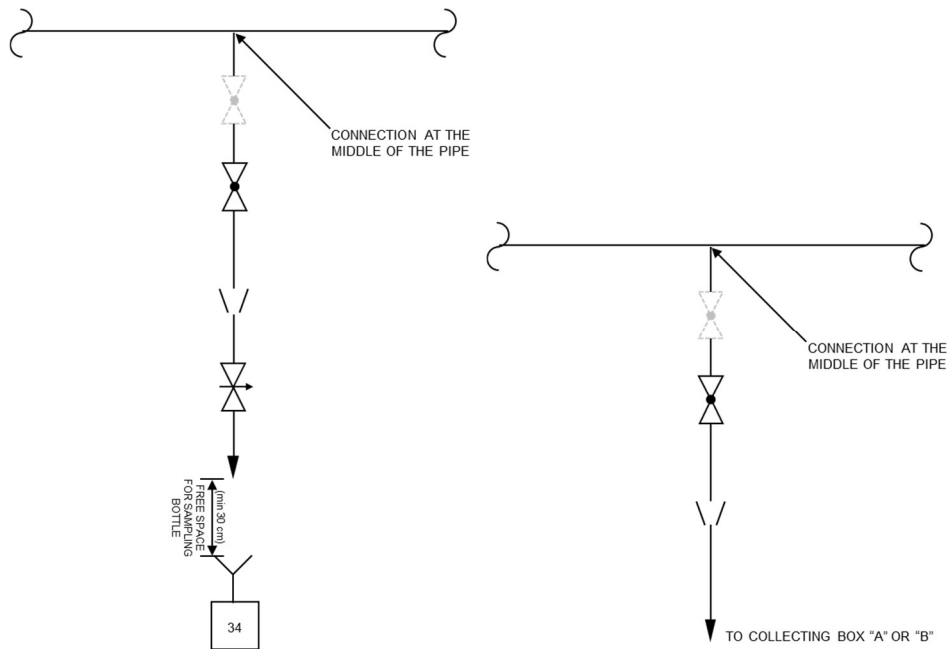
4.1.2 SC1 A2 - HIGH PRESSURE; LOW TEMPERATURE; HOT WATER CLEANING REQUIRED



4.1.3 SC1 A3 - LOW PRESSURE; LOW TEMPERATURE; HOT WATER CLEANING NOT REQUIRED



4.1.4 SC1 A4 - HIGH PRESSURE; LOW TEMPERATURE; HOT WATER CLEANING NOT REQUIRED

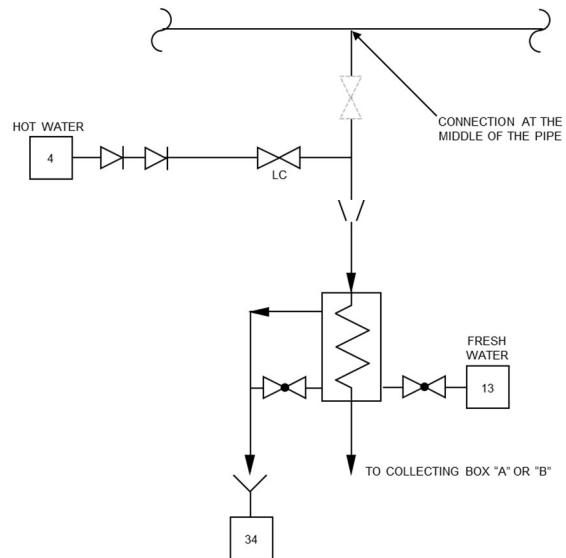
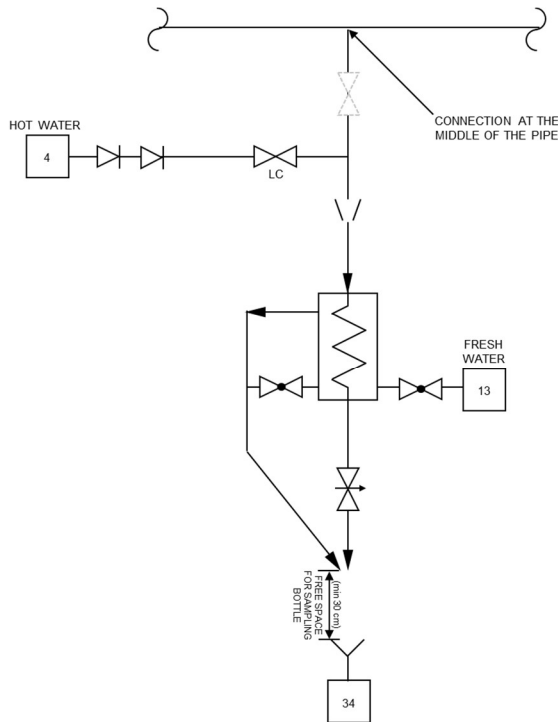


4.2 SC2 - SAMPLE CONNECTION FOR LIQUIDS WITH TEMPERATURE GREATER THAN OR EQUAL TO 60°C

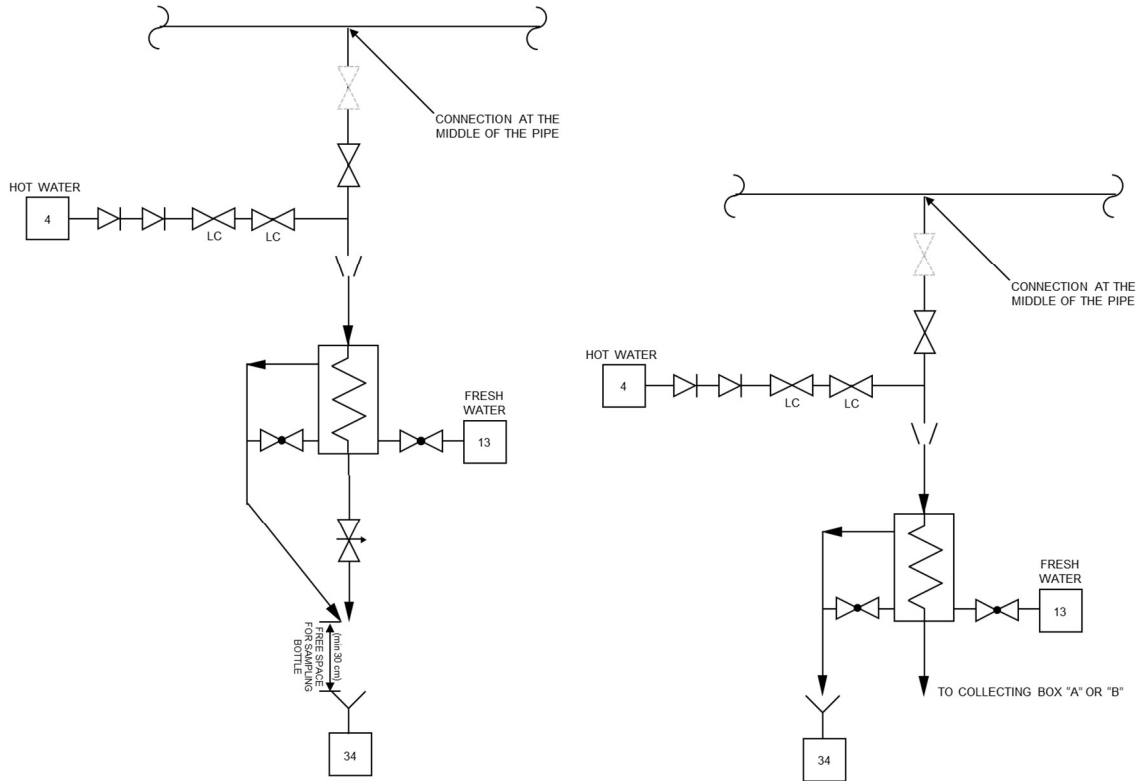
SC2 is not used for produced water, injection water, oil or streams with benzene ($\geq 1\%$ volume content).

Sampling of liquids that classify area and/or may release gas with ≥ 10 ppm_v H₂S content shall take place in collecting box type "B".

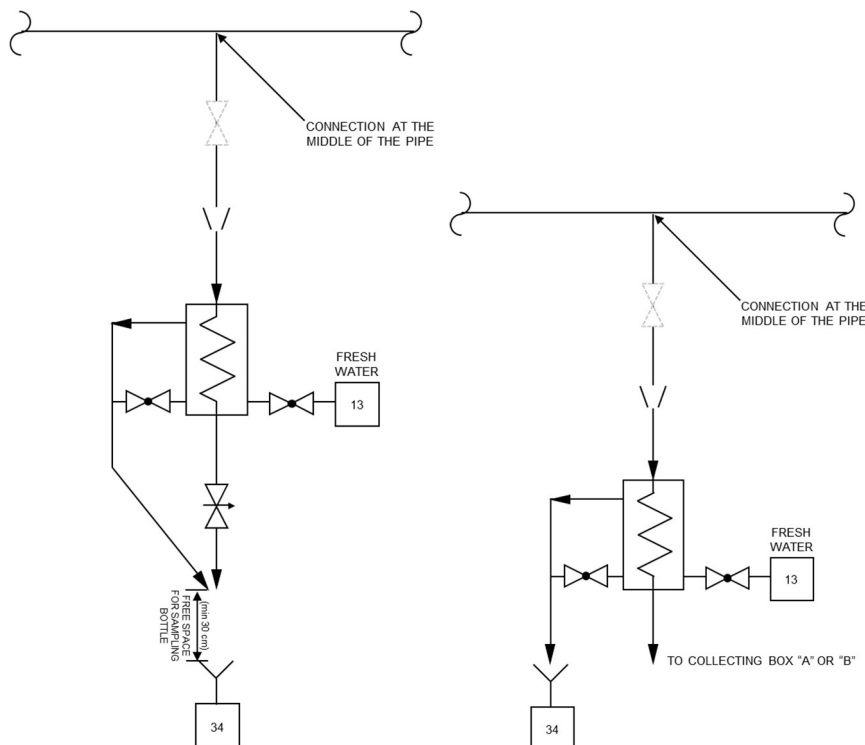
4.2.1 SC2 B1 - LOW PRESSURE; HIGH TEMPERATURE; HOT WATER CLEANING REQUIRED



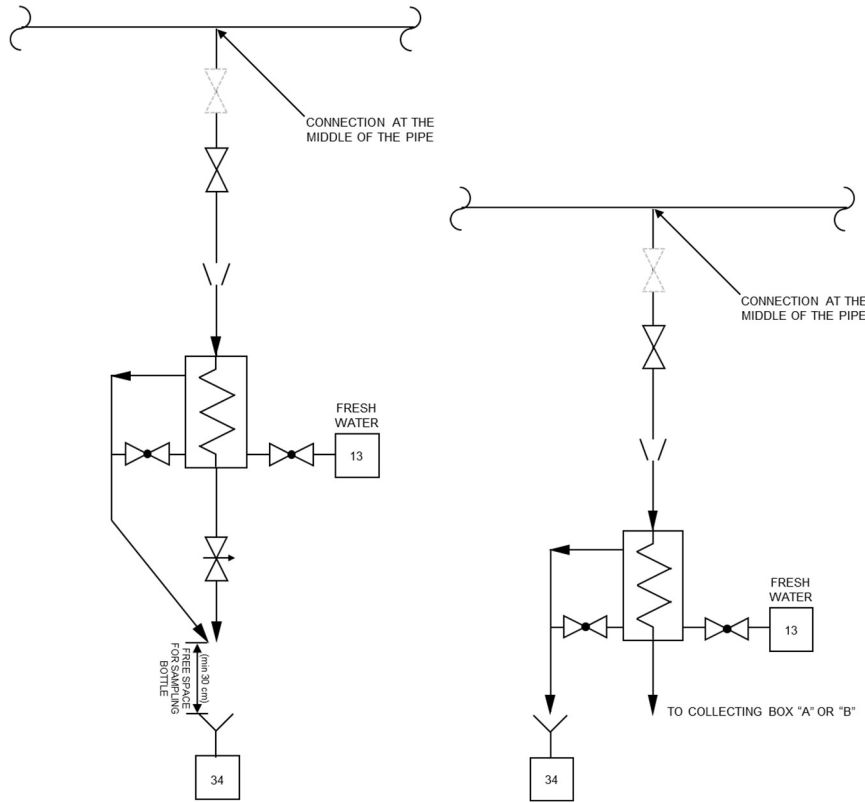
4.2.2 SC2 B2 - HIGH PRESSURE; HIGH TEMPERATURE; HOT WATER CLEANING REQUIRED



4.2.3 SC2 B3 - LOW PRESSURE; HIGH TEMPERATURE; HOT WATER CLEANING NOT REQUIRED



4.2.4 SC2 B4 - HIGH PRESSURE; HIGH TEMPERATURE; HOT WATER CLEANING NOT REQUIRED

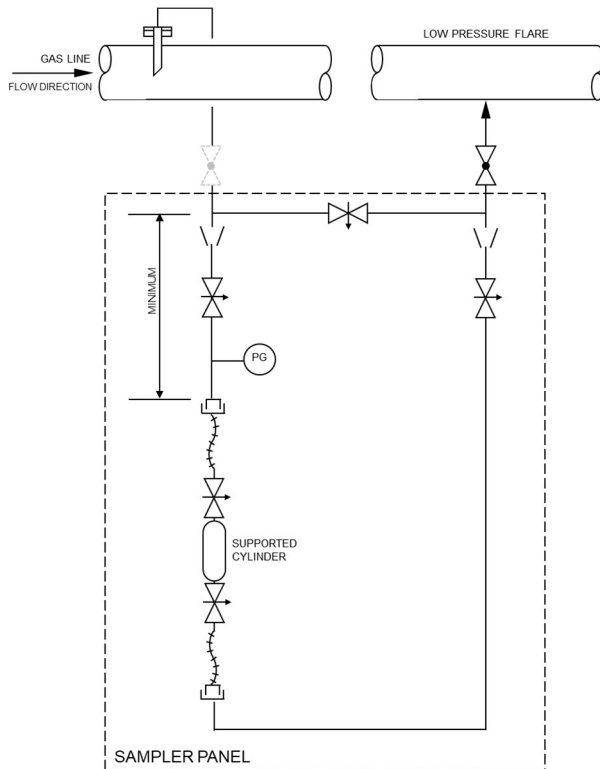


4.3 SC3 - GAS SAMPLER

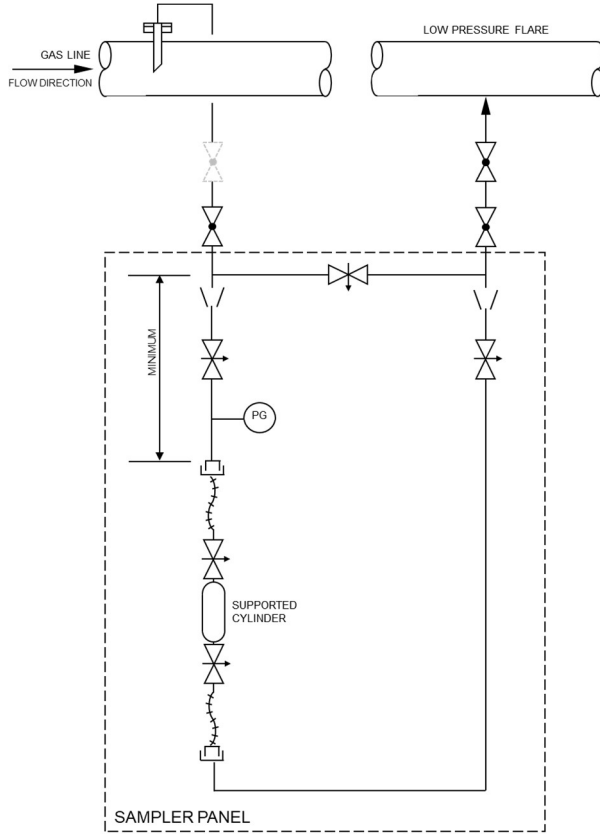
45° beveled probe shall be used, according to the schematics below.

Gas sampler shall be routed to the low pressure flare of the unit.

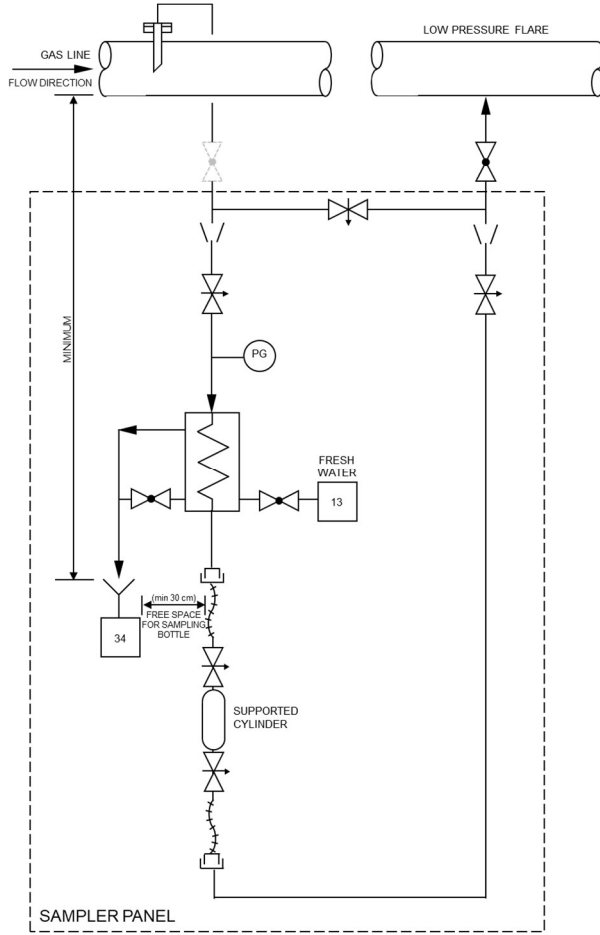
4.3.1 SC3 C1 - LOW PRESSURE; LOW TEMPERATURE



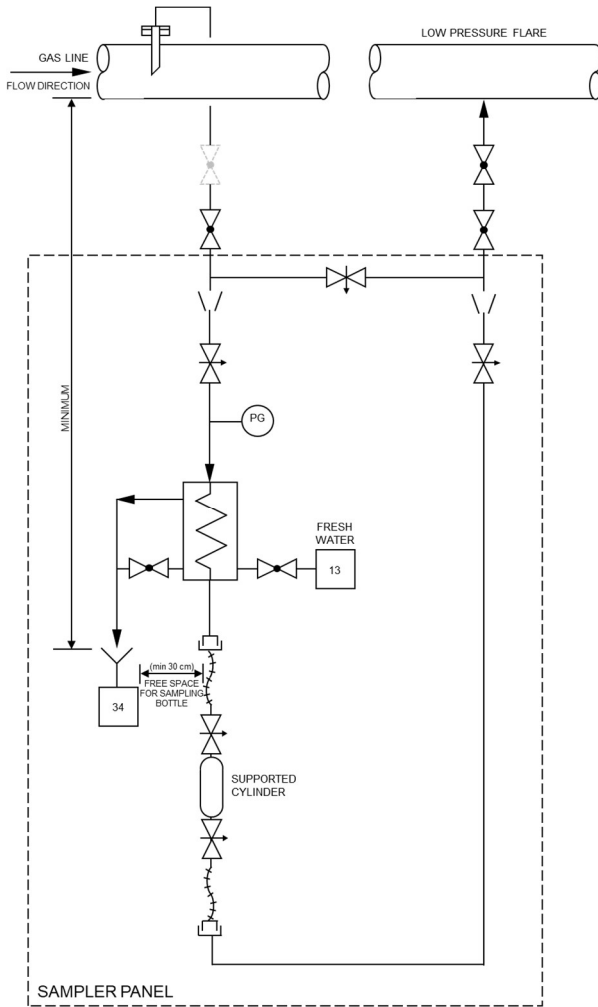
4.3.2 SC3 C2 - HIGH PRESSURE; LOW TEMPERATURE



4.3.3 SC3 C3 - LOW PRESSURE; HIGH TEMPERATURE

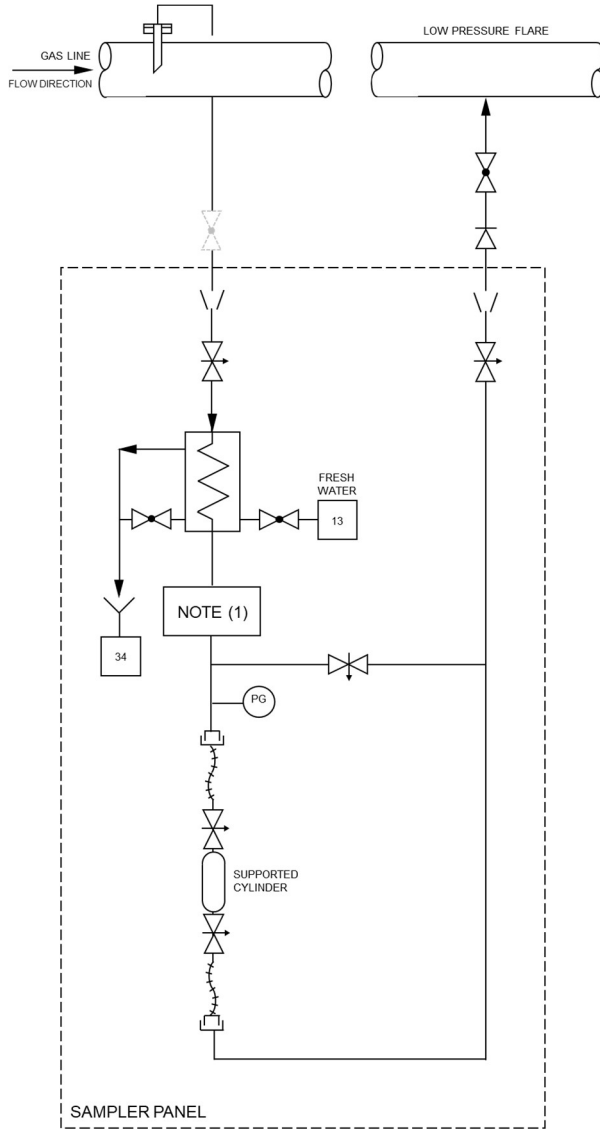


4.3.4 SC3 C4 - HIGH PRESSURE; HIGH TEMPERATURE



4.3.5 SC3 C5 - LOW LOW PRESSURE; HIGH TEMPERATURE

SC3 C5 is used if pressure is not enough to fill the sampling cylinders. Examples include but are not limited to: low pressure flare header, high pressure flare header.



(1) Vacuum pump system used to achieve the required sampling pressure.

4.3.6 SC3 C6 - HIGH HIGH PRESSURE; LOW TEMPERATURE

SC3 C6 is used if the design pressure of the system exceeds 5000 psig.

SC3 C6 schematic to be confirmed by PETROBRAS during Detailed Design.

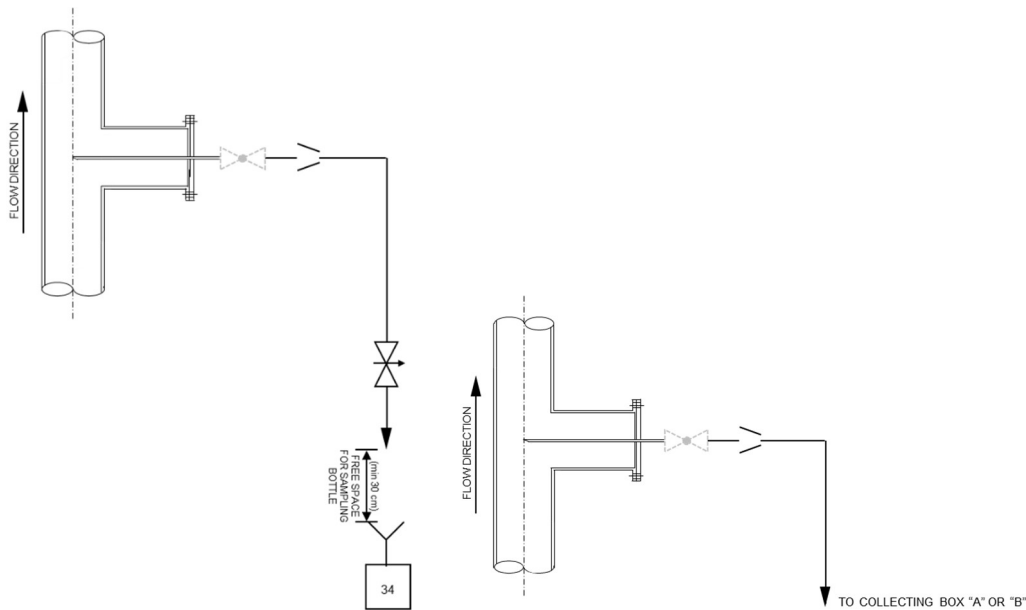
4.4 SC4 - SAMPLE CONNECTION FOR LOW BSW (BSW < 5%) DEAD OIL

45° beveled probe shall be used, according to the schematics below.

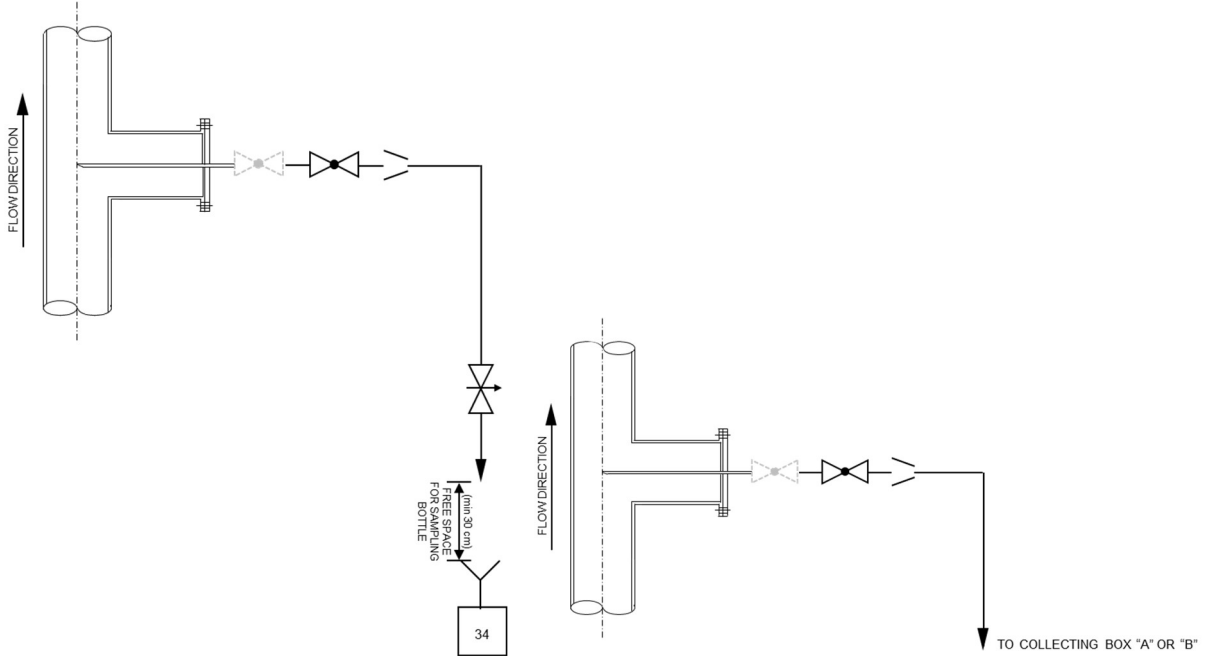
Connection with hot water system for hot cleaning shall be confirmed during Detailed Design considering the physical properties of the oil sample.

Sampling of liquids that classify area and/or may release gas with ≥ 10 ppm_v H₂S content shall take place in collecting box type "B".

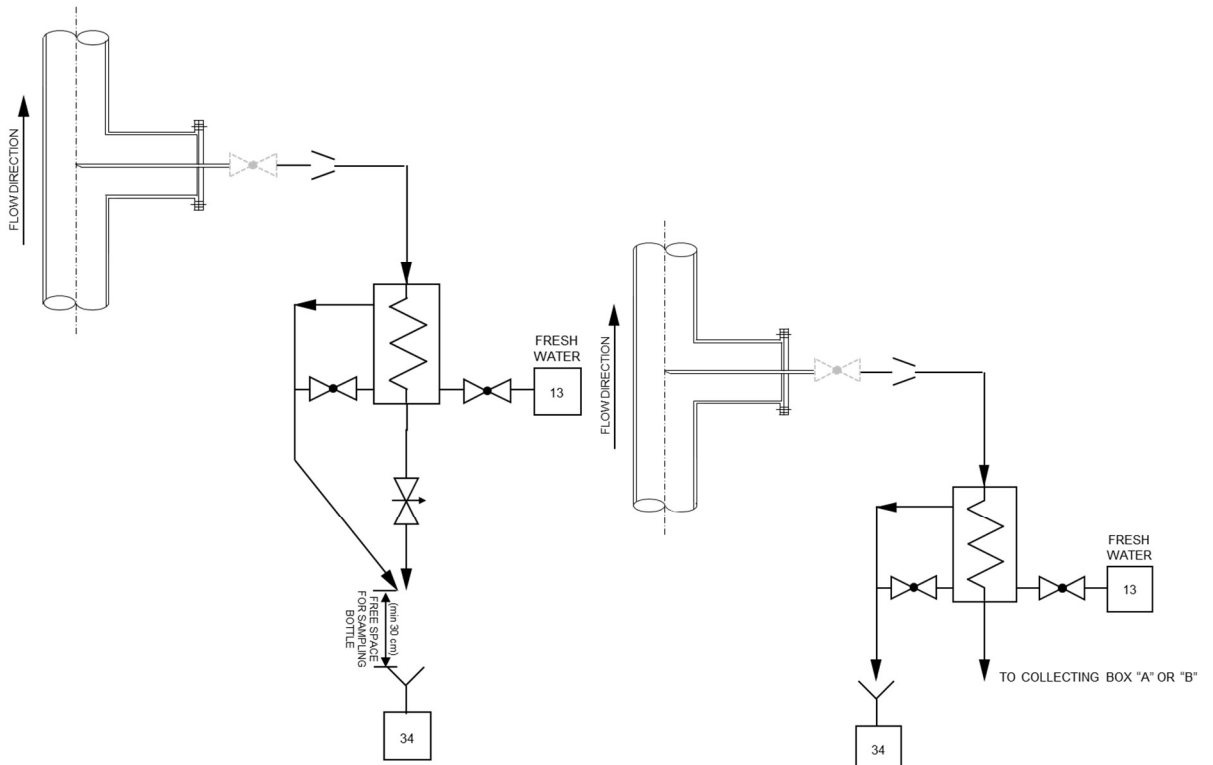
4.4.1 SC4 D1 - LOW PRESSURE; LOW TEMPERATURE



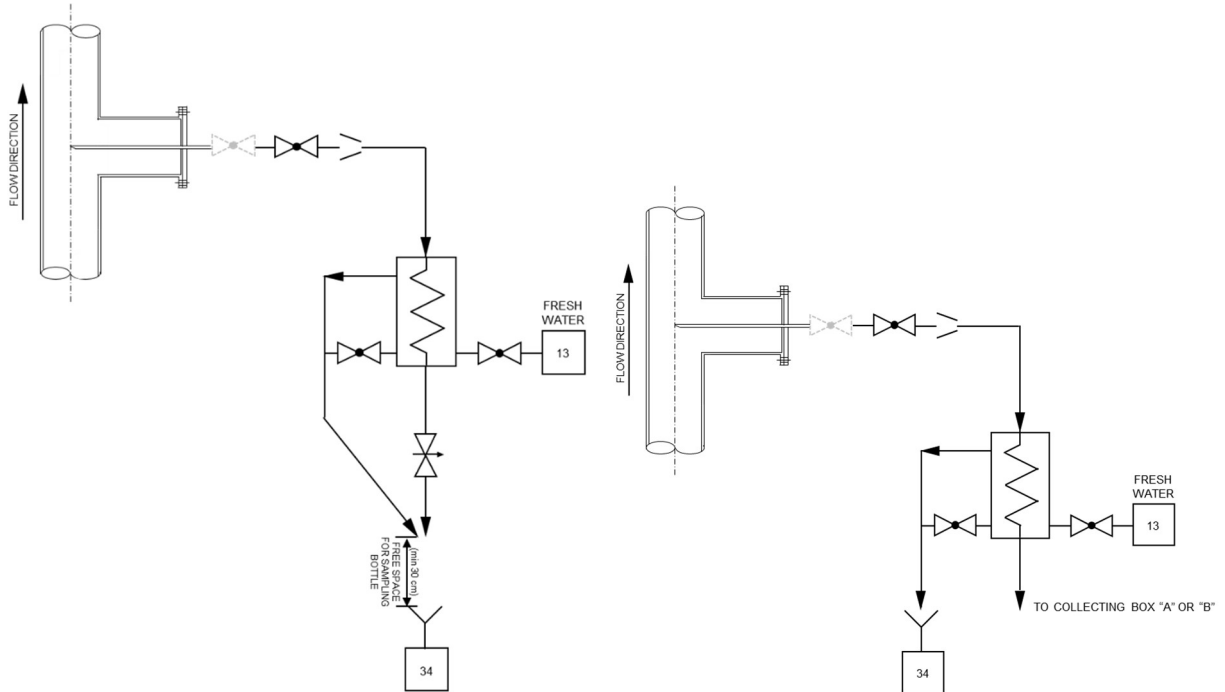
4.4.2 SC4 D2 - HIGH PRESSURE; LOW TEMPERATURE



4.4.3 SC4 D3 - LOW PRESSURE; HIGH TEMPERATURE



4.4.4 SC4 D4 - HIGH PRESSURE; HIGH TEMPERATURE



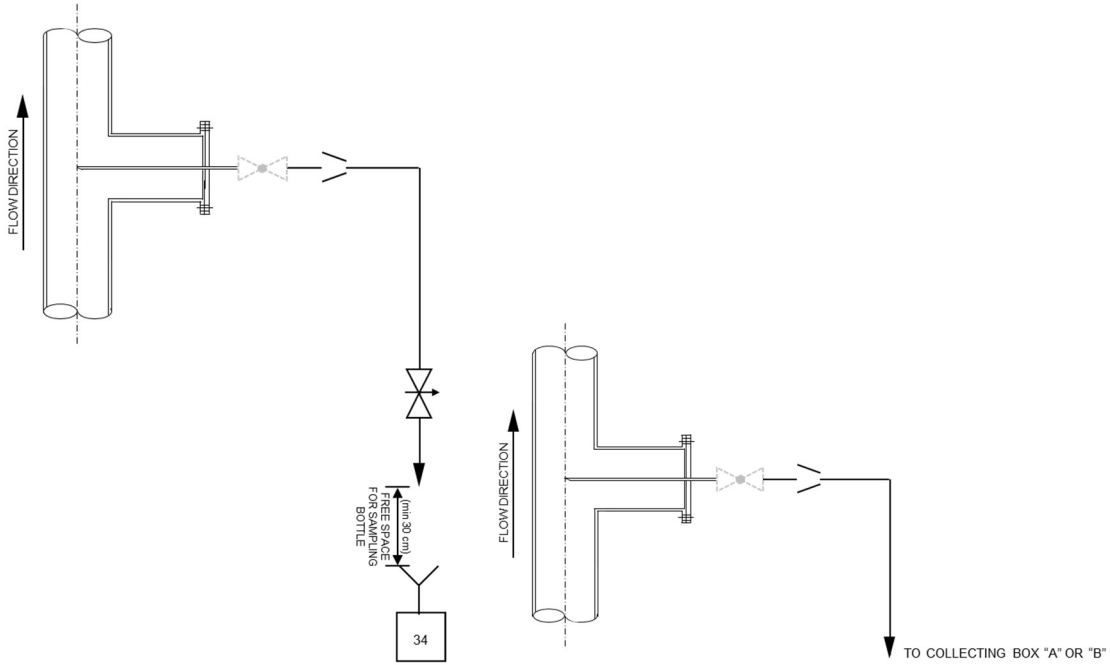
4.5 SC5 - SAMPLE CONNECTION FOR HIGH BSW (BSW GREATER THAN OR EQUAL TO 5%) DEAD OIL

45° beveled probe shall be used, according to the schematics below.

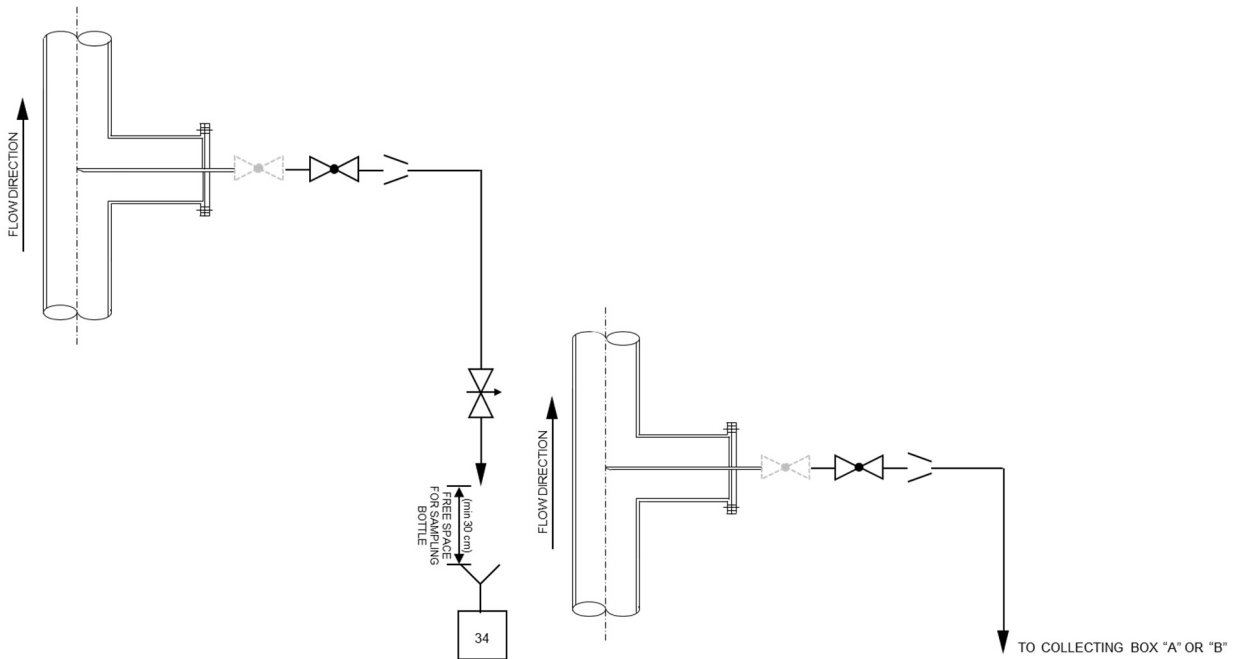
Connection with hot water system for hot cleaning shall be confirmed during Detailed Design considering the physical properties of the oil sample.

Sampling of liquids that classify area and/or may release gas with ≥ 10 ppm_v H₂S content shall take place in collecting box type "B".

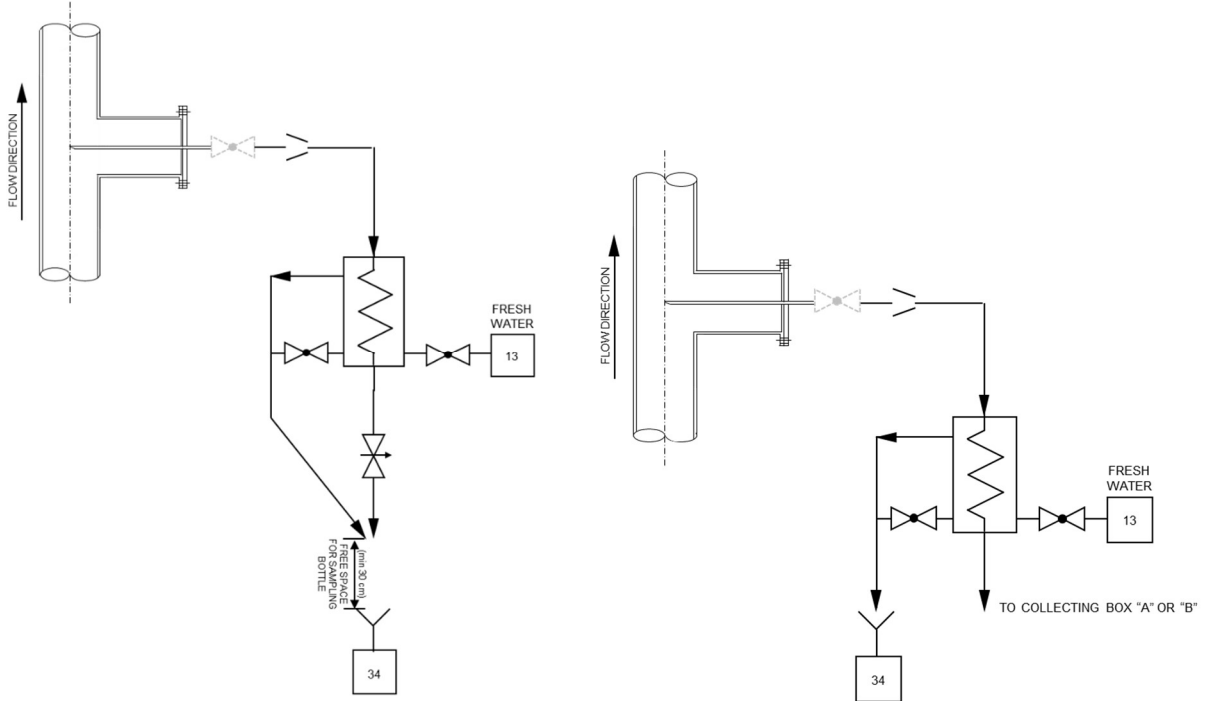
4.5.1 SC5 E1 - LOW PRESSURE; LOW TEMPERATURE



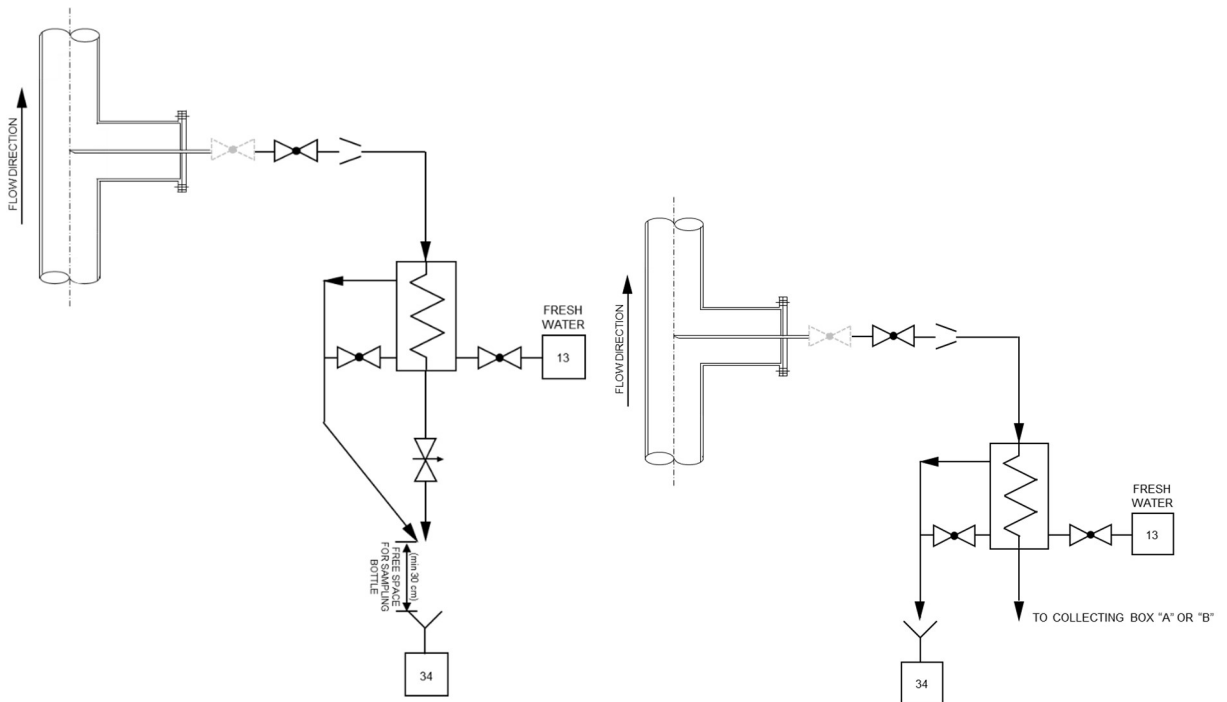
4.5.2 SC5 E2 - HIGH PRESSURE; LOW TEMPERATURE



4.5.3 SC5 E3 - LOW PRESSURE; HIGH TEMPERATURE



4.5.4 SC5 E4 - HIGH PRESSURE; HIGH TEMPERATURE

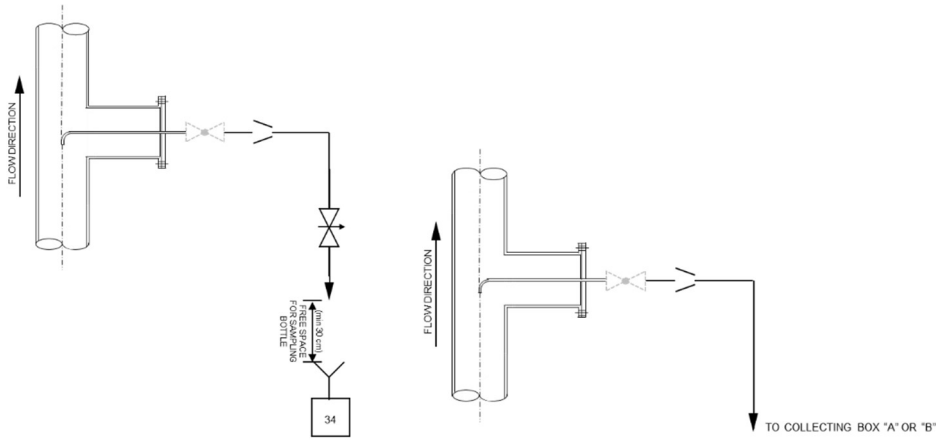


4.6 SC6 - INJECTION WATER (SEAWATER OR PRODUCED WATER) SAMPLE CONNECTION

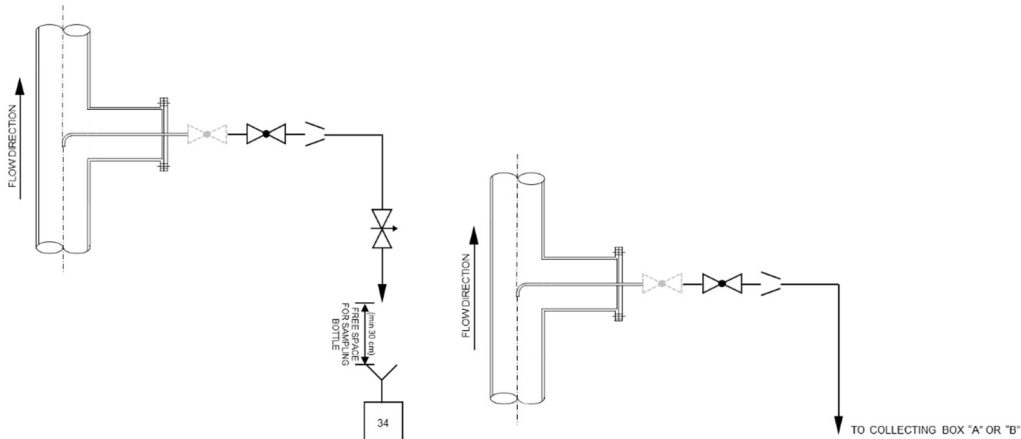
Pitot probe shall be used, according to the schematics below.

Sampling of liquids that classify area and/or may release gas with ≥ 10 ppm_v H₂S content shall take place in collecting box type "B".

4.6.1 SC6 F1 - LOW PRESSURE; LOW TEMPERATURE



4.6.2 SC6 F2 - HIGH PRESSURE; LOW TEMPERATURE



4.7 SC7 - SAMPLE CONNECTION FOR LIVE OIL

Pitot probe shall be used, according to the schematics below.

Connection with hot water system for hot cleaning shall be confirmed during Detailed Design considering the physical properties of the oil sample.

Sampling of liquids that classify area and/or may release gas with ≥ 10 ppm_v H₂S content shall take place in collecting box type "B".

Classified in two groups, as follows:

NON-PRESSURIZED SAMPLING

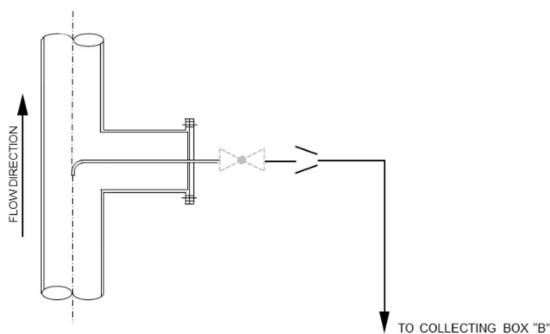
e.g. live oil sampling for BS&W metering, when PVT sampling with cylinder is not required.

PVT SAMPLING WITH CYLINDER

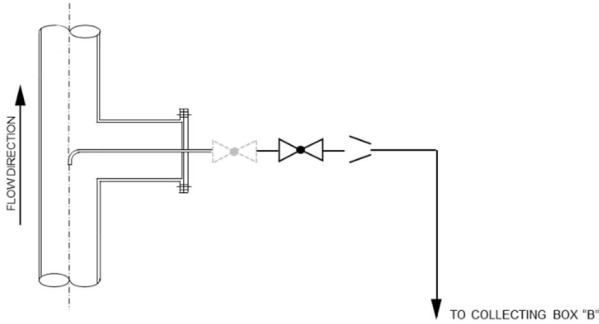
e.g. live oil for fiscal metering downstream TEST SEPARATOR, when PVT sampling with cylinder is required.

PVT sampling with cylinder already includes derivation for non-pressurized sampling (see item 5.1.2 COLLECTING BOX TYPE "B")

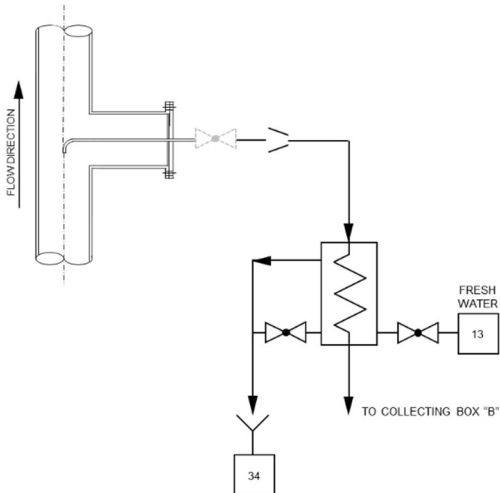
4.7.1 SC7 G1 - LOW PRESSURE; LOW TEMPERATURE; NON-PRESSURIZED SAMPLING



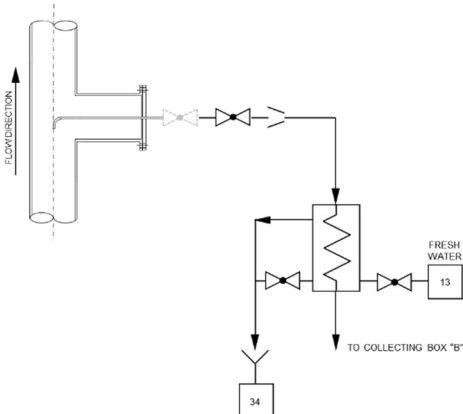
4.7.2 SC7 G2 - HIGH PRESSURE; LOW TEMPERATURE; NON-PRESSURIZED SAMPLING



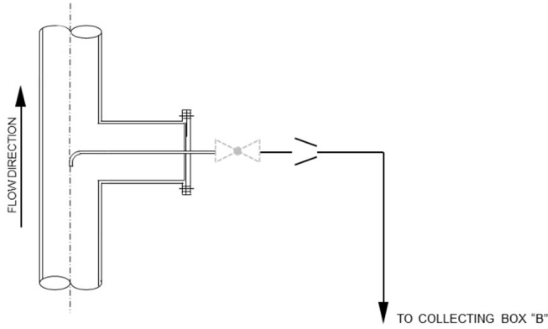
4.7.3 SC7 G3 - LOW PRESSURE; HIGH TEMPERATURE; NON-PRESSURIZED SAMPLING



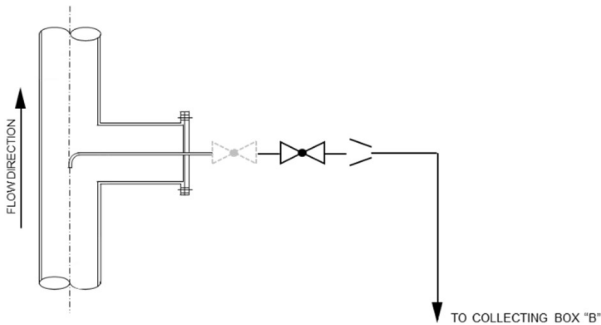
4.7.4 SC7 G4 - HIGH PRESSURE; HIGH TEMPERATURE; NON-PRESSURIZED SAMPLING



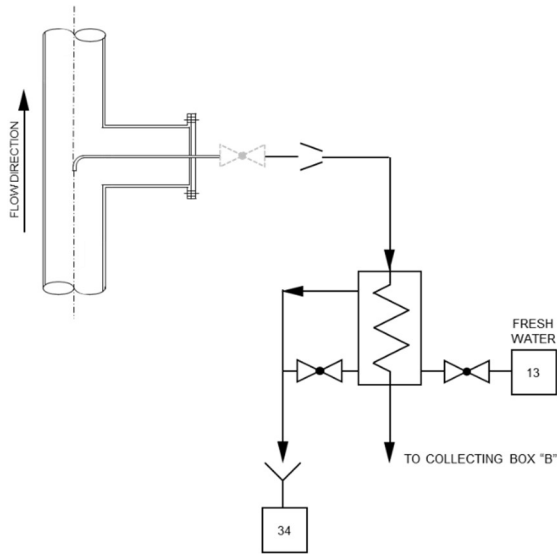
4.7.5 SC7 G5 - LOW PRESSURE; LOW TEMPERATURE; PVT SAMPLING WITH CYLINDER



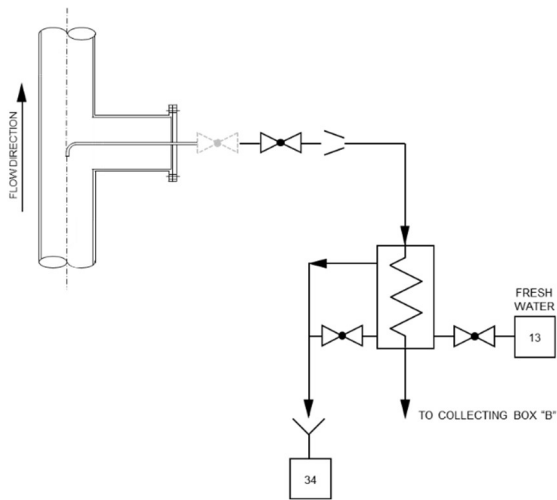
4.7.6 SC7 G6 - HIGH PRESSURE; LOW TEMPERATURE; PVT SAMPLING WITH CYLINDER



4.7.7 SC7 G7 - LOW PRESSURE; HIGH TEMPERATURE; PVT SAMPLING WITH CYLINDER



4.7.8 SC7 G8 - HIGH PRESSURE; HIGH TEMPERATURE; PVT SAMPLING WITH CYLINDER





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Pitot probe shall be used, according to the schematics below.

Sampling of liquids that classify area and/or may release gas with ≥ 10 ppm_v H₂S content shall take place in collecting box type "B".

Classified in two groups, as follows:

COMPLIANCE WITH LEGISLATION

Point for environmental monitoring. Must be located after the last equipment through which the flow of produced water before disposal occurs.

Requirements:

- It shall be located in an ascending vertical pipe;
- Sampling tube diameter shall preferably be at least ½" in stainless steel;
- In cases where it is not possible to install an intrusive tube, such as small diameter pipes, the connection must be at the middle of the pipe (lateral connection);
- Sampling line length shall not exceed 4 meters;
- It shall be kept constantly open at the maximum opening of the sampling valve.

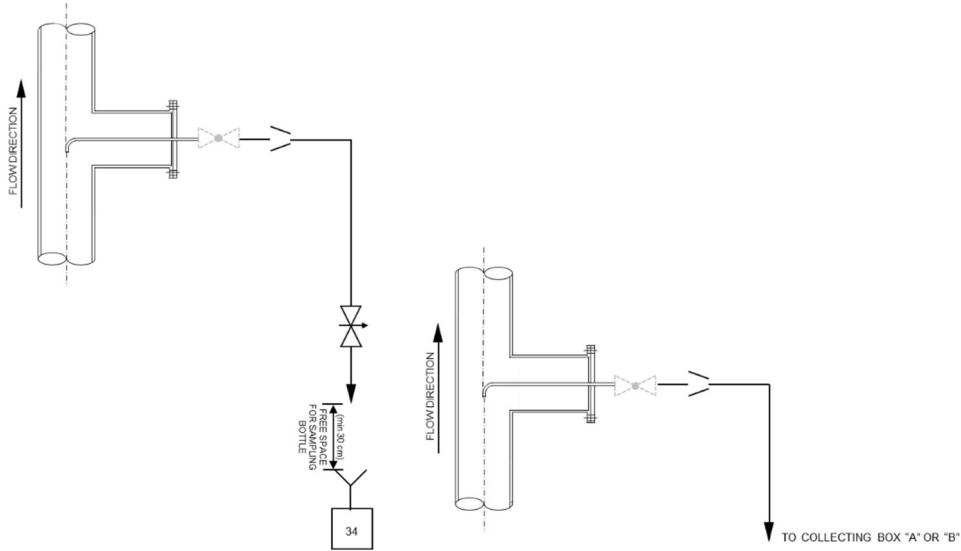
OPERATIONAL

Other points to monitor the performance of produced water treatment plant.

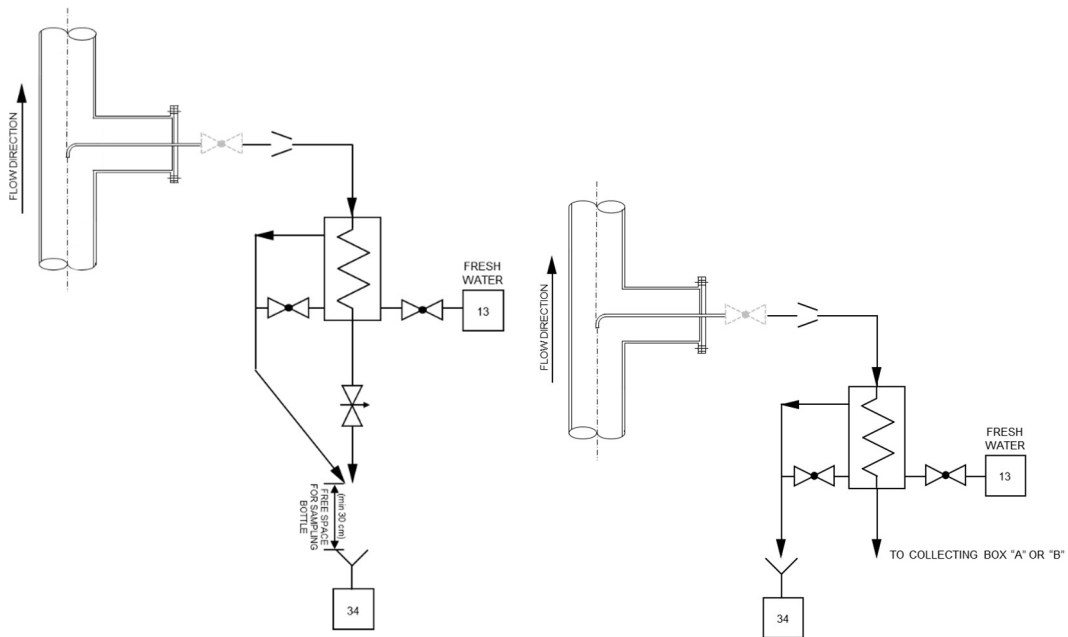
Requirements:

- Preferably, it shall be located in an ascending vertical pipe;
- Sampling tube diameter shall preferably be at least ½" in stainless steel;
- In cases where it is not possible to install an intrusive tube, such as small diameter pipes, the connection must be at the middle of the pipe (lateral connection);
- Sampling line length shall not exceed 4 meters.

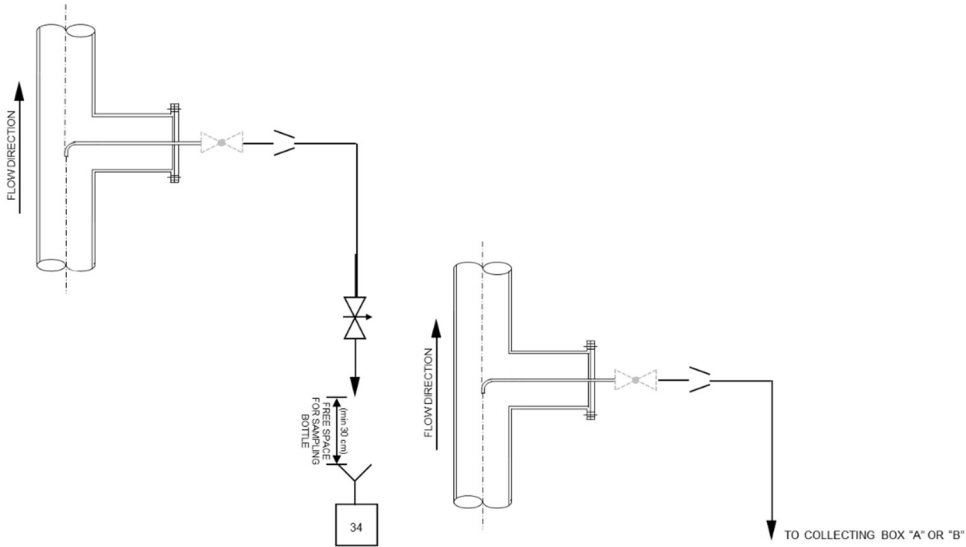
4.8.1 SC8 H1 - LOW PRESSURE; LOW TEMPERATURE; COMPLIANCE WITH LEGISLATION



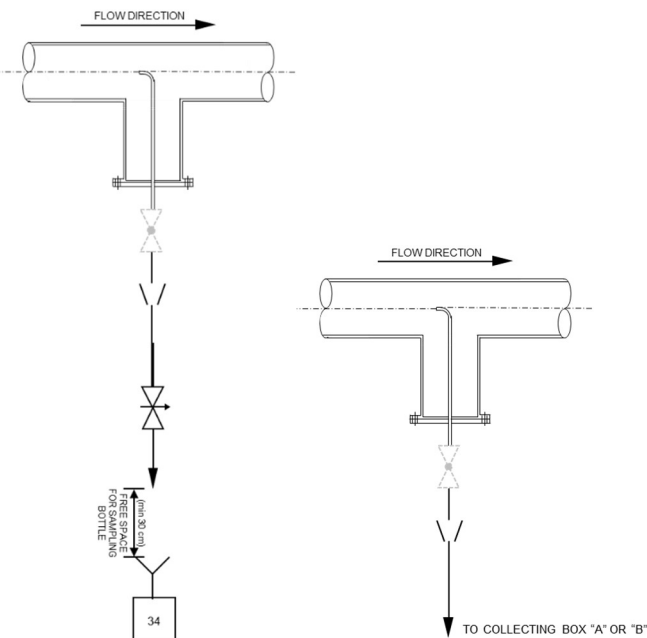
4.8.2 SC8 H2 - LOW PRESSURE; HIGH TEMPERATURE; COMPLIANCE WITH LEGISLATION



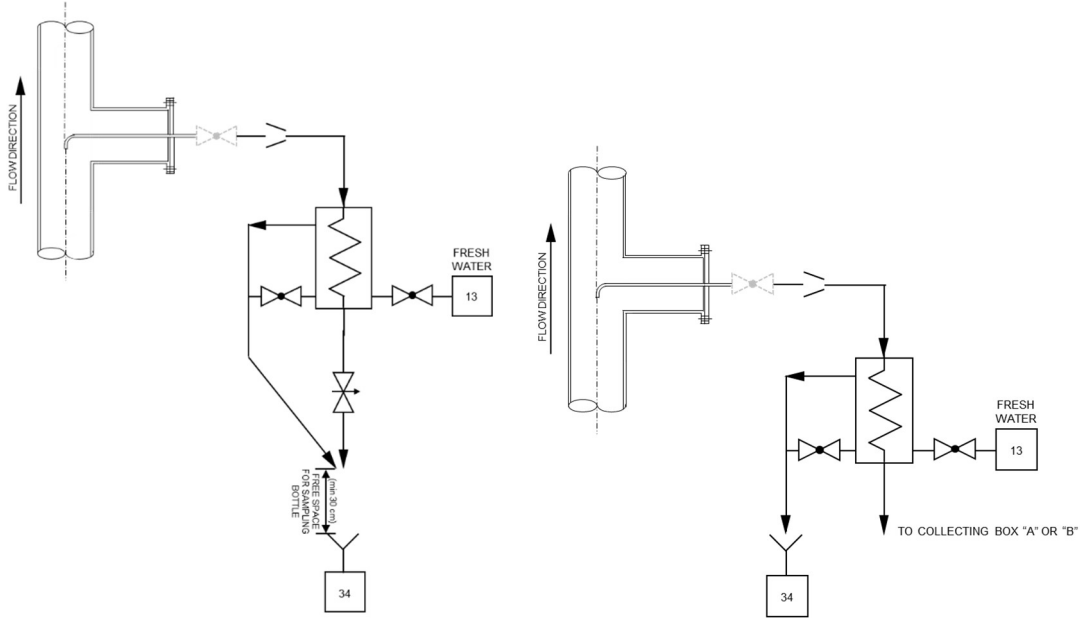
4.8.3 SC8 H3 - LOW PRESSURE; LOW TEMPERATURE; OPERATIONAL



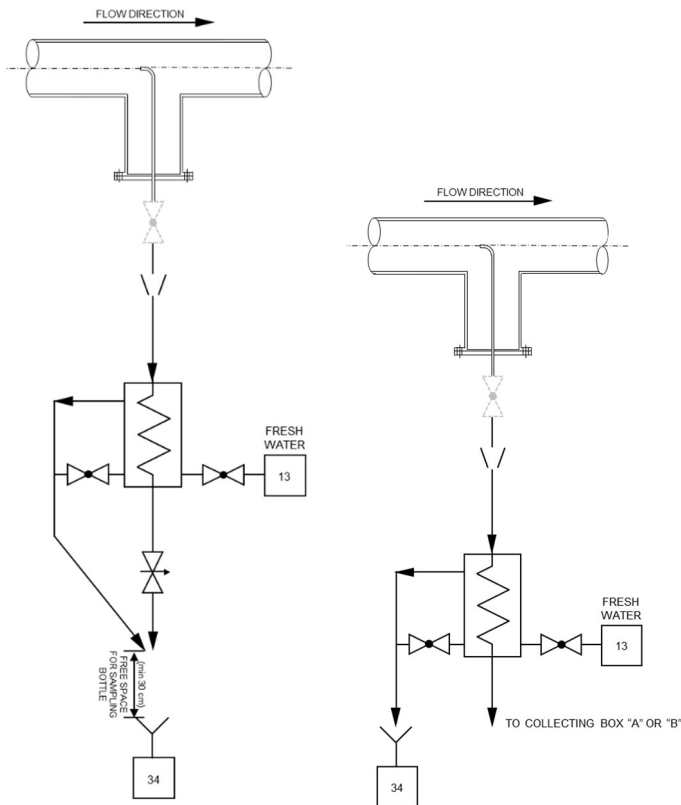
OR



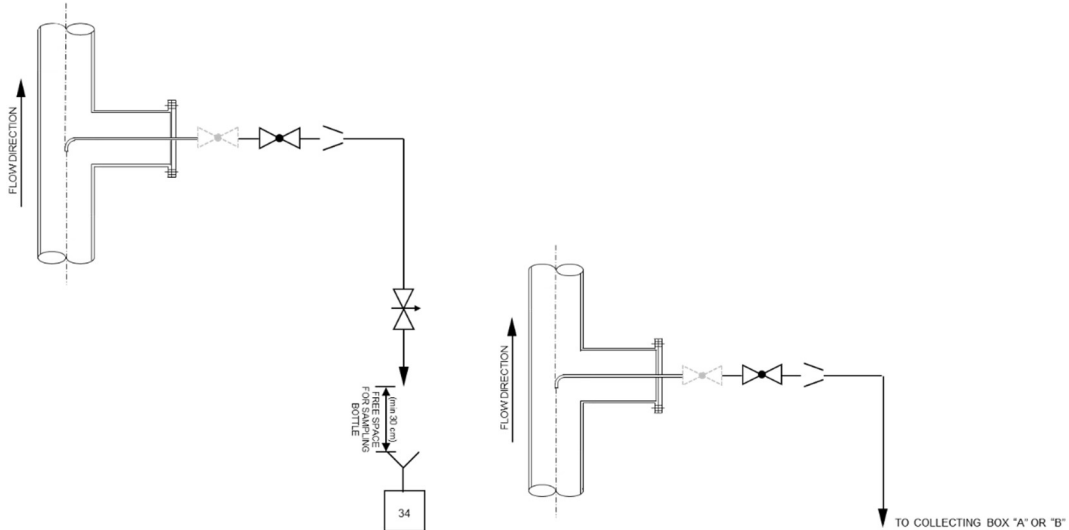
4.8.4 SC8 H4 - LOW PRESSURE; HIGH TEMPERATURE; OPERATIONAL



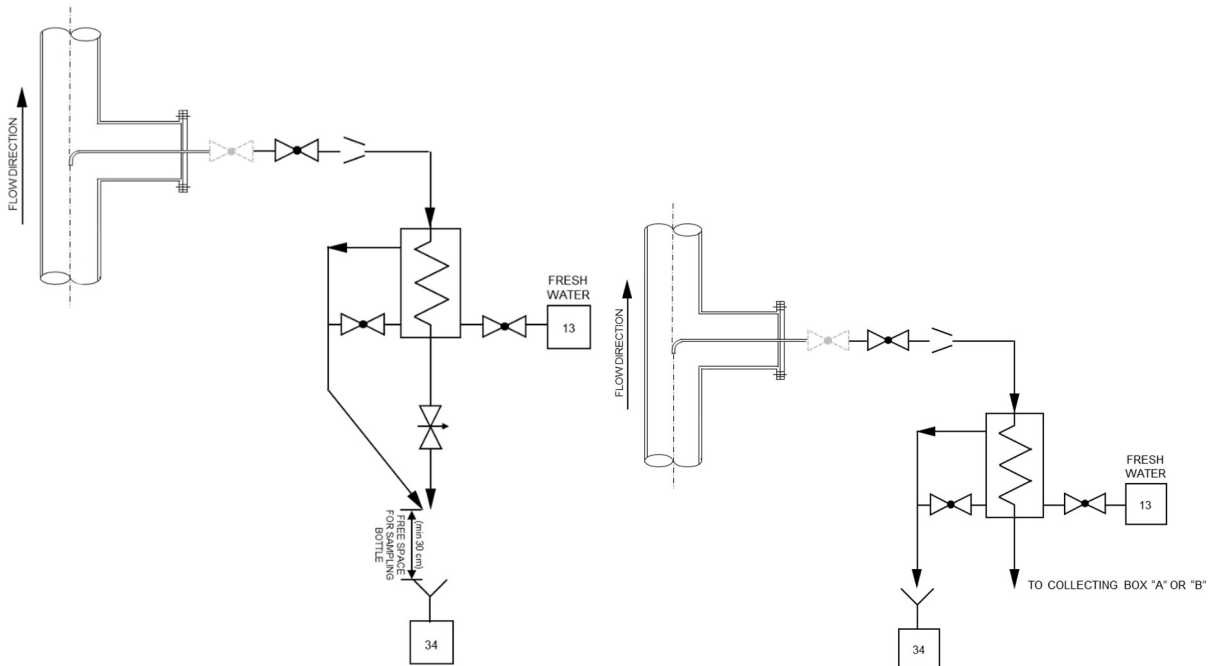
OR



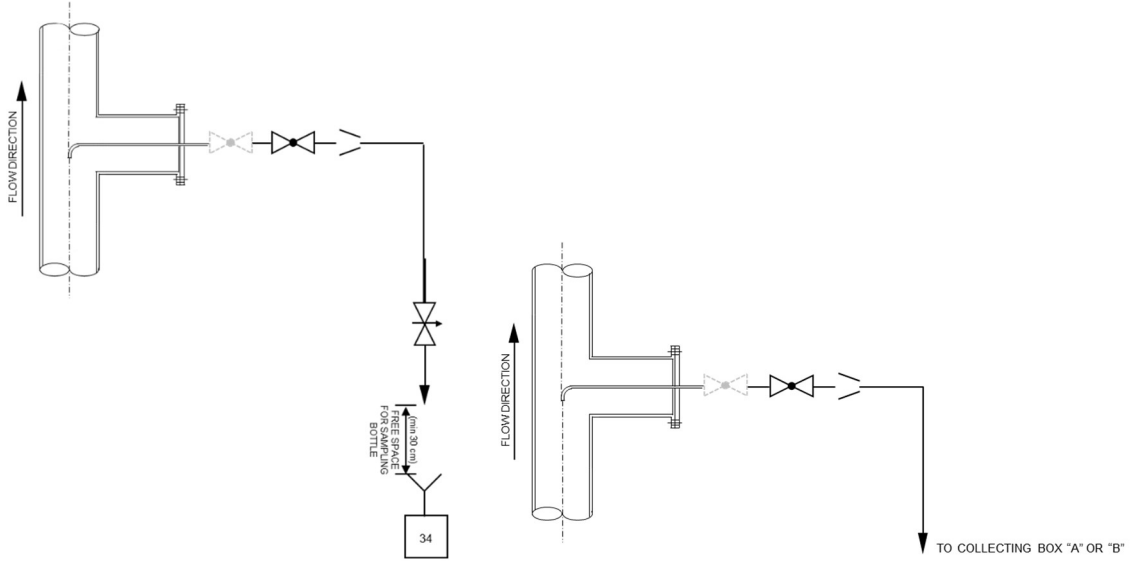
4.8.5 SC8 H5 - HIGH PRESSURE; LOW TEMPERATURE; COMPLIANCE WITH LEGISLATION



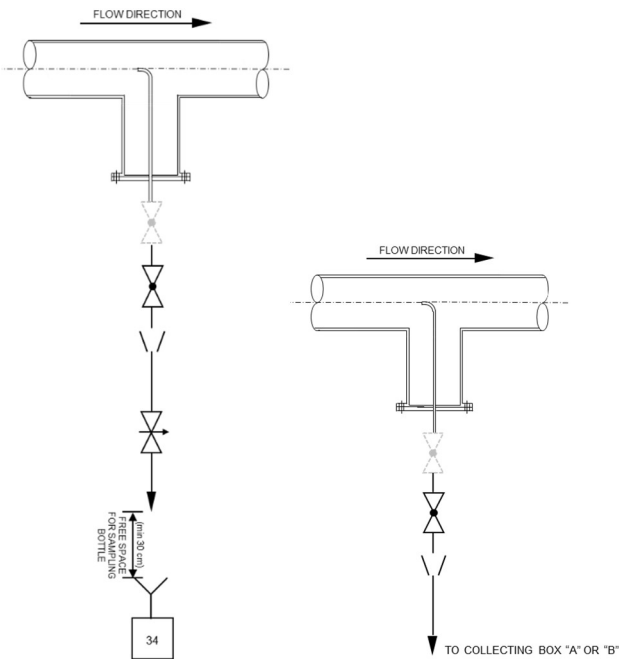
4.8.6 SC8 H6 - HIGH PRESSURE; HIGH TEMPERATURE; COMPLIANCE WITH LEGISLATION



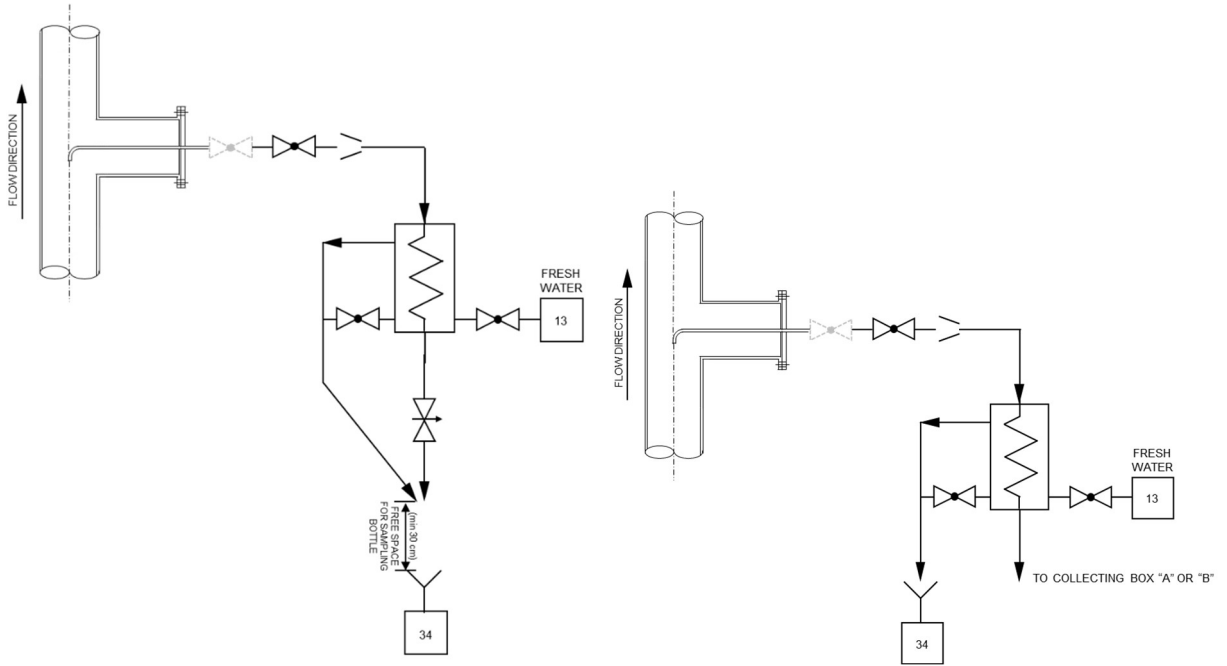
4.8.7 SC8 H7 - HIGH PRESSURE; LOW TEMPERATURE; OPERATIONAL



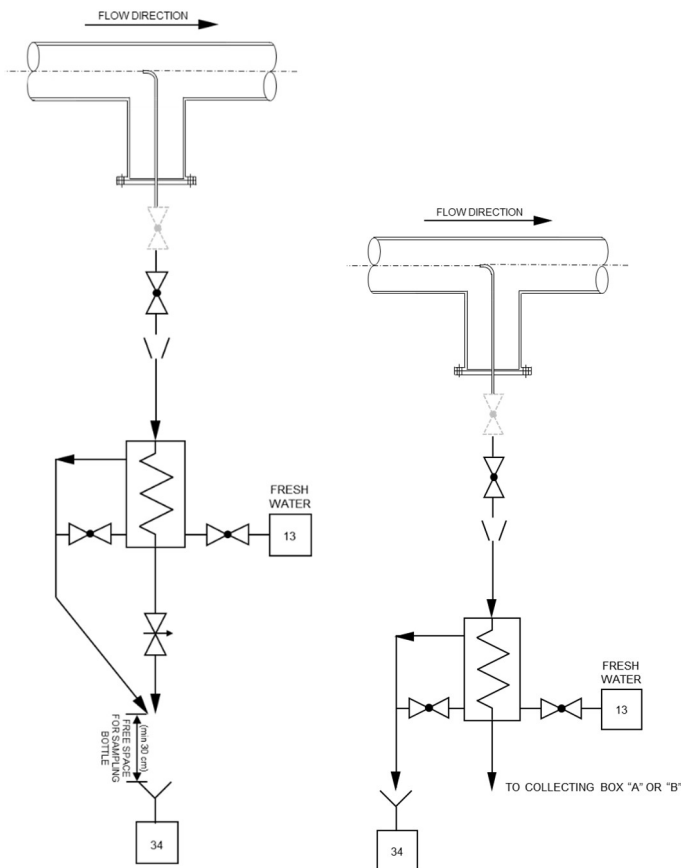
OR



4.8.8 SC8 H8 - HIGH PRESSURE; HIGH TEMPERATURE; OPERATIONAL



OR

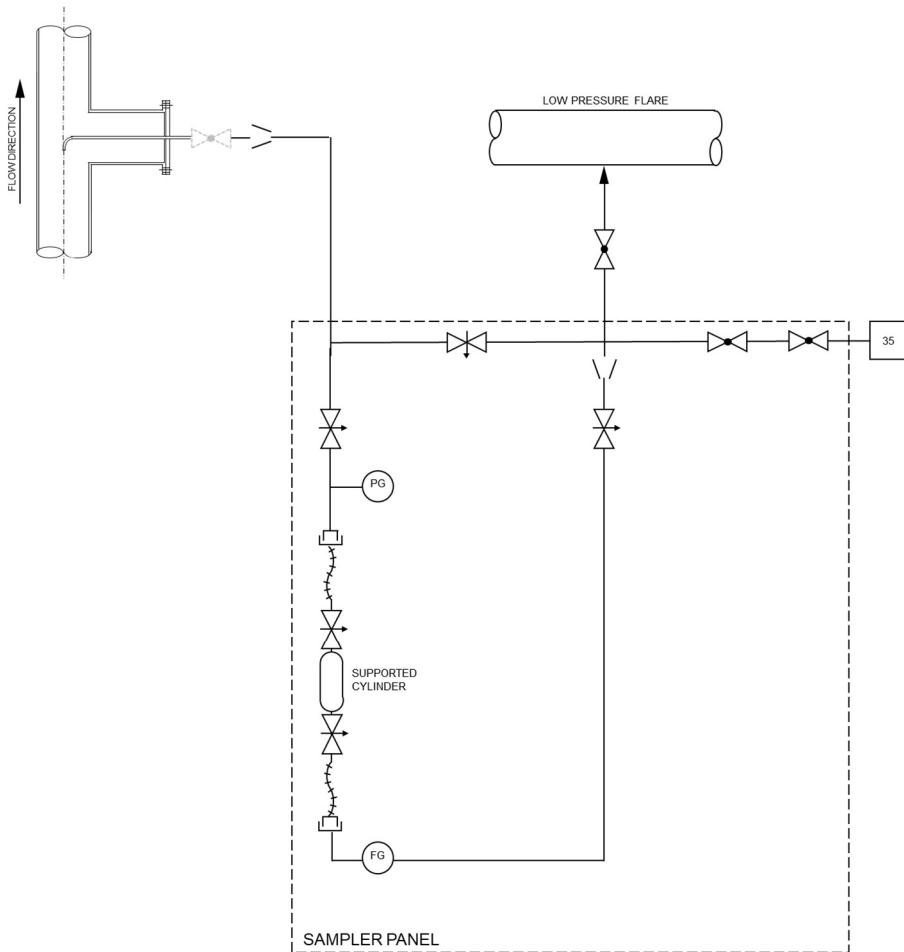


4.9 SC9 - SAMPLE CONNECTION FOR STREAMS WITH BENZENE

SC9 is used for streams with $\geq 1\%$ benzene volume content.

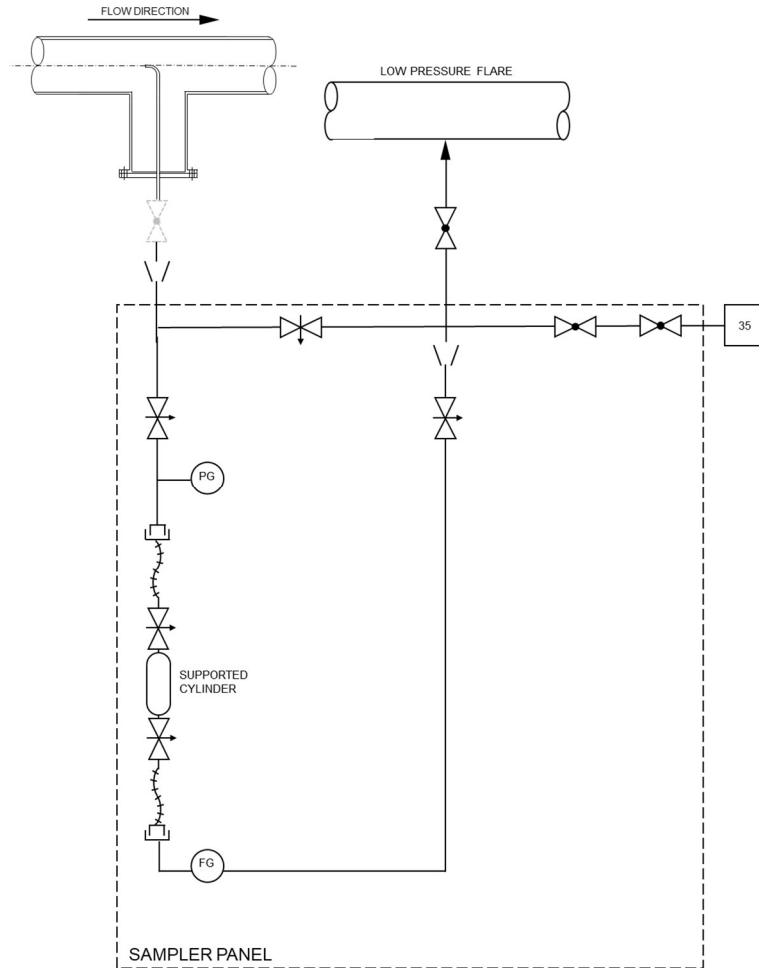
Pitot probe shall be used, according to the schematics below.

4.9.1 SC9I1 - LOW PRESSURE; LOW TEMPERATURE; CONDENSATE AND BIPHASIC SAMPLING

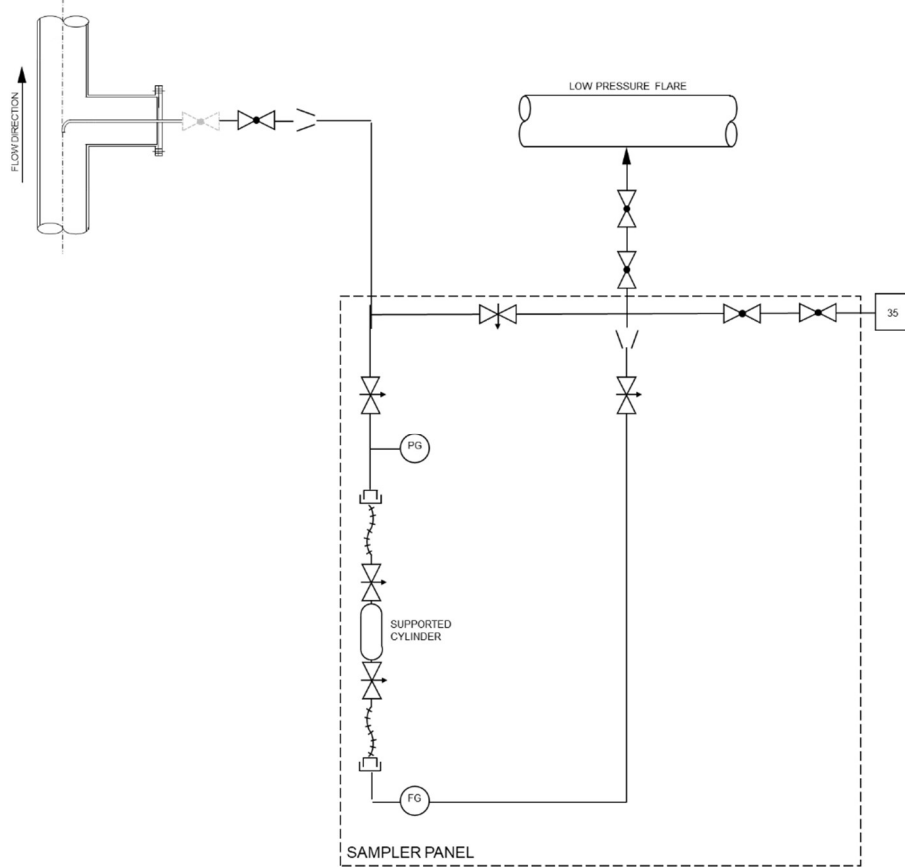


SAMPLE CONNECTIONS

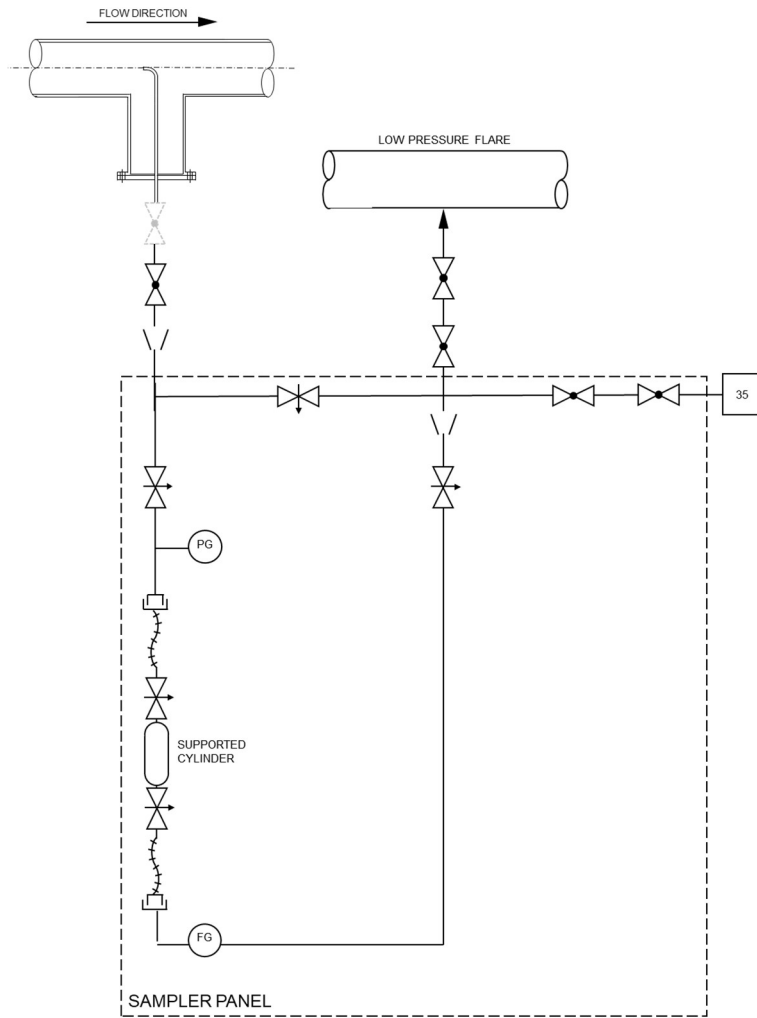
OR



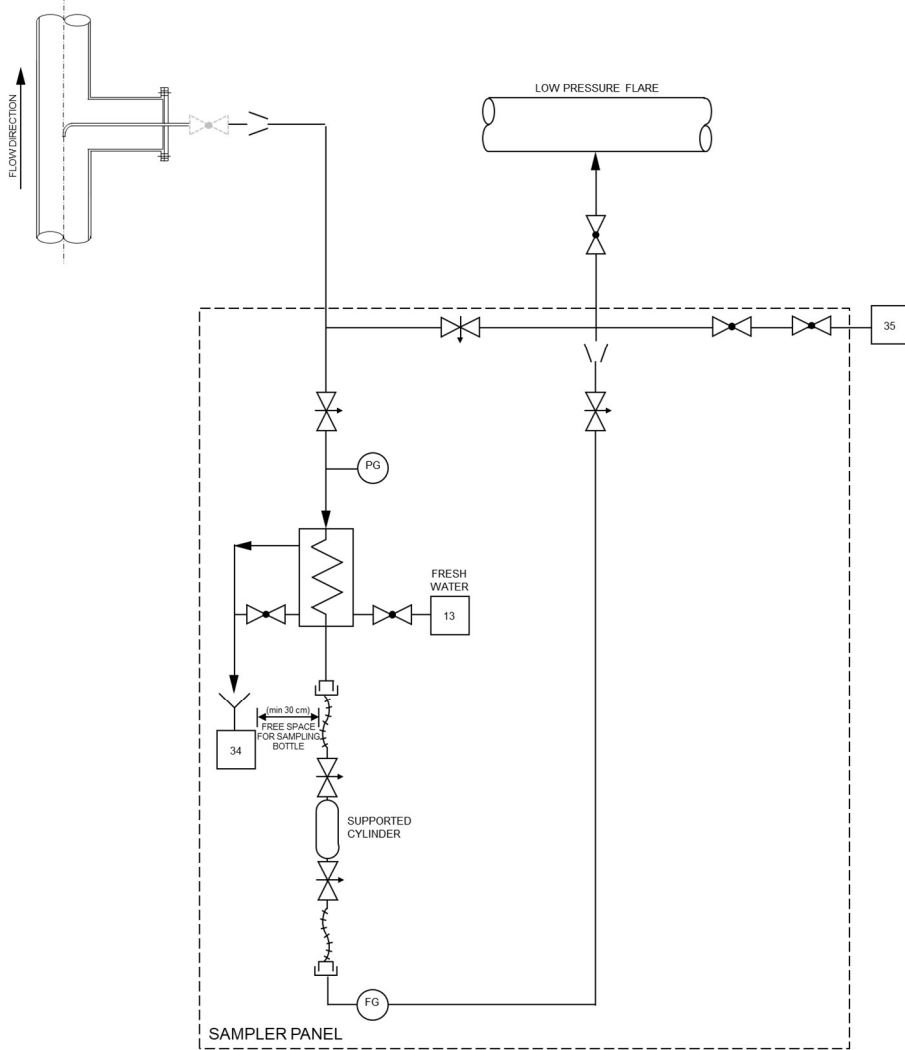
4.9.2 SC912 - HIGH PRESSURE; LOW TEMPERATURE; CONDENSATE AND BIPHASIC SAMPLING



OR

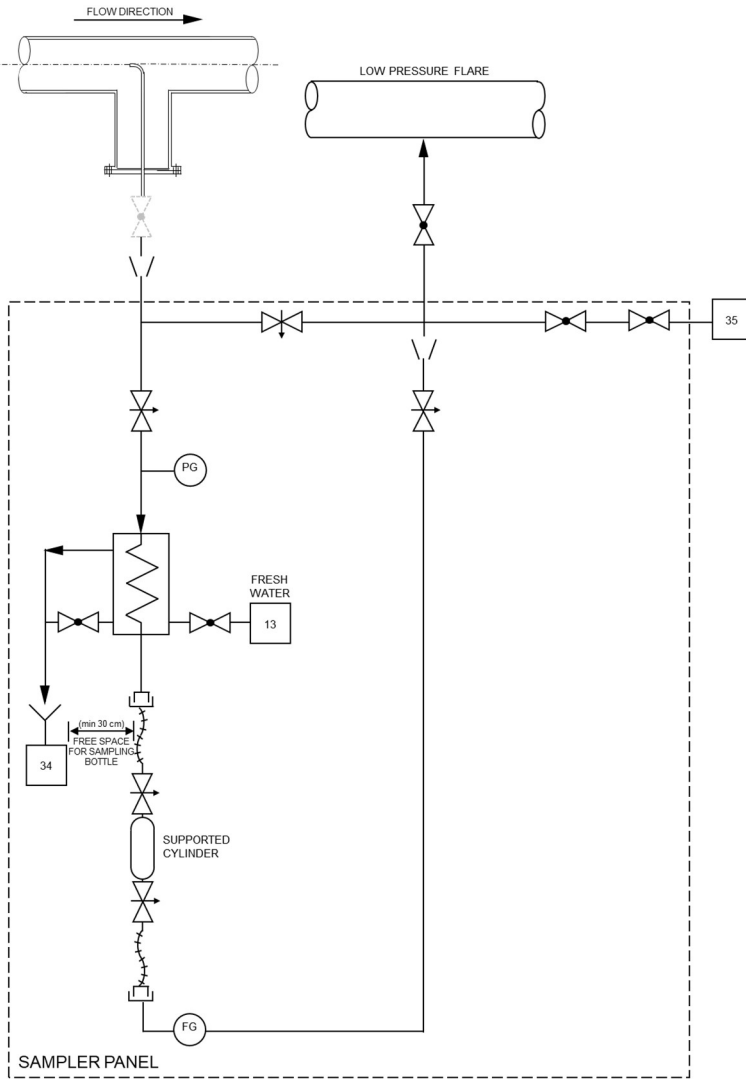


4.9.3 SC9I3 - LOW PRESSURE; HIGH TEMPERATURE; CONDENSATE AND BIPHASIC SAMPLING

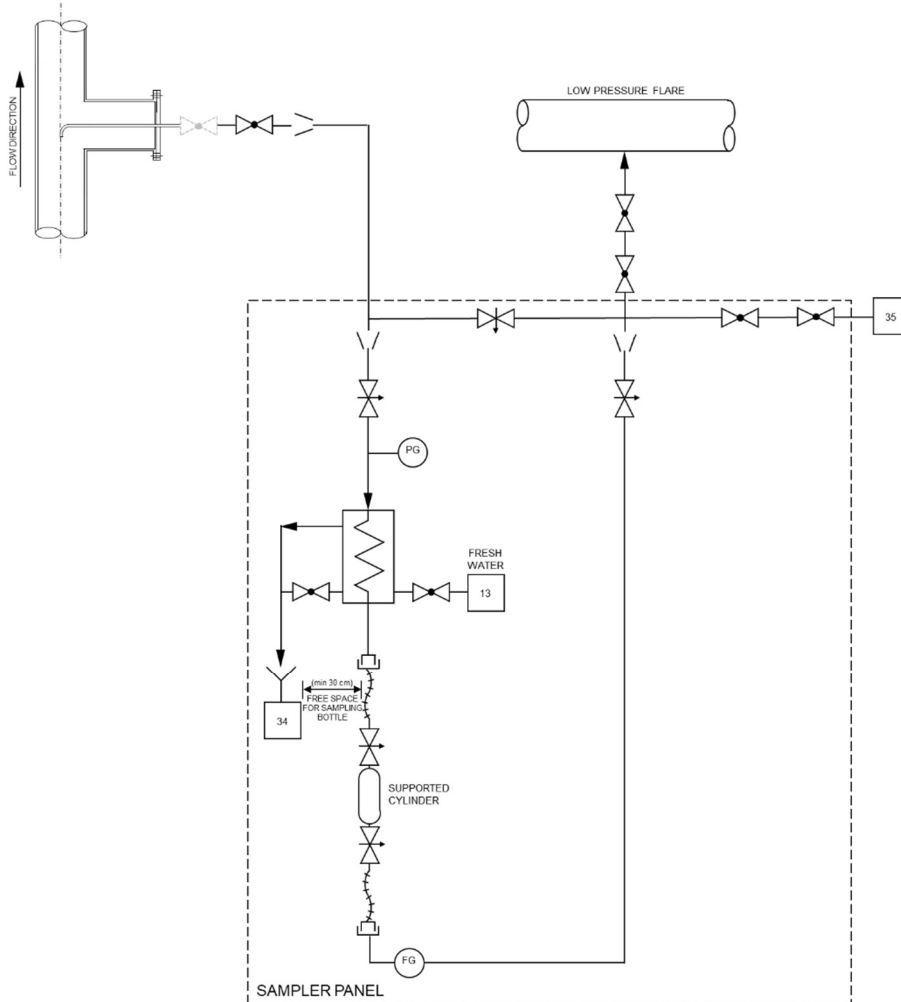


SAMPLE CONNECTIONS

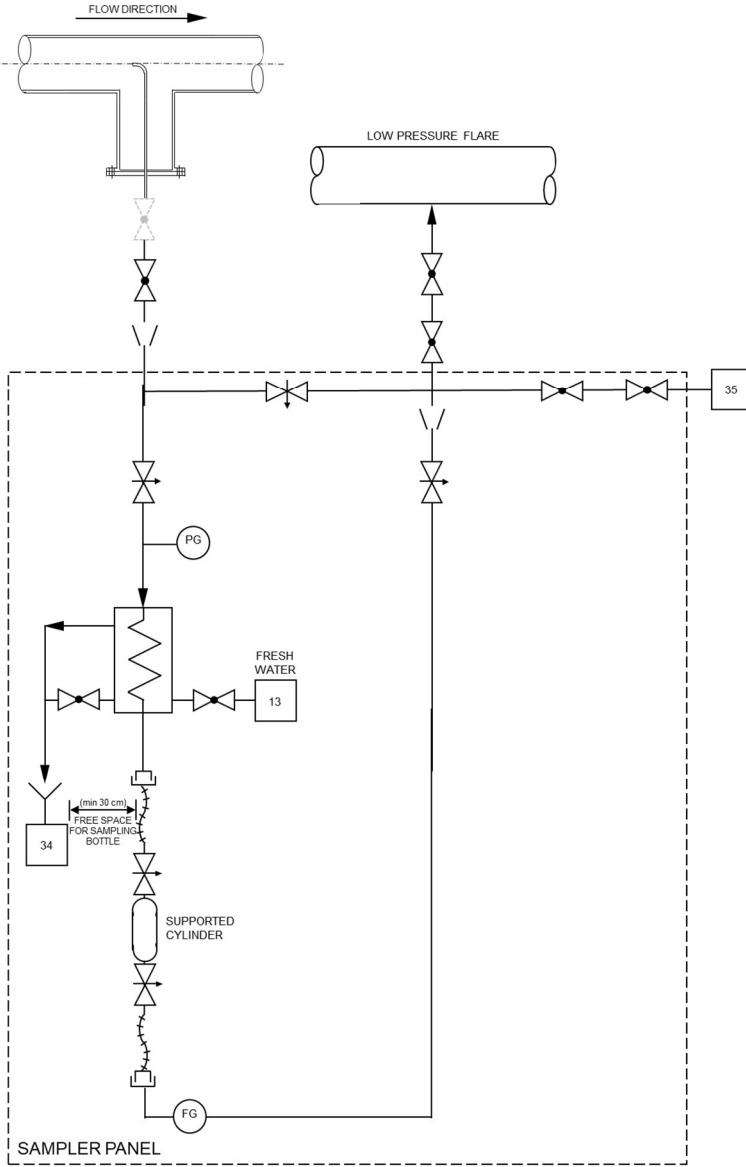
OR



4.9.4 SC9I4 - HIGH PRESSURE; HIGH TEMPERATURE; CONDENSATE AND BIPHASIC SAMPLING



OR



5 COLLECTING BOXES

Detailed Design shall define the quantity of collecting boxes according to final arrangement, ensuring representativeness of the samples.

All sample points shall be identified in the collecting boxes, where the sampling takes place. Identification must be visible for the operator.

Sample collecting boxes shall be provided with lid to avoid collecting rain water.

Design of collecting boxes shall allow the use of 30 cm sampling bottles/cylinders.

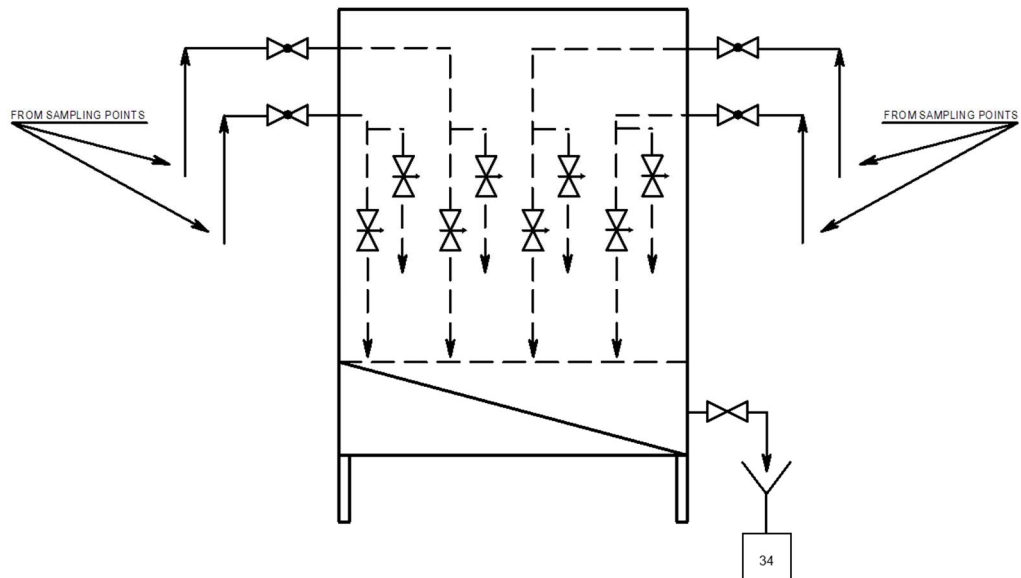
Each inlet connection of collecting box shall be dedicated to 01 (one) sample point.

Alternative arrangements may be accepted under previous approval of PETROBRAS.

5.1 CLASSIFICATION

5.1.1 COLLECTING BOX TYPE "A"

Collecting box type "A" is used for non-pressurized sampling of liquids that do not classify area and do not release gas with ≥ 10 ppm_v content.



5.1.2 COLLECTING BOX TYPE "B"

Collecting box type "B" is used for sampling of liquids that classify area and/or release gas with ≥ 10 ppm_v content.

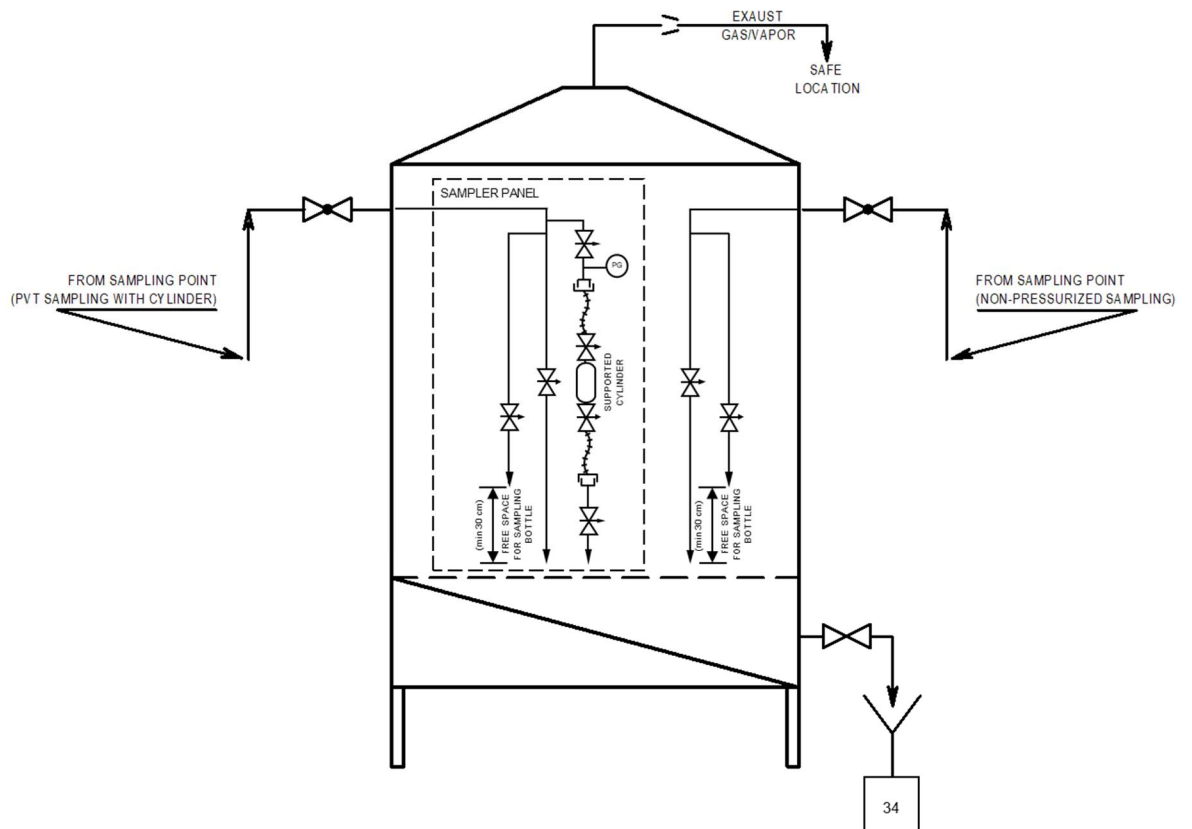
Collecting box type "B" includes:

NON-PRESSURIZED SAMPLING

e.g. live oil sampling for BS&W metering, when PVT sampling with cylinder is not required.

PVT SAMPLING WITH CYLINDER

e.g. live oil for fiscal metering downstream TEST SEPARATOR, when PVT sampling with cylinder is required. PVT sampling with cylinder already includes derivation for non-pressurized sampling.





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SAMPLE CONNECTIONS**INTERNAL****ESUP**

Mechanical exhaust device for flammable or toxic gas shall be installed in case of insufficient natural dispersion.

“Safe location” means a location:

- With no risks to personal safety (such as high temperatures, high pressure sources, asphyxiating atmosphere generation) or to equipment/valve operation;
- At least 4.5 meters far from air suction of HVAC system;
- At least 8.0 meters far from air inlets or another openings to accommodations or other service environments and from possible sources of ignition;
- Out of people traffic, including access to escape routes, modules/equipment, manual firefighting resources, lifesaving equipment etc.

The edge of the pipe routing the exhaust gas/vapor shall be defined by Detailed Design based on exhaust gas dispersion analysis.

6 ERGONOMIC REQUIREMENTS

The access to the sample collection area, including the handling of regulating valves, block valves, sampling bottles, pressurized cylinders, hoses and other items required to sample collection operation, shall be located with permanent access at deck level or have access via stairs, when possible. Alternative means of access including vertical ladders with a purpose-built standing surface could be acceptable.

The recommended height for the access to sample collection area ranges from 760 and 1100 mm* from the floor.

There must be adequate space (around 0.4 m²* per person at minimum) for people, including the necessary equipment, tools and personal protective equipment, as well as free space for the movements and activities required to perform maintenance tasks.

Special consideration must be given to access the area for both normal operations and emergency situations.

All the items required to sample collection operation shall be designed so that access can be made from above and outside rather than from below and inside components.

Access openings shall be large enough to provide complete visual access to the task area.

A minimum clearance of 150 x 115 mm* for handle access for each valve shall be considered (for gloved hand access).

Sample collection areas that fall outside the recommended height range shall not prejudice the sample quality and are acceptable under PETROBRAS previous approval.

*Based on ABS GUIDANCE NOTES FOR THE APPLICATION OF ERGONOMICS TO MARINE SYSTEMS, Valves Category 2.



TECHNICAL SPECIFICATION

Nº I-ET-3010.00-1200-588-P4X-001

REV. E

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INTERNAL

ESUP

7 REFERENCE DOCUMENTS

- I-ET-3000.00-1200-940-P4X-001 - TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN
- I-ET-3000.00-8222-941-PJN-001 - LABORATORY – EQUIPMENT
- I-ET-3010.00-1200-813-P4X-001 - GENERAL CRITERIA FOR FLOW METERING SYSTEMS