PETROBRAS	**TECHNICAL SPECIFICATION**	N° I-ET-3010.00-1200-588-P4X-001	
	CLIENT:		SHEET: 1 of 47
	JOB:		
	AREA:		
SRGE	TÍTLE: **SAMPLE CONNECTIONS**		INTERNAL
			ESUP

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SUMMARY

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.

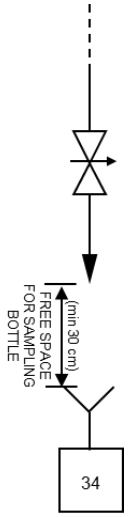
2 NORMATIVE REFERENCES

- 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-3000.00-0000-940-P4X-002 - SYMBOLS FOR PRODUCTION UNITS DESIGN
- 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.

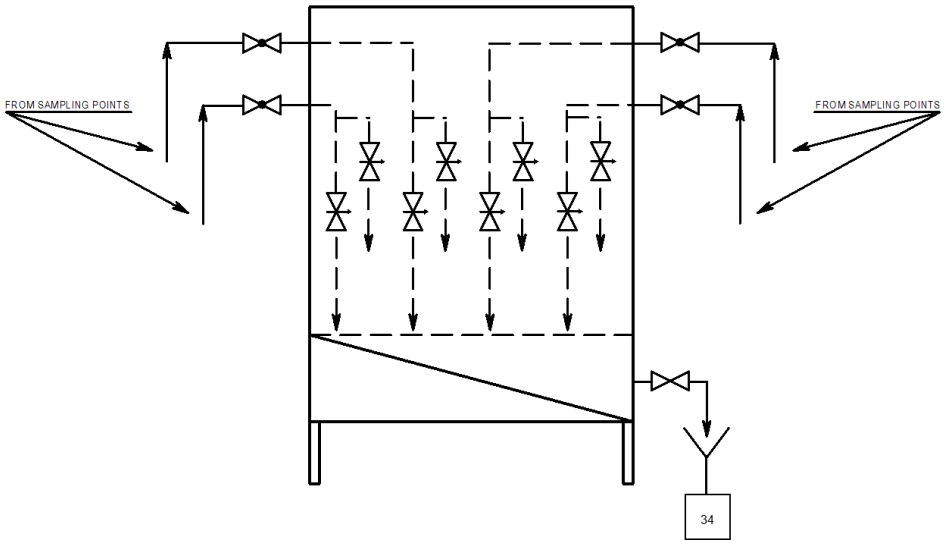


In this case, a clearance of 30 cm at minimum shall be specified between the outlet of the liquid line and the drainage collector, allowing the handling of the sampling bottle.

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.

3.2 Sampling of liquids that classify area and/or may release gas with ≥10 ppm_v H_2S 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 shall correspond to the lowest existing diameters of the pipe specification where the sample connections are installed. The minimum diameter shall be ½”. If different value is indicated in the Piping and Instrumentation Diagrams (P&IDs), this one shall prevail.

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 Regarding probe tip location and need of probe reinforcement inside the pipe, the following configuration shall be adopted:

- 1st choice: Probe tip located between 25-50% of pipe diameter without need of probe reinforcement inside the pipe;
- 2nd choice: Probe tip located between 10-25% of pipe diameter without need of probe reinforcement inside the pipe;
- 3rd choice: Probe tip located between 10-25% of pipe diameter and need of probe reinforcement inside the pipe.

3.10 Hoses, couplings, supports and other items required to sample collection with pressurized cylinders shall be in contractors scope of supply.

3.11 Sample cylinders required for pressurized sample collection will be supplied by PETROBRAS. Nominal working pressure of gas sample cylinders is 5000 psig. Additional sample cylinders specifications will be informed by PETROBRAS during Detailed Design phase.

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 shall 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 dowstream of any disturbance or pipe accident.

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

3.22 Sampling points shall be located and positioned to minimize segregation of fluid components.

3.23 Sampling points shall not be installed in vertical sections with downward flow.

3.24 Sampling points shall not be installed on tube ends and dead zones.

3.25 Manual sample connection point shall be installed as close as possible to the respective online analyzer.

4 CLASSIFICATION OF SAMPLE CONNECTIONS

Classification of sample connections is indicated below.

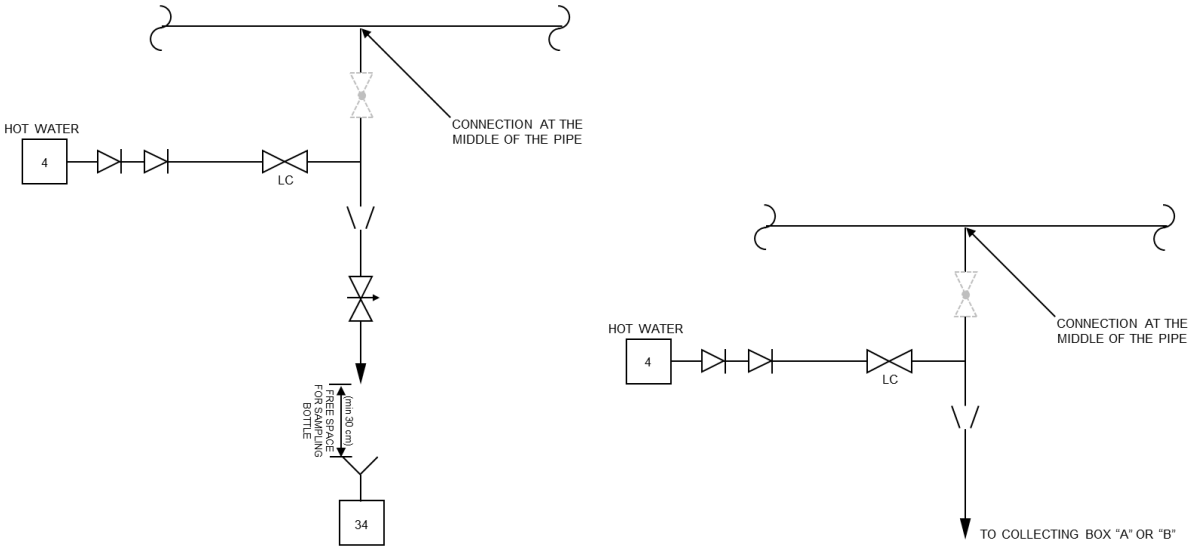
The schematics of sample connections indicate the first block valve next to the process pipe as gray and hatched. This block valve is the same represented in the Piping and Instrumentation Diagrams (P&IDs) and it is shown in this document for elucidative purpose. This block valve shall follow the same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

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

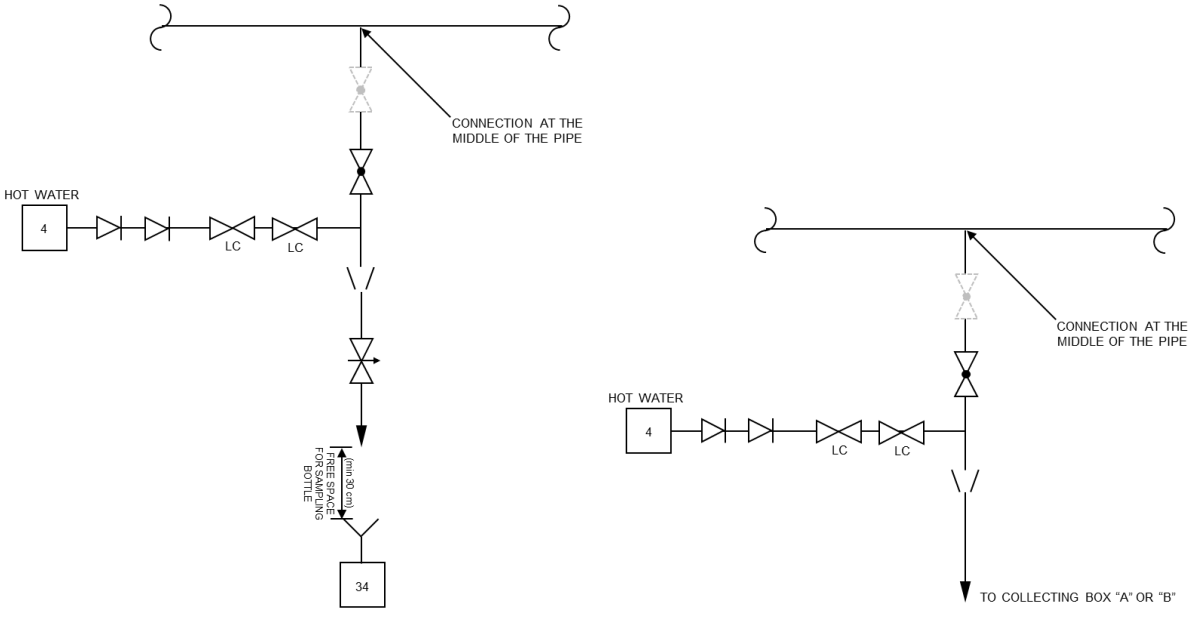
SC1 is not used for produced water, injection water, oil or streams with benzene (≥1% volume content).

Sampling of liquids that classify area and/or may release gas with ≥10 ppm_v H_2S content shall take place in collecting box type “B”.

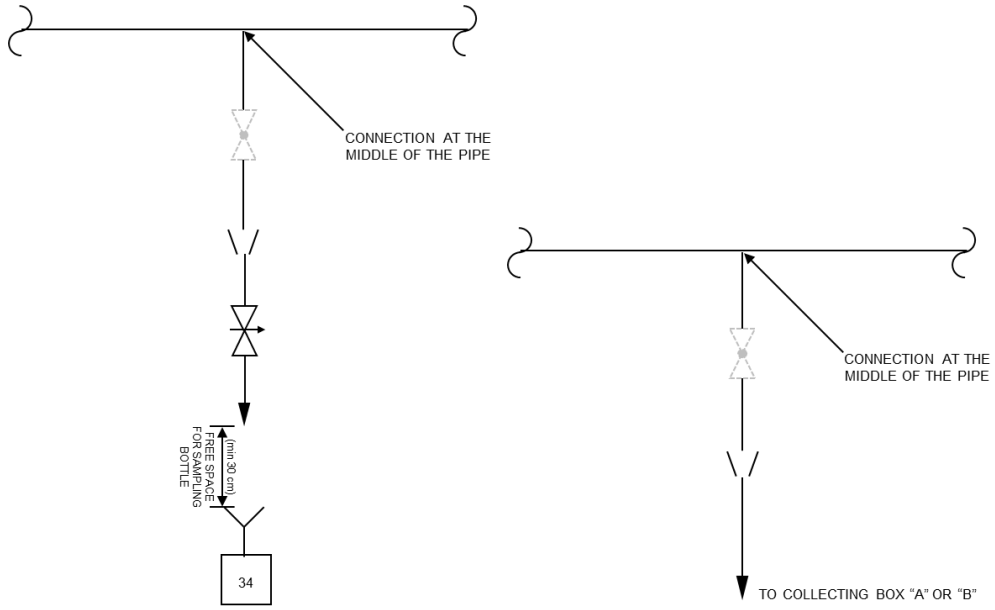
4.1.1 SC1 A1 - LOW PRESSURE; LOW TEMPERATURE; HOT WATER CLEANING REQUIRED



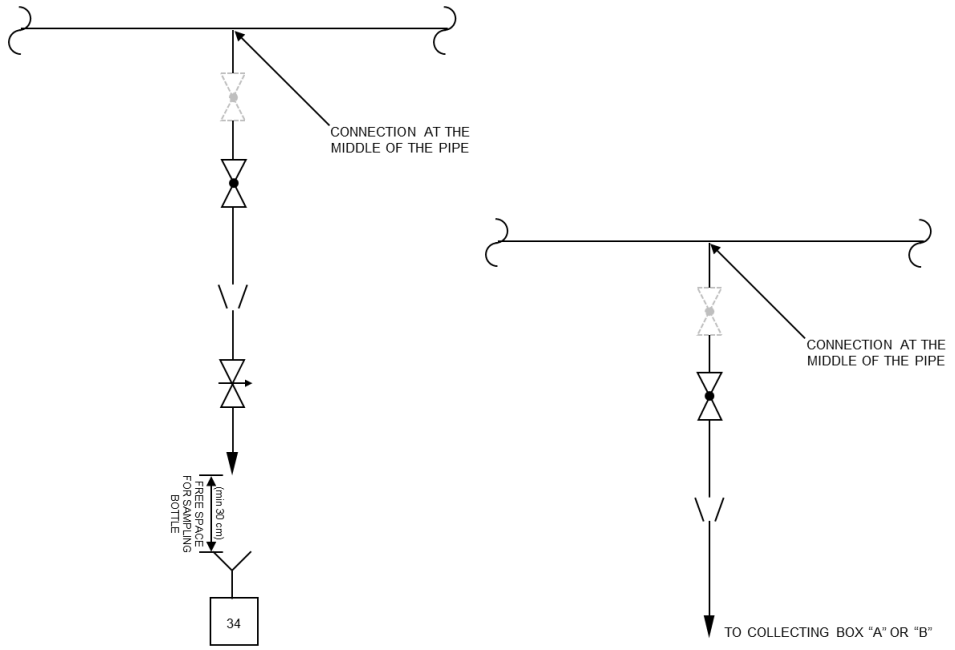
4.1.2 SC1 A2 - HIGH PRESSURE; LOW TEMPERATURE; HOT WATER CLEANING REQUIRED



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

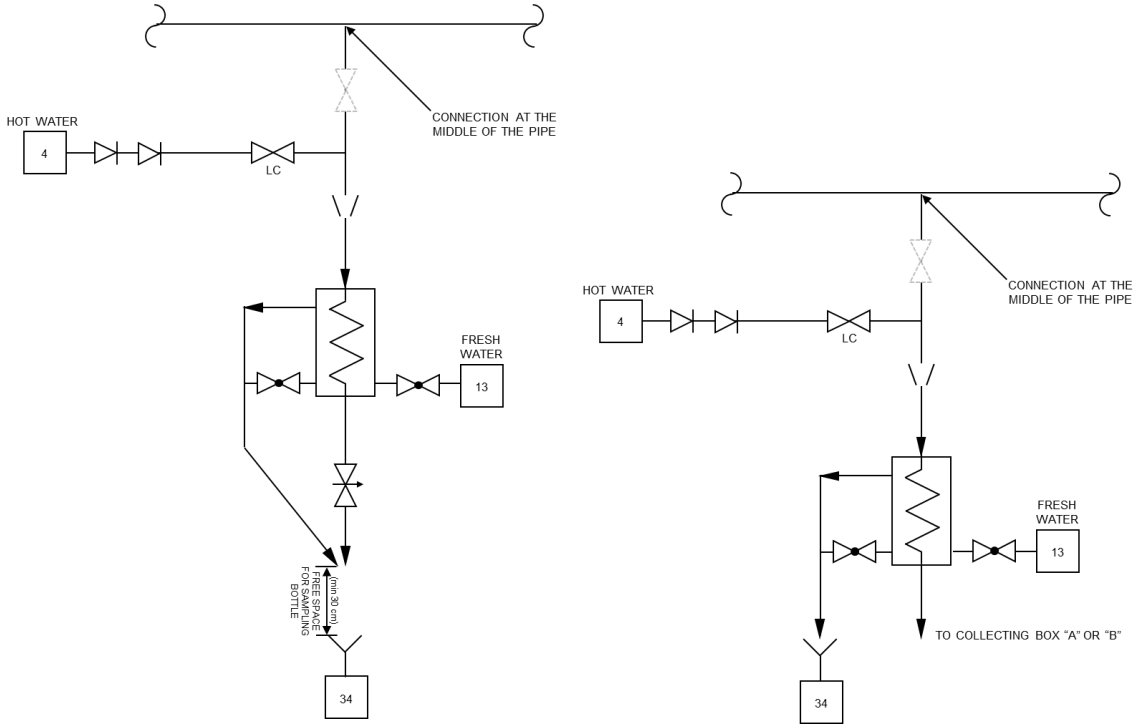


4.2 SC2 - SAMPLE CONNECTION FOR LIQUIDS WITH TEMPERATURE GREATER THAN OR EQUAL TO 60°C

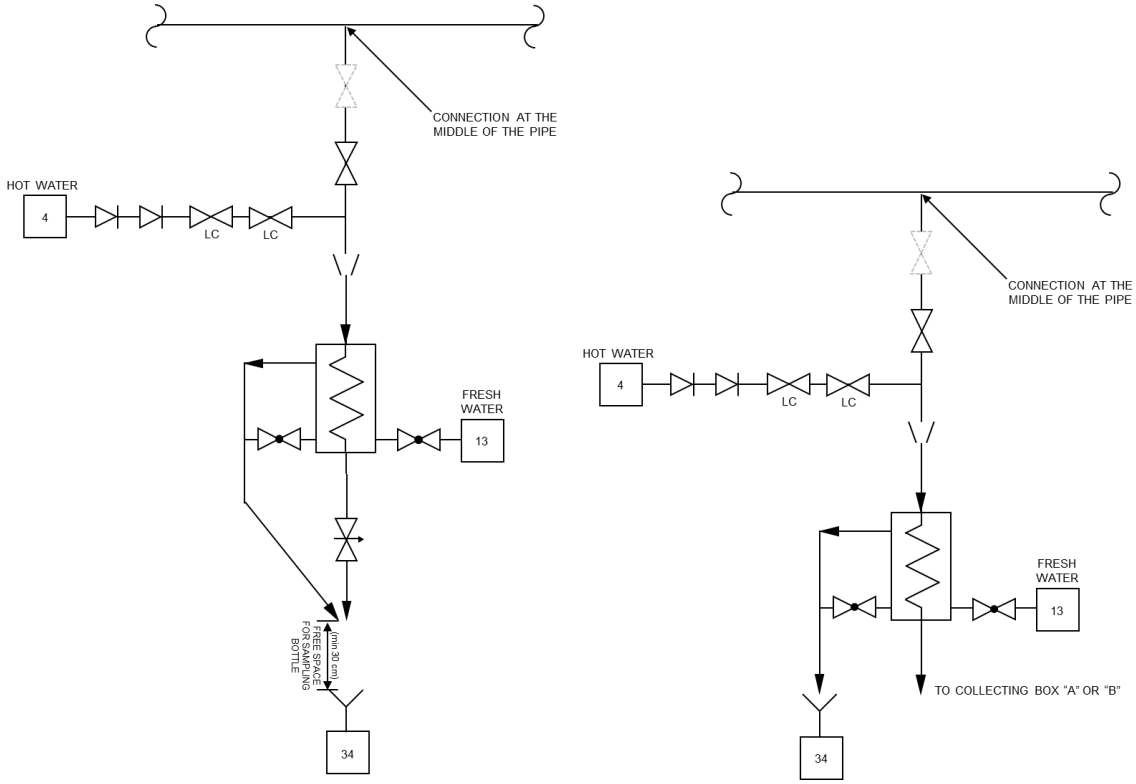
SC2 is not used for produced water, injection water, oil or streams with benzene (≥1% volume content).

Sampling of liquids that classify area and/or may release gas with ≥10 ppm_v H_2S content shall take place in collecting box type “B”.

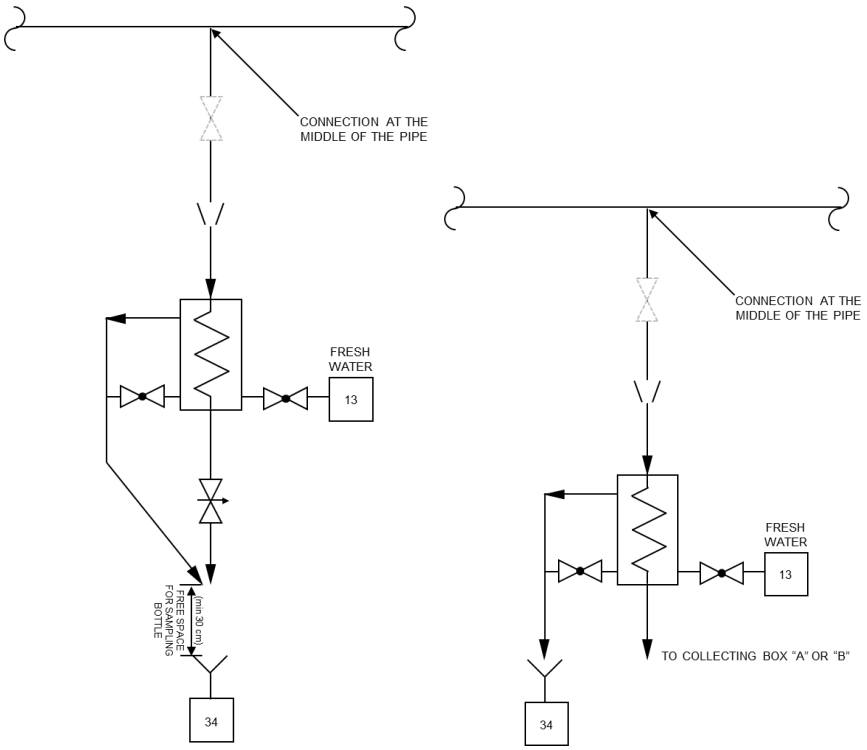
4.2.1 SC2 B1 - LOW PRESSURE; HIGH TEMPERATURE; HOT WATER CLEANING REQUIRED



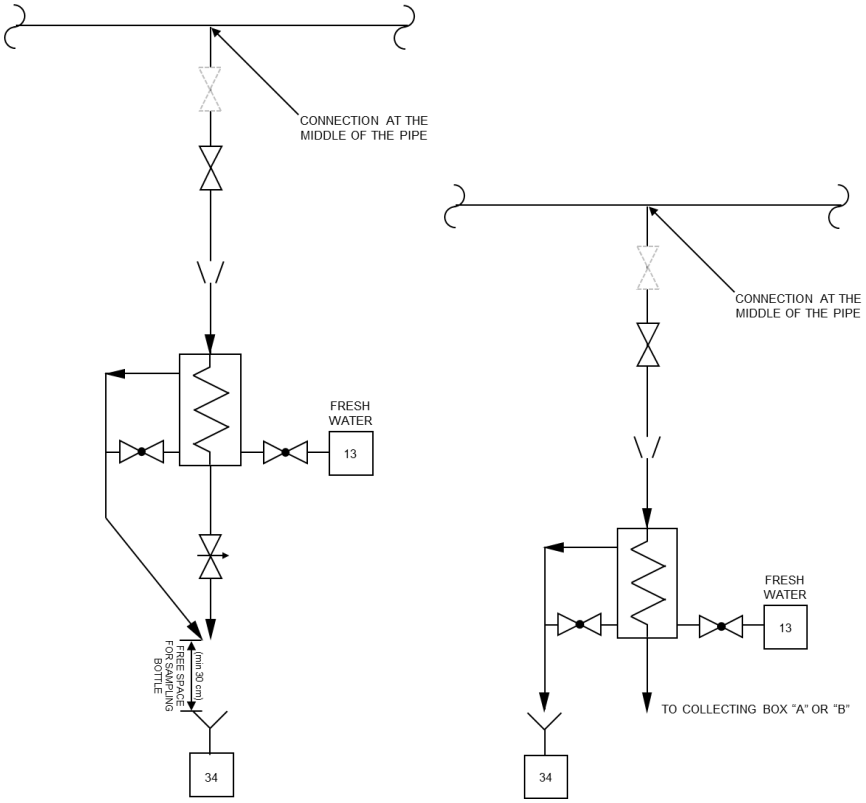
4.2.2 SC2 B2 - HIGH PRESSURE; HIGH TEMPERATURE; HOT WATER CLEANING REQUIRED



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

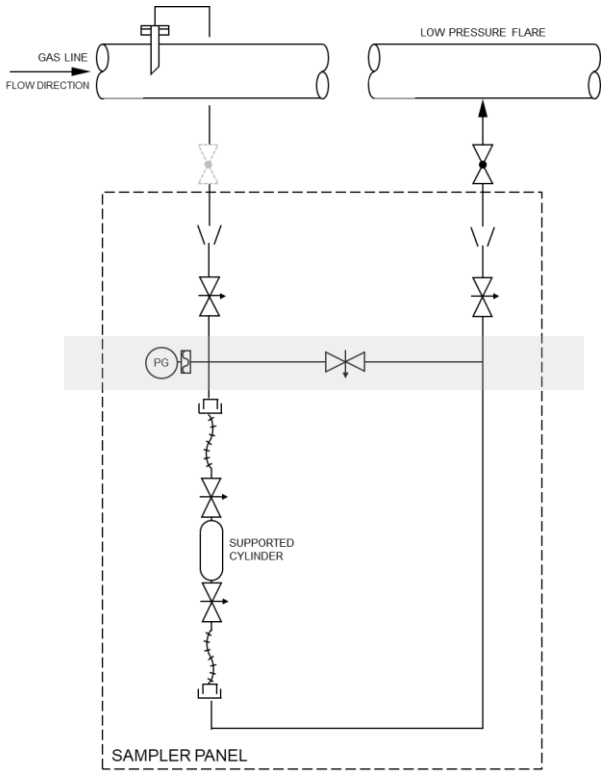


4.3 SC3 - GAS SAMPLER

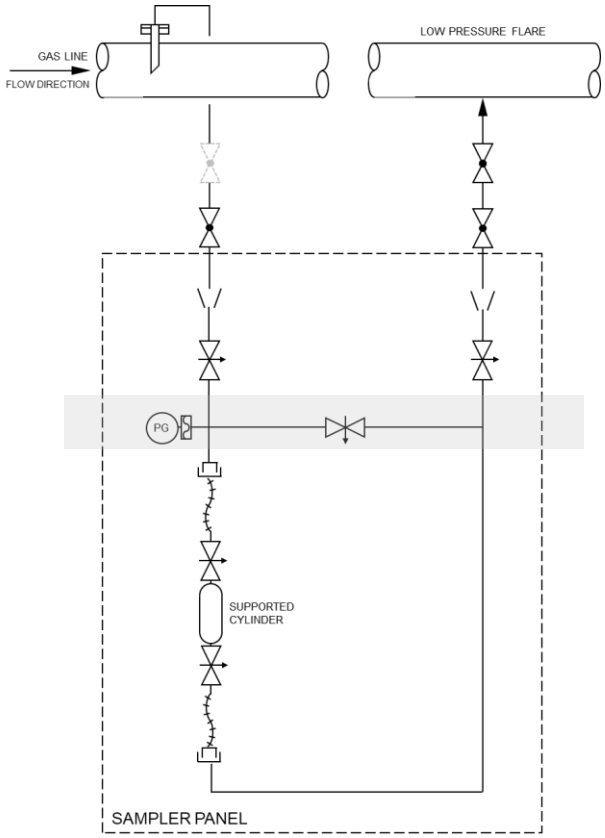
45º beveled probe shall be used, according to the schematics below.

Gas sampler connections represented below (SC3) indicate the gas stream routed to low pressure flare system. Alternatively, the gas stream may be routed to high pressure flare system if there are not any constraints regarding backpressure.

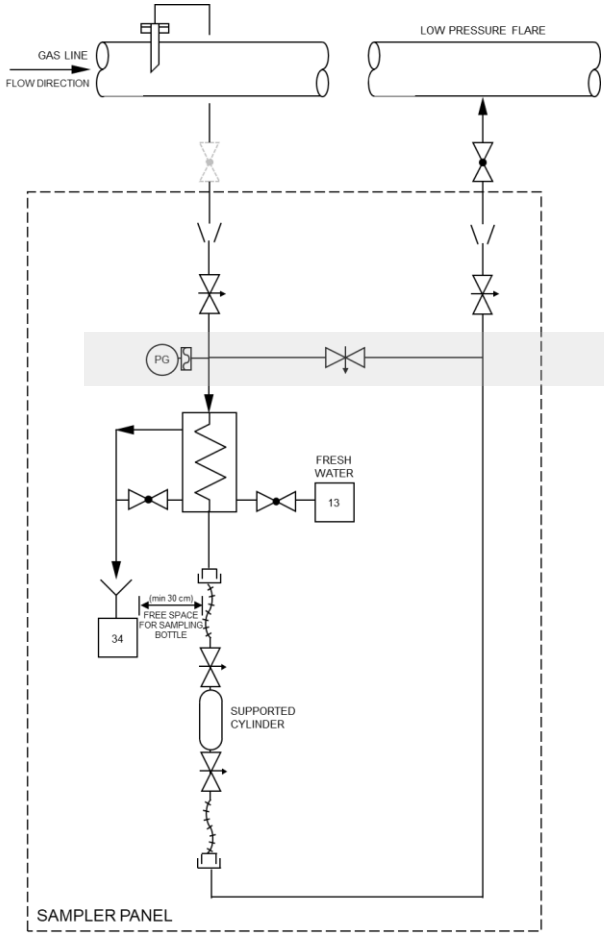
4.3.1 SC3 C1 - LOW PRESSURE; LOW TEMPERATURE



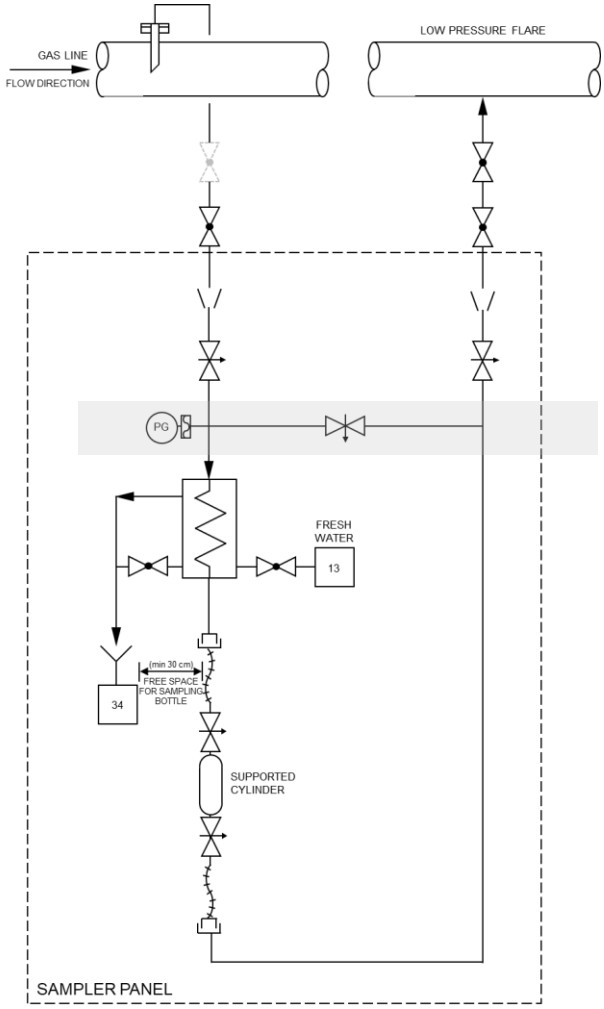
4.3.2 SC3 C2 - HIGH PRESSURE; LOW TEMPERATURE



4.3.3 SC3 C3 - LOW PRESSURE; HIGH TEMPERATURE



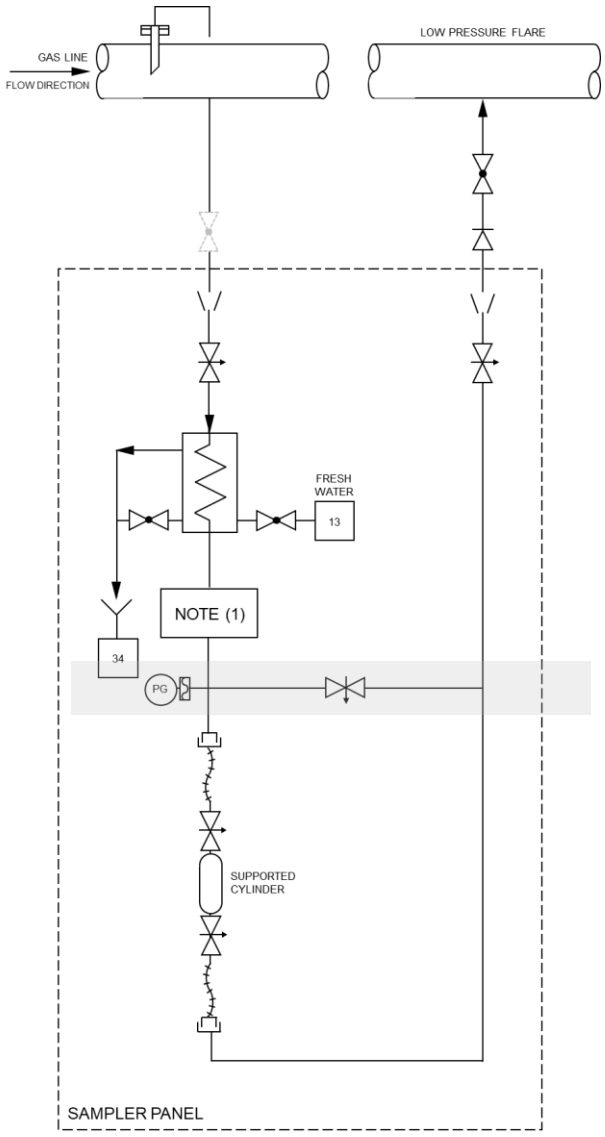
4.3.4 SC3 C4 - HIGH PRESSURE; HIGH TEMPERATURE



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.

In the case of gas sampling from the regenerator tower/reflux vessel of the amine regeneration unit, gas stream may be routed to the reflux vessel.

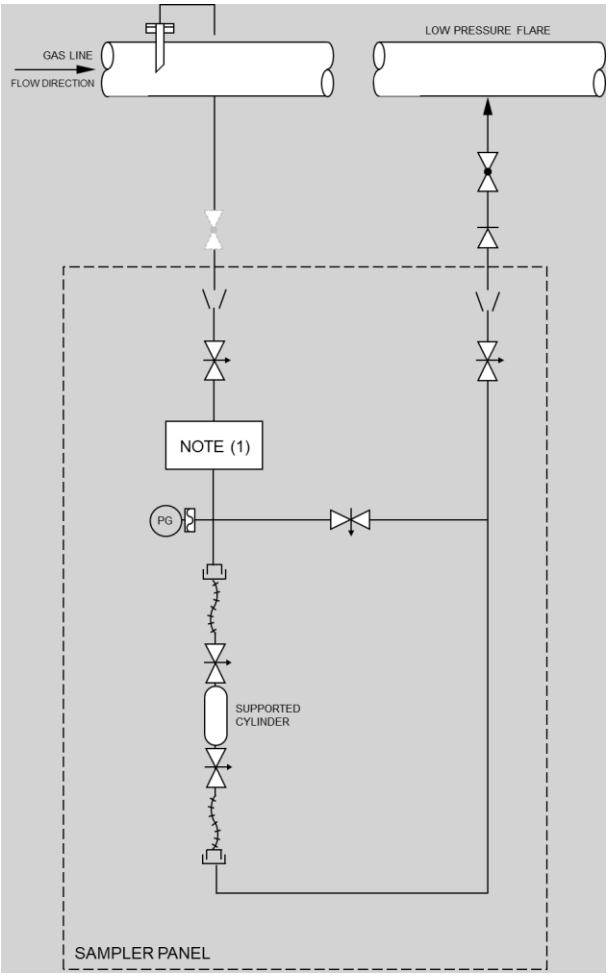


(1) Vacuum pump system used to achieve the required sampling pressure.

4.3.6 SC3 C6 - LOW LOW PRESSURE; LOW TEMPERATURE

SC3 C6 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.

In the case of gas sampling from the regenerator tower/reflux vessel of the amine regeneration unit, gas stream may be routed to the reflux vessel.



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

4.3.7 SC3 C7 - HIGH HIGH PRESSURE; LOW TEMPERATURE

SC3 C7 is used if the design pressure of the system exceeds 5000 psig.

SC3 C7 schematic to be confirmed by PETROBRAS during Detailed Design.

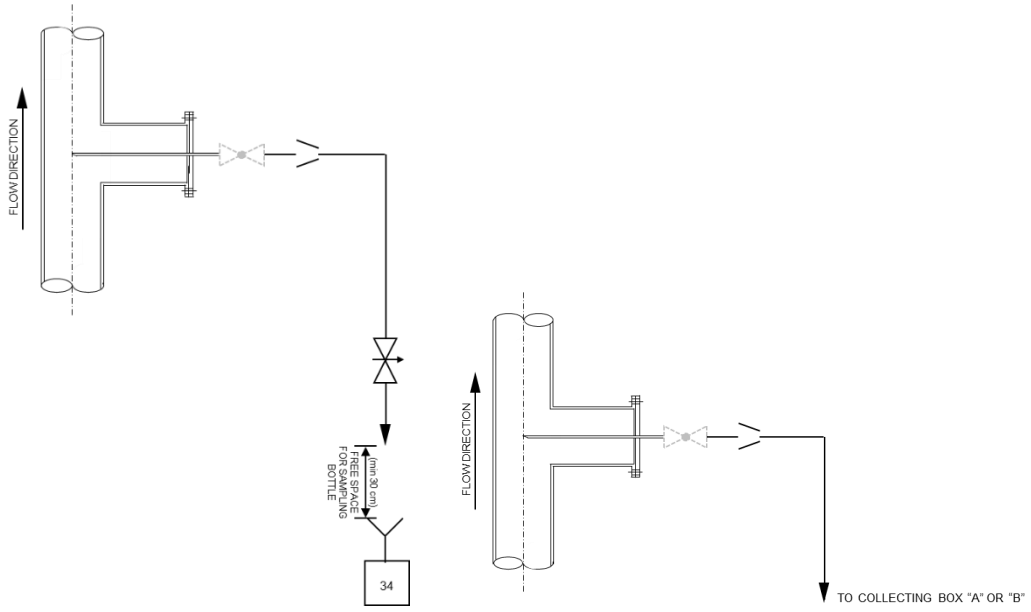
4.4 SC4 - SAMPLE CONNECTION FOR LOW BSW (BSW < 5%) DEAD OIL

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

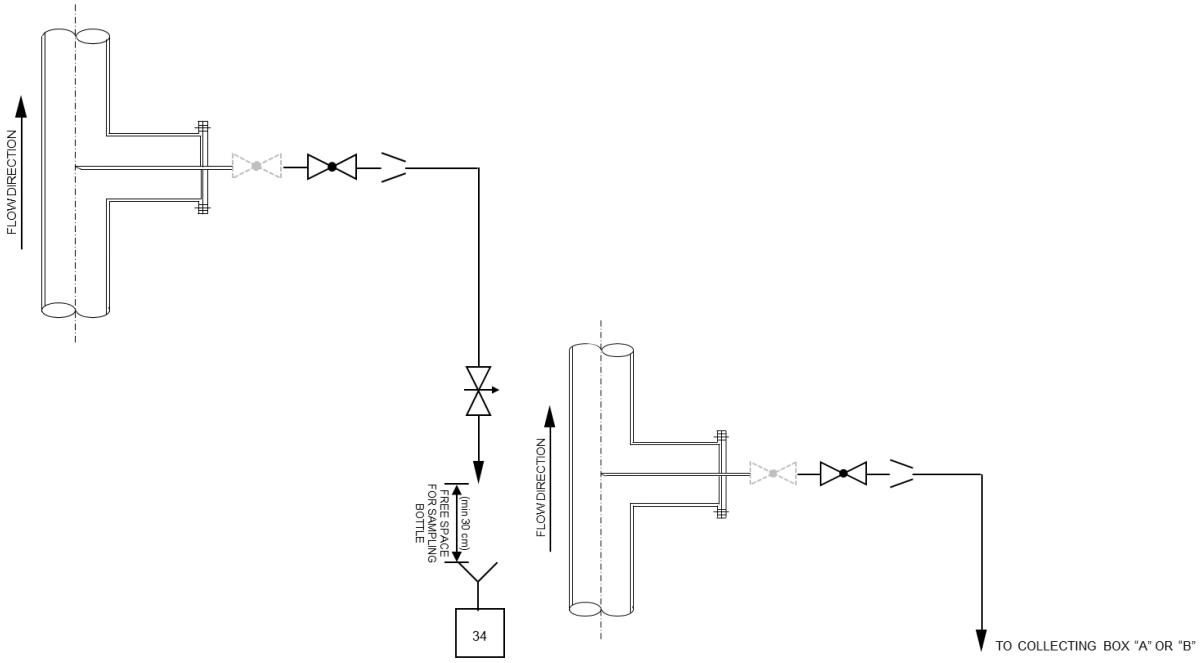
Connection with hot water system for hot cleaning shall be confirmed during Detailed Design considering the physical properties of the oil sample.

Sampling of liquids that classify area and/or may release gas with ≥10 ppm_v H_2S content shall take place in collecting box type “B”.

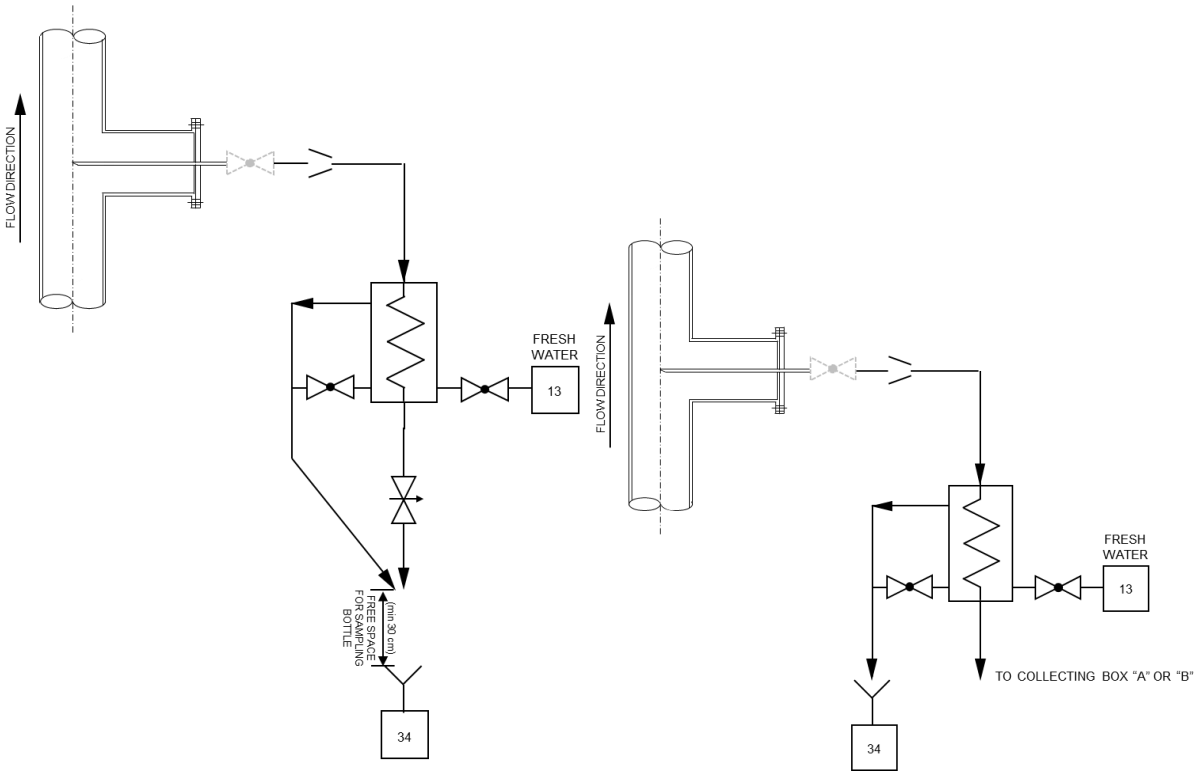
4.4.1 SC4 D1 - LOW PRESSURE; LOW TEMPERATURE



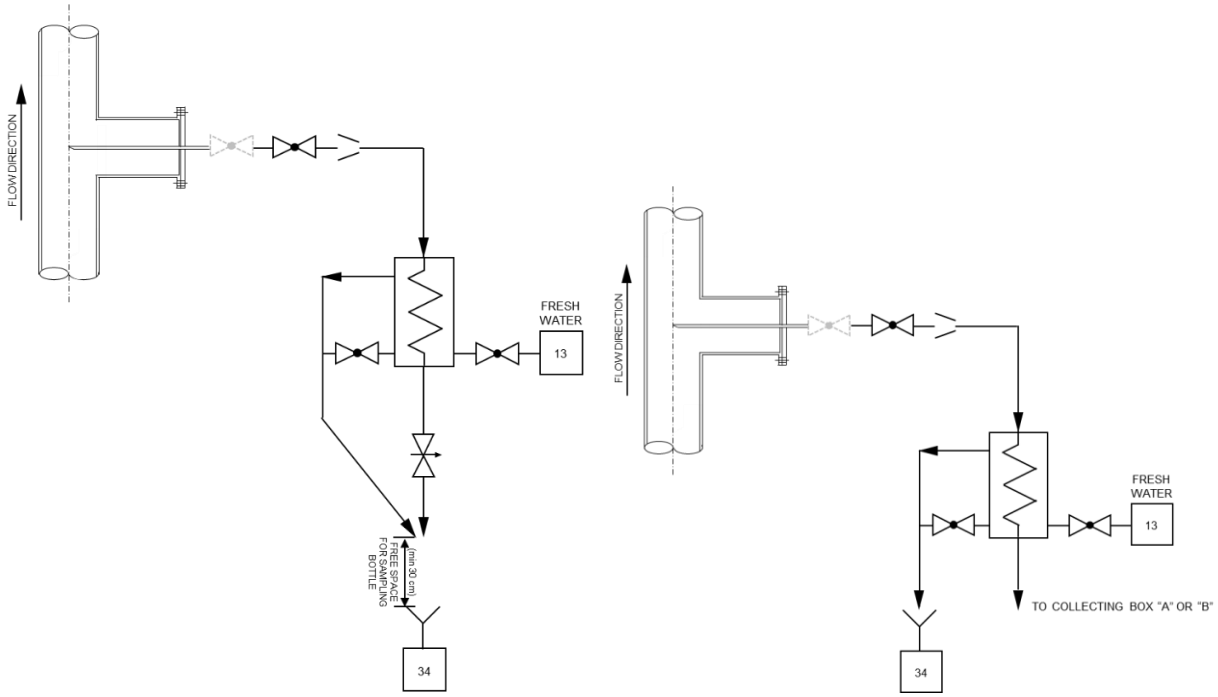
4.4.2 SC4 D2 - HIGH PRESSURE; LOW TEMPERATURE



4.4.3 SC4 D3 - LOW PRESSURE; HIGH TEMPERATURE



4.4.4 SC4 D4 - HIGH PRESSURE; HIGH TEMPERATURE



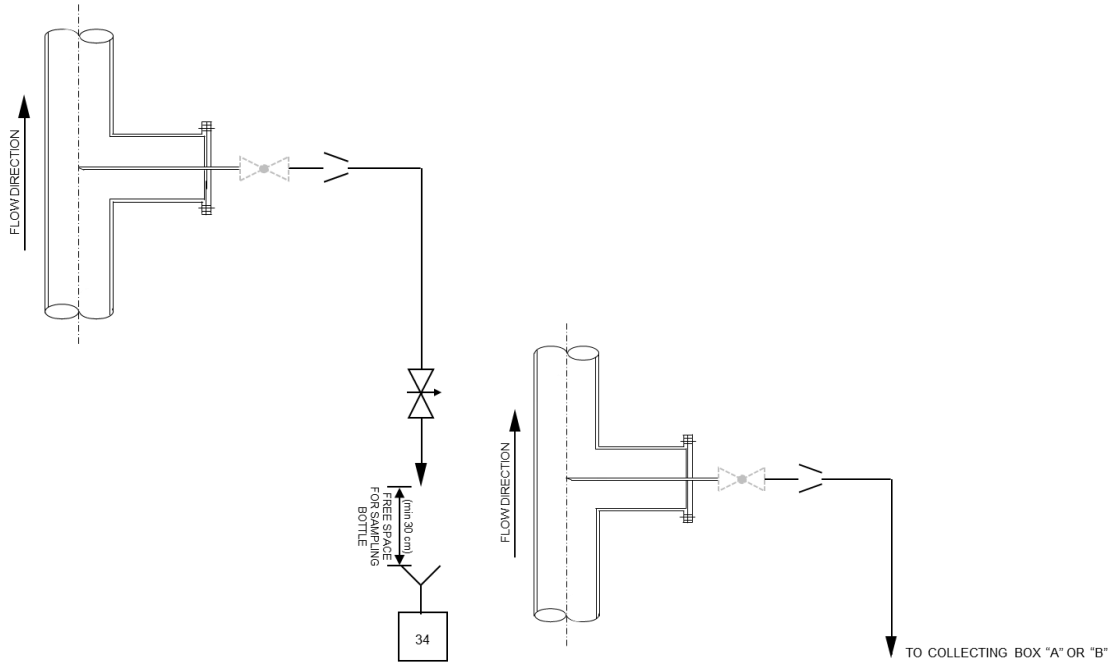
4.5 SC5 - SAMPLE CONNECTION FOR HIGH BSW (BSW GREATER THAN OR EQUAL TO 5%) DEAD OIL

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

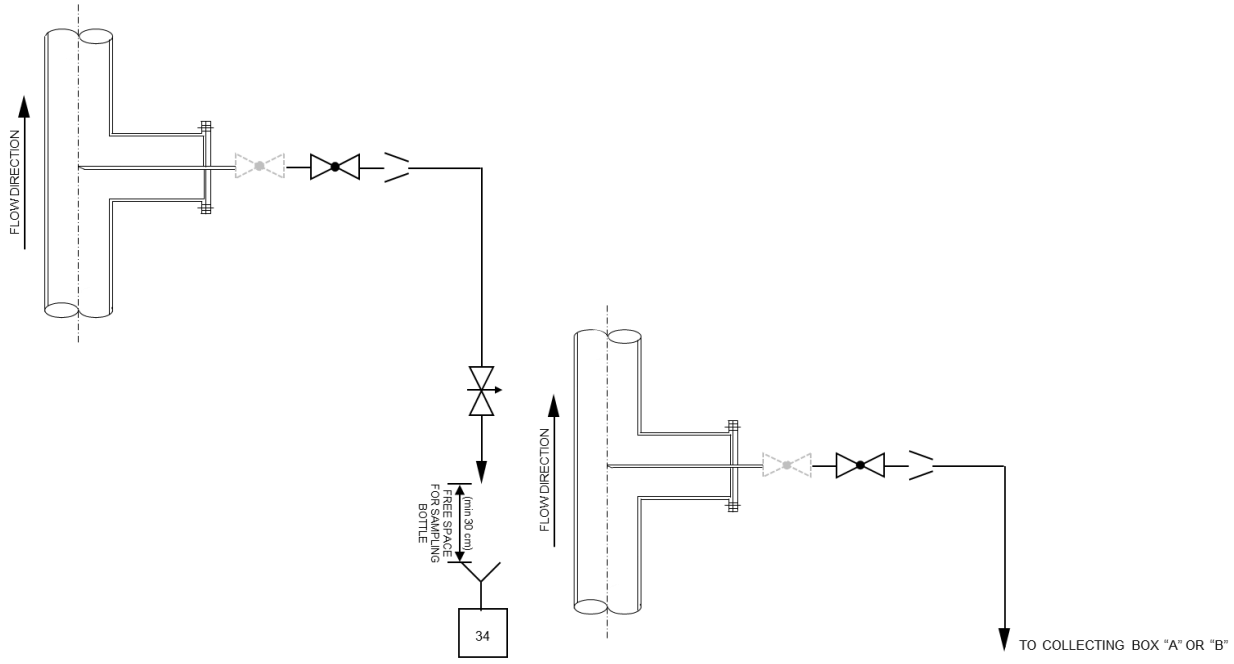
Connection with hot water system for hot cleaning shall be confirmed during Detailed Design considering the physical properties of the oil sample.

Sampling of liquids that classify area and/or may release gas with ≥10 ppm_v H_2S content shall take place in collecting box type “B”.

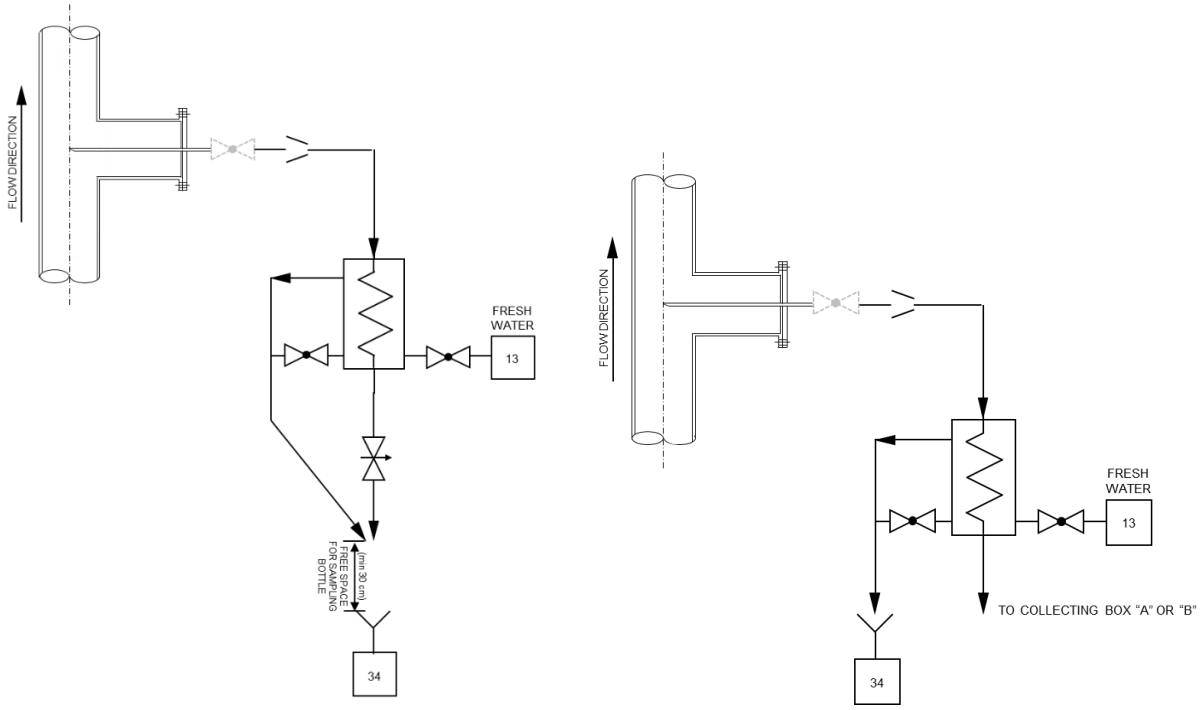
4.5.1 SC5 E1 - LOW PRESSURE; LOW TEMPERATURE



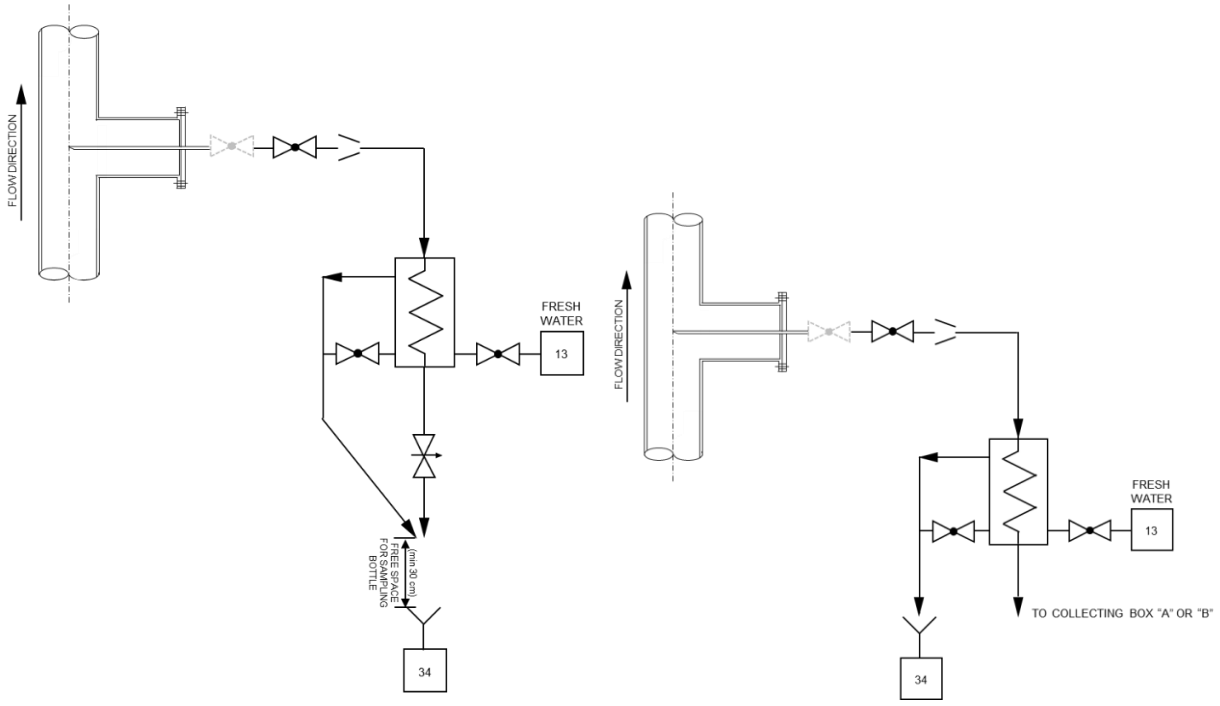
4.5.2 SC5 E2 - HIGH PRESSURE; LOW TEMPERATURE



4.5.3 SC5 E3 - LOW PRESSURE; HIGH TEMPERATURE



4.5.4 SC5 E4 - HIGH PRESSURE; HIGH TEMPERATURE

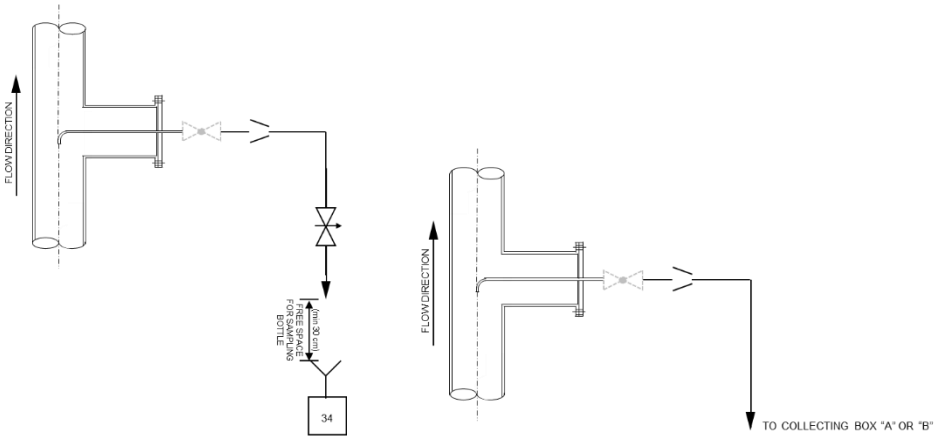


4.6 SC6 - INJECTION WATER (SEAWATER OR PRODUCED WATER) SAMPLE CONNECTION

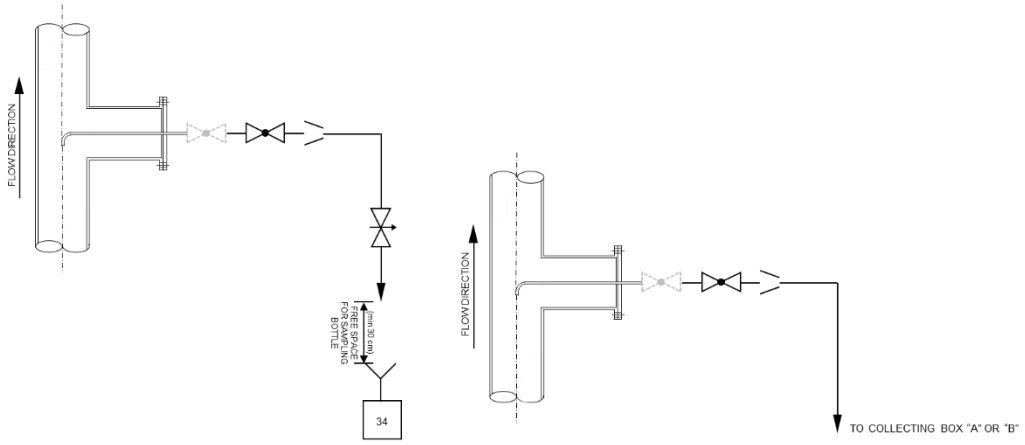
Pitot probe shall be used, according to the schematics below.

Sampling of liquids that classify area and/or may release gas with ≥10 ppm_v H_2S 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 H_2S content shall take place in collecting box type “B”.

Classified in two groups, as follows:

NON-PRESSURIZED SAMPLING

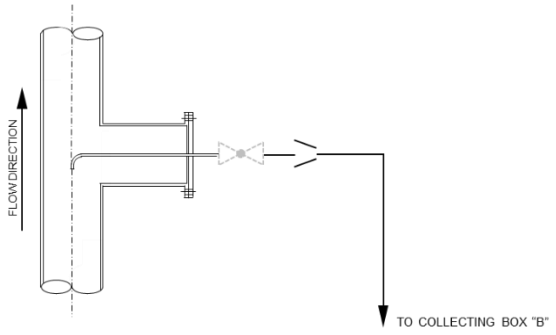
e.g. live oil sampling for BS&W metering, when PVT sampling with cylinder is not required.

PVT SAMPLING WITH CYLINDER

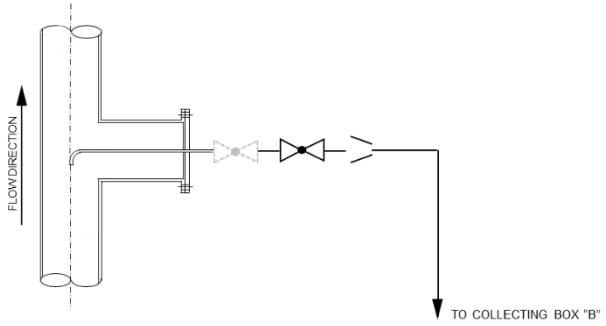
e.g. live oil for fiscal metering downstream TEST SEPARATOR, when PVT sampling with cylinder is required.

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

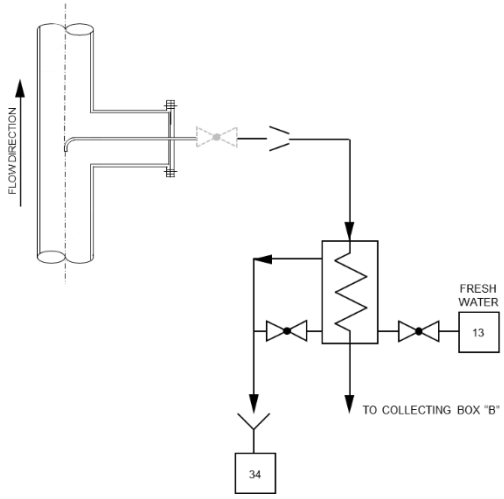
4.7.1 SC7 G1 - LOW PRESSURE; LOW TEMPERATURE; NON-PRESSURIZED SAMPLING



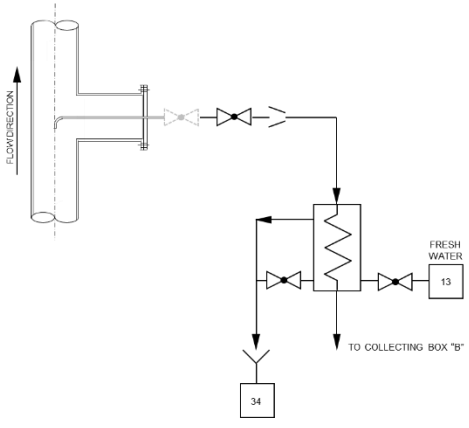
4.7.2 SC7 G2 - HIGH PRESSURE; LOW TEMPERATURE; NON-PRESSURIZED SAMPLING



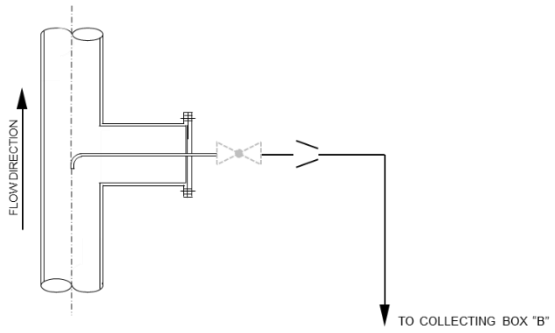
4.7.3 SC7 G3 - LOW PRESSURE; HIGH TEMPERATURE; NON-PRESSURIZED SAMPLING



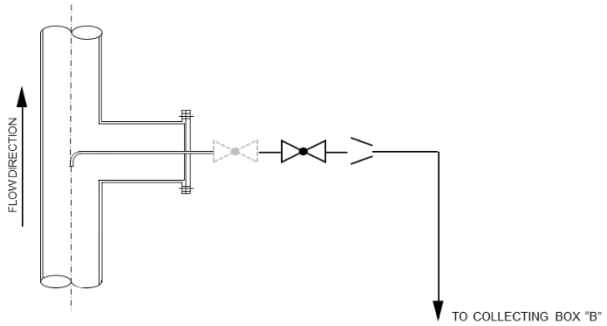
4.7.4 SC7 G4 - HIGH PRESSURE; HIGH TEMPERATURE; NON-PRESSURIZED SAMPLING



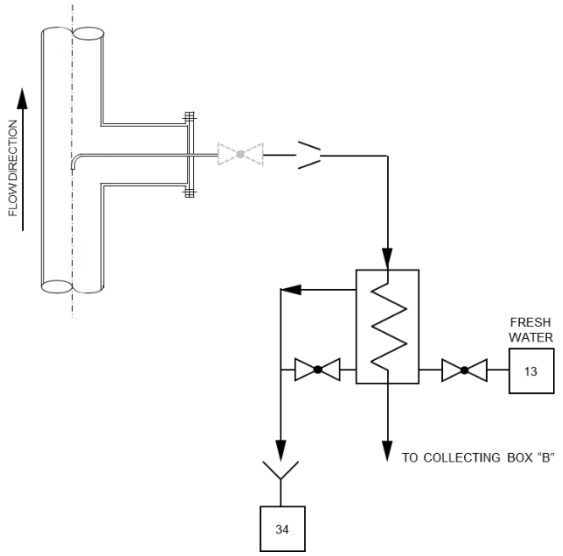
4.7.5 SC7 G5 - LOW PRESSURE; LOW TEMPERATURE; PVT SAMPLING WITH CYLINDER



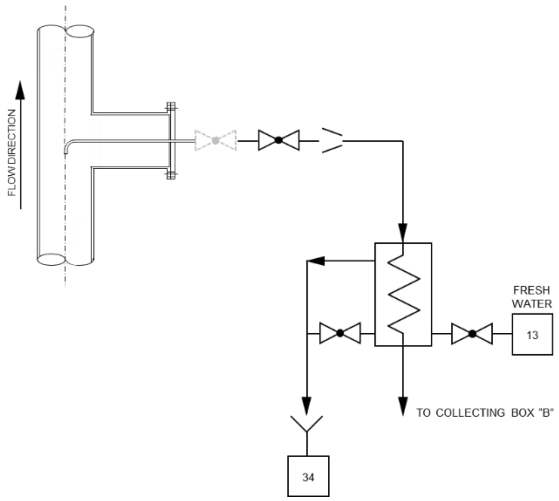
4.7.6 SC7 G6 - HIGH PRESSURE; LOW TEMPERATURE; PVT SAMPLING WITH CYLINDER



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



4.8 SC8 - SAMPLE CONNECTION FOR PRODUCED WATER

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 H_2S content shall take place in collecting box type “B”.

Classified in two groups, as follows:

COMPLIANCE WITH LEGISLATION

Point for environmental monitoring. Shall 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;

4.9 In cases where it is not possible to install an intrusive tube, such as small diameter pipes, the connection shall be at the middle of the pipe (lateral connection);

- Sampling line length shall not exceed 4 meters;
- Sampling line routing shall be via straight tubing. In the event of technical impossibility, routing shall be free of ups and downs, with as few accidents and curves as possible, minimizing the use of 90° bends;
- It shall be kept constantly open at the maximum opening of the sampling valve.

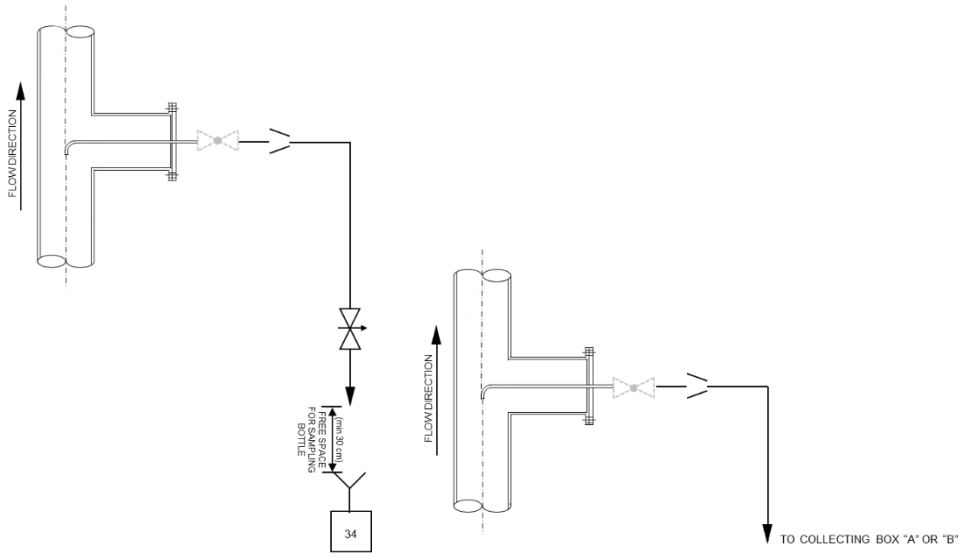
OPERATIONAL

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

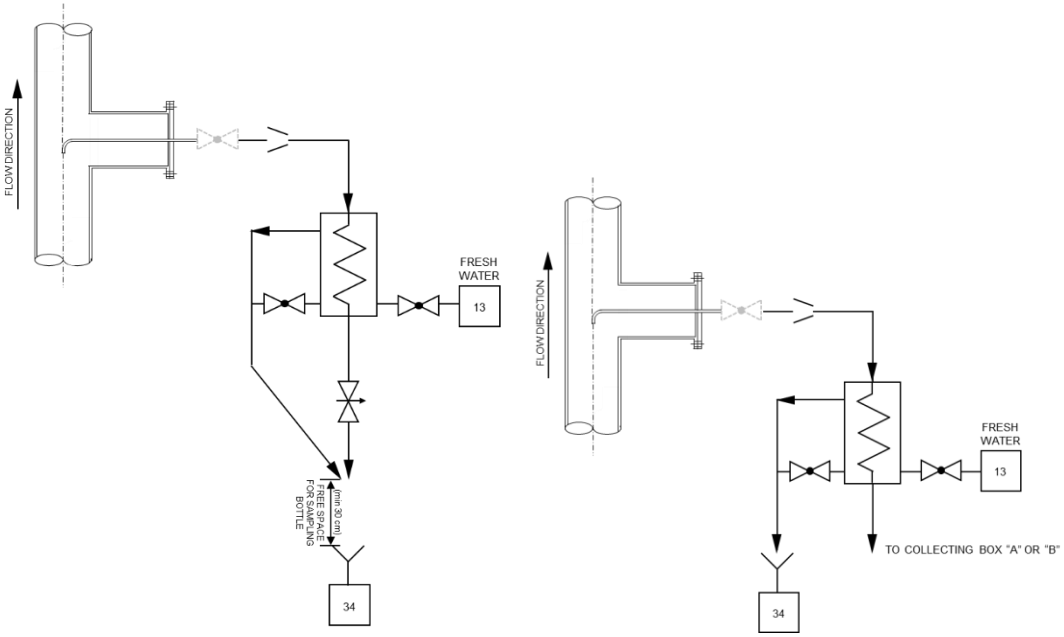
Requirements:

- 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 shall be at the middle of the pipe (lateral connection);
- Sampling line length shall not exceed 4 meters.

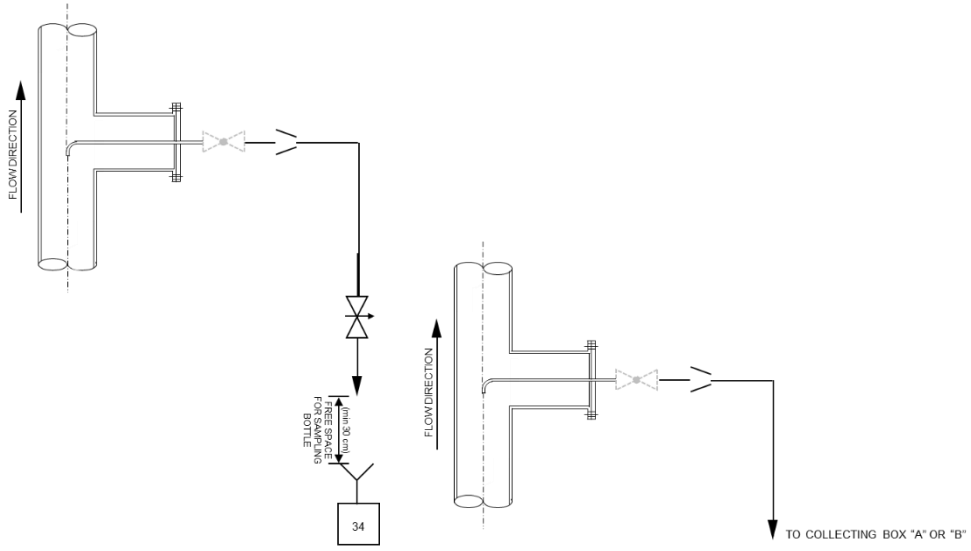
4.9.1 SC8 H1 - LOW PRESSURE; LOW TEMPERATURE; COMPLIANCE WITH LEGISLATION



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



4.9.3 SC8 H3 - LOW PRESSURE; LOW TEMPERATURE; OPERATIONAL



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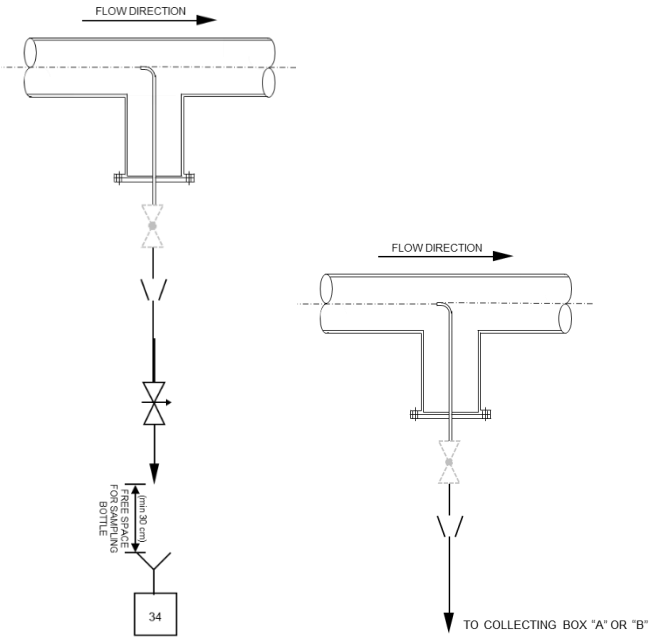
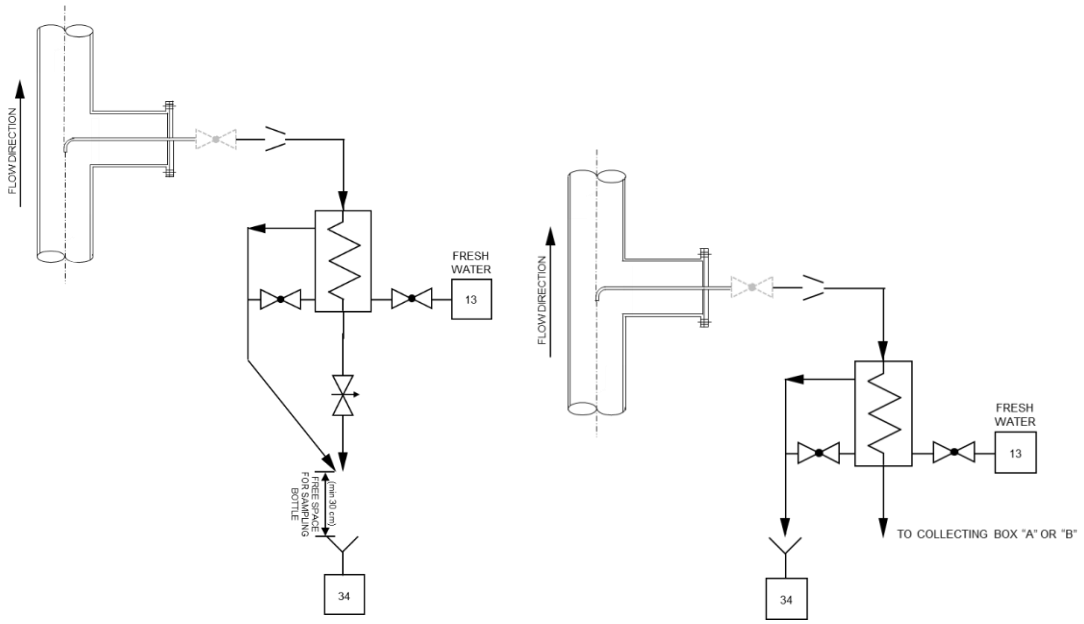


4.9.4 SC8 H4 - LOW PRESSURE; HIGH TEMPERATURE; OPERATIONAL



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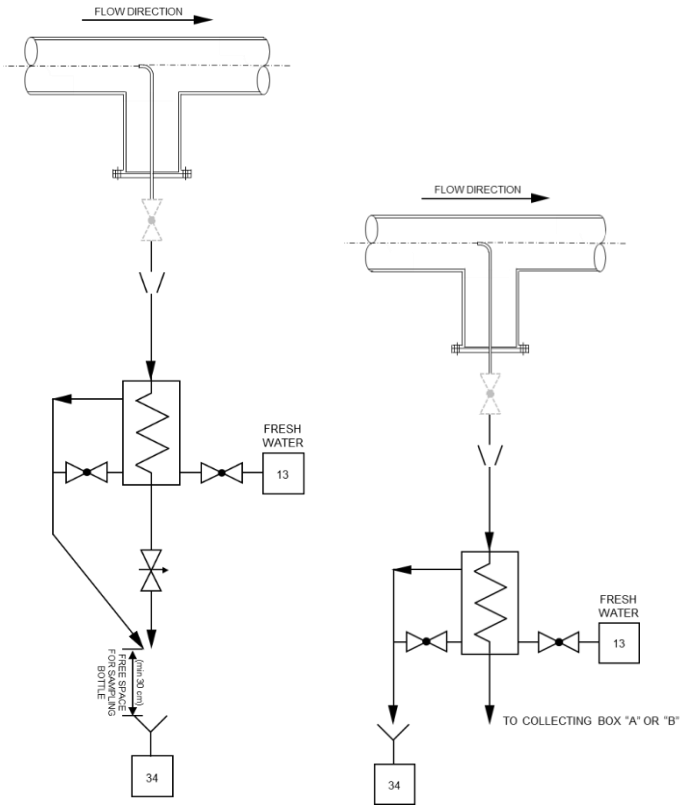
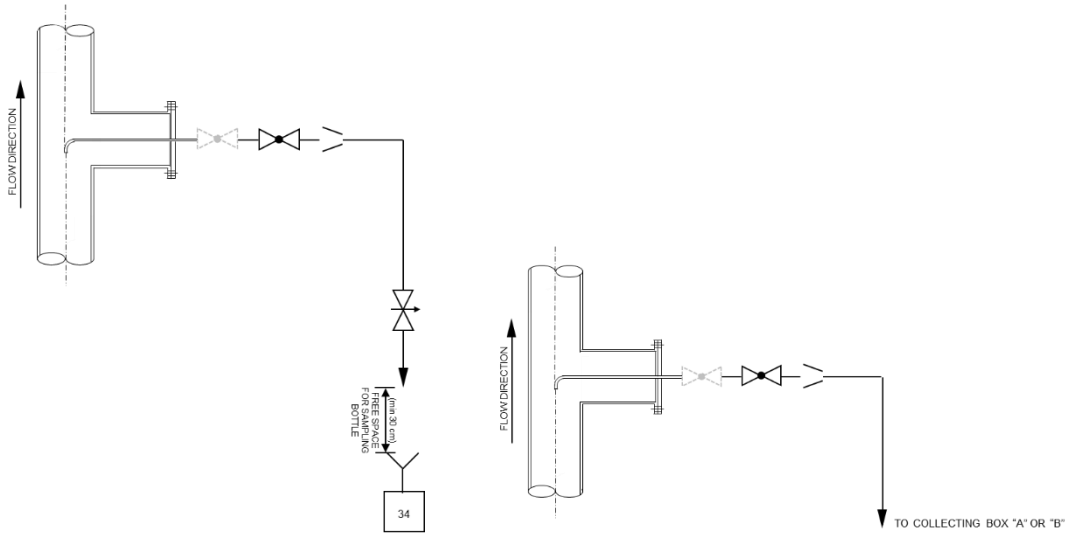
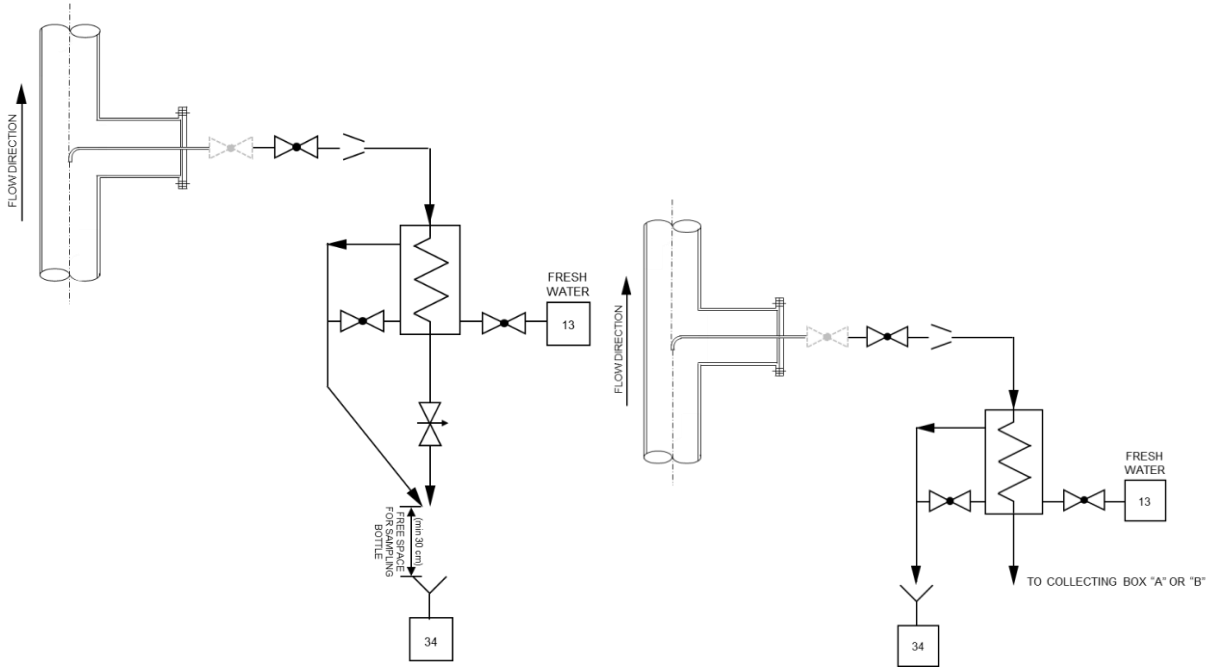


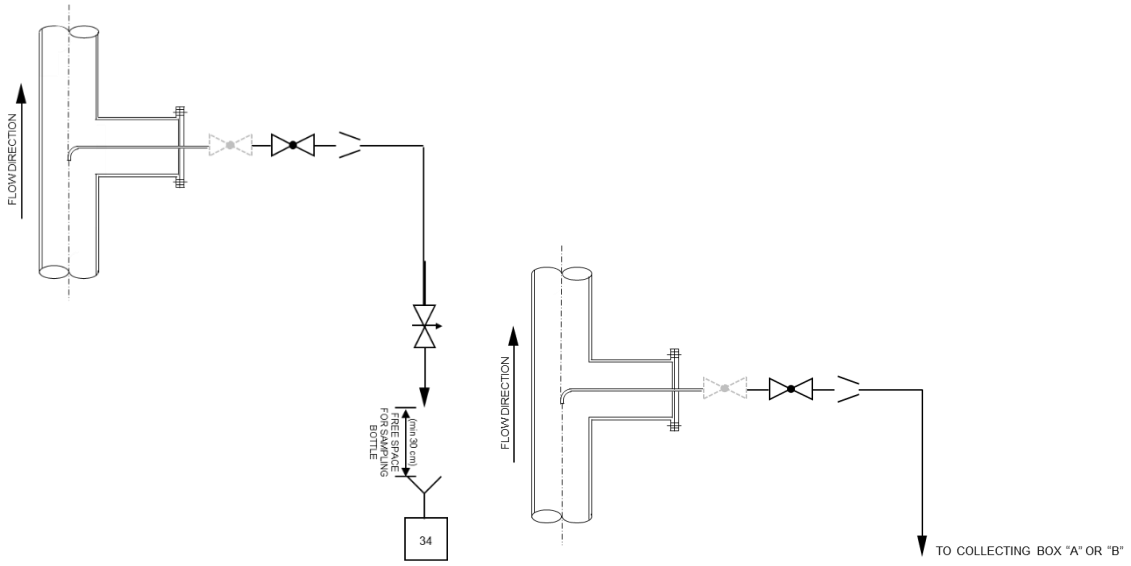
4.9.5 SC8 H5 - HIGH PRESSURE; LOW TEMPERATURE; COMPLIANCE WITH LEGISLATION



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



4.9.7 SC8 H7 - HIGH PRESSURE; LOW TEMPERATURE; OPERATIONAL



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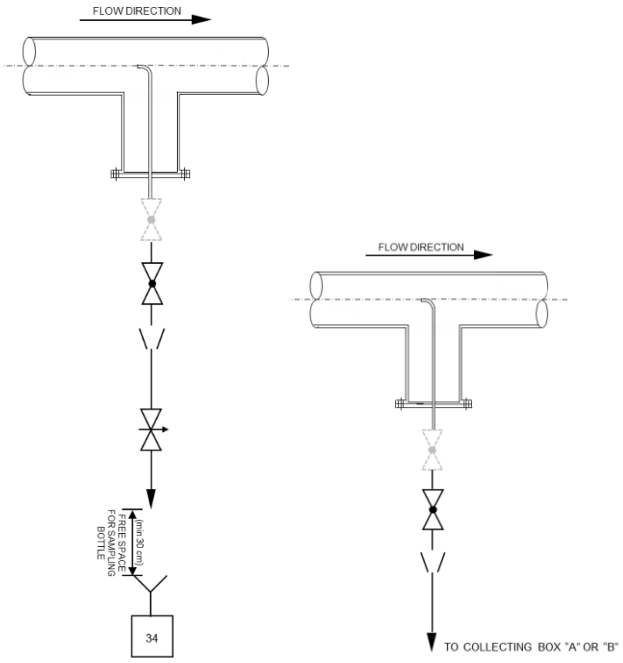
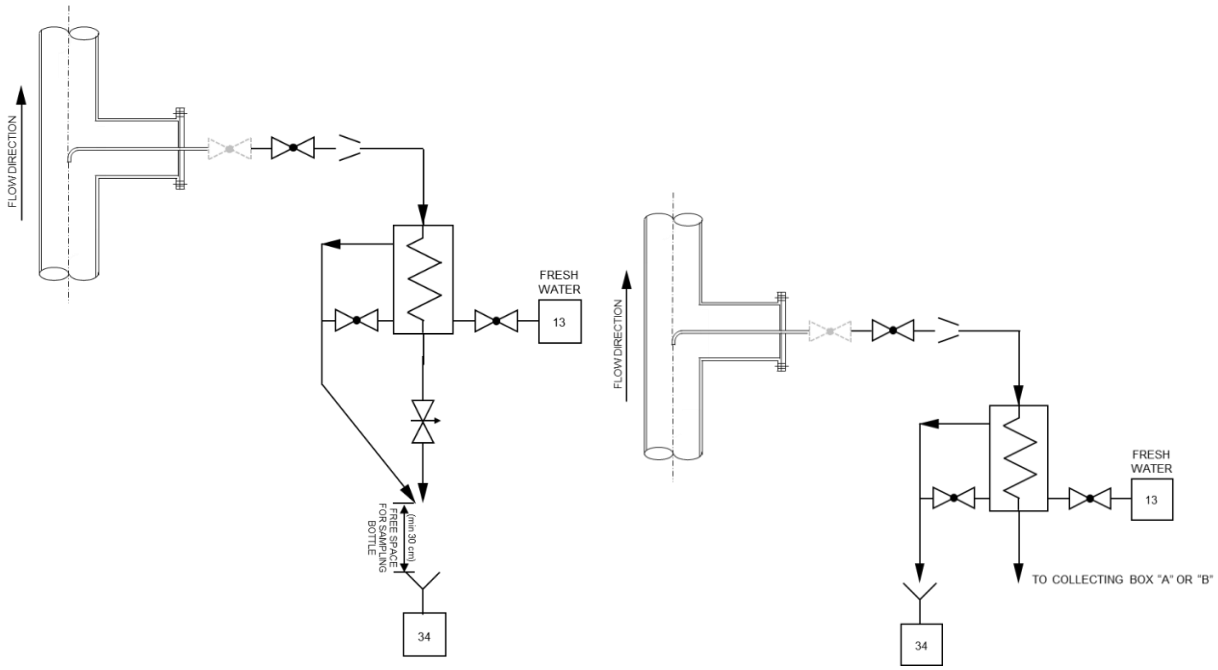


4.9.8 SC8 H8 - HIGH PRESSURE; HIGH TEMPERATURE; OPERATIONAL



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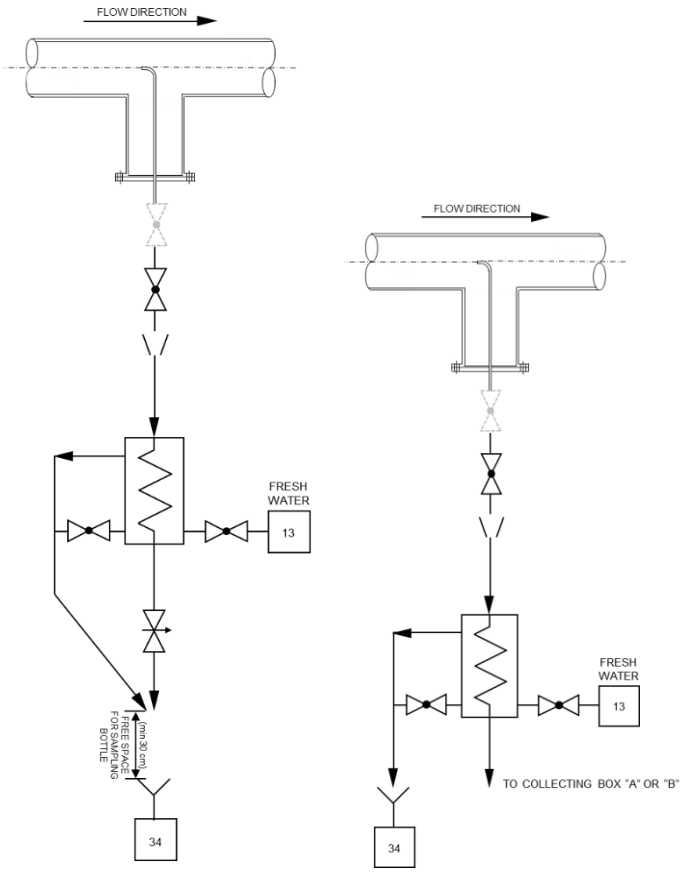


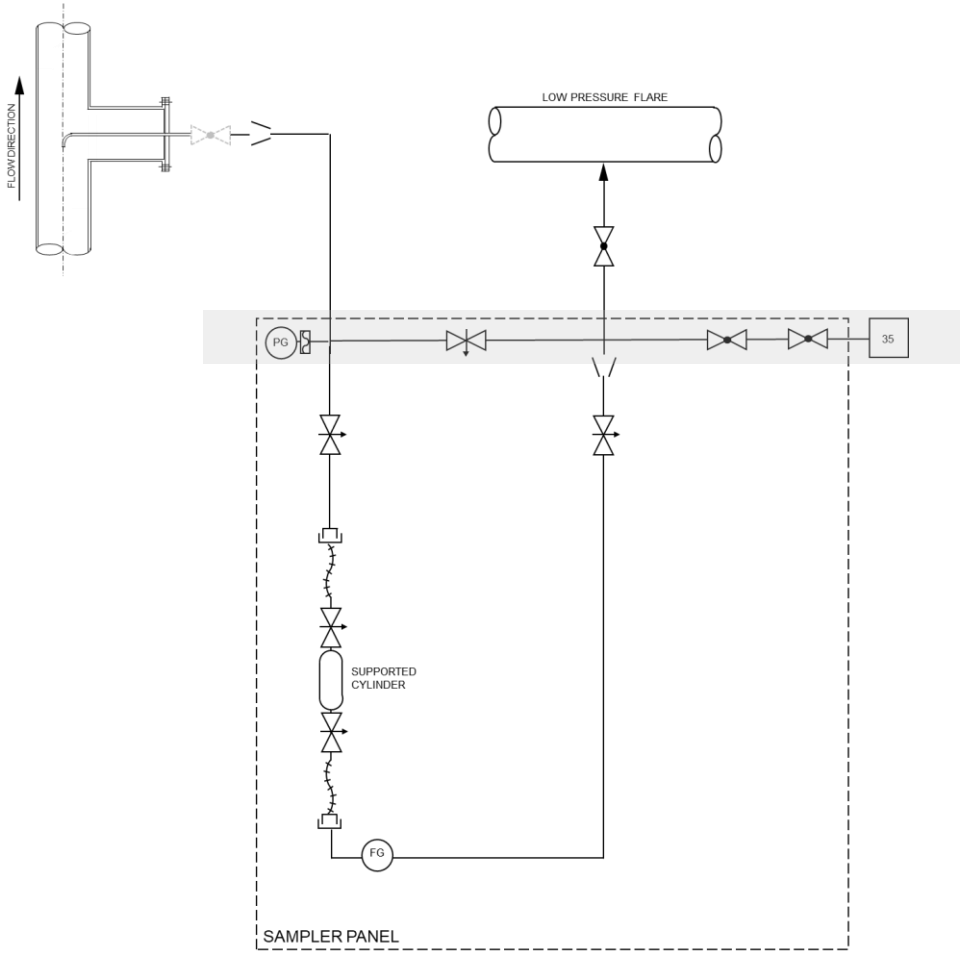
4.10 SC9 - SAMPLE CONNECTION FOR STREAMS WITH BENZENE

SC9 is used for streams with ≥1% benzene volume content.

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

Sample connections for streams with benzene represented below (SC9) indicate the gas stream routed to low pressure flare system of the unit. Alternatively, the gas stream may be routed to high pressure flare system as long as the maximum backpressure of the high pressure flare header and the sampling pressure are observed.

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



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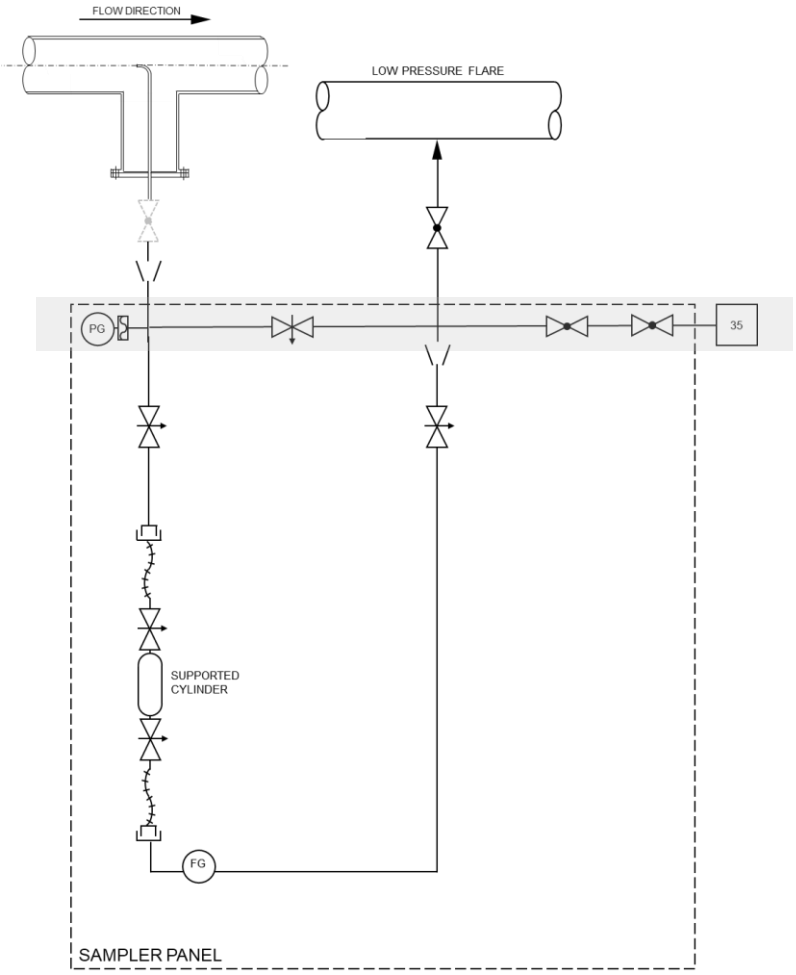
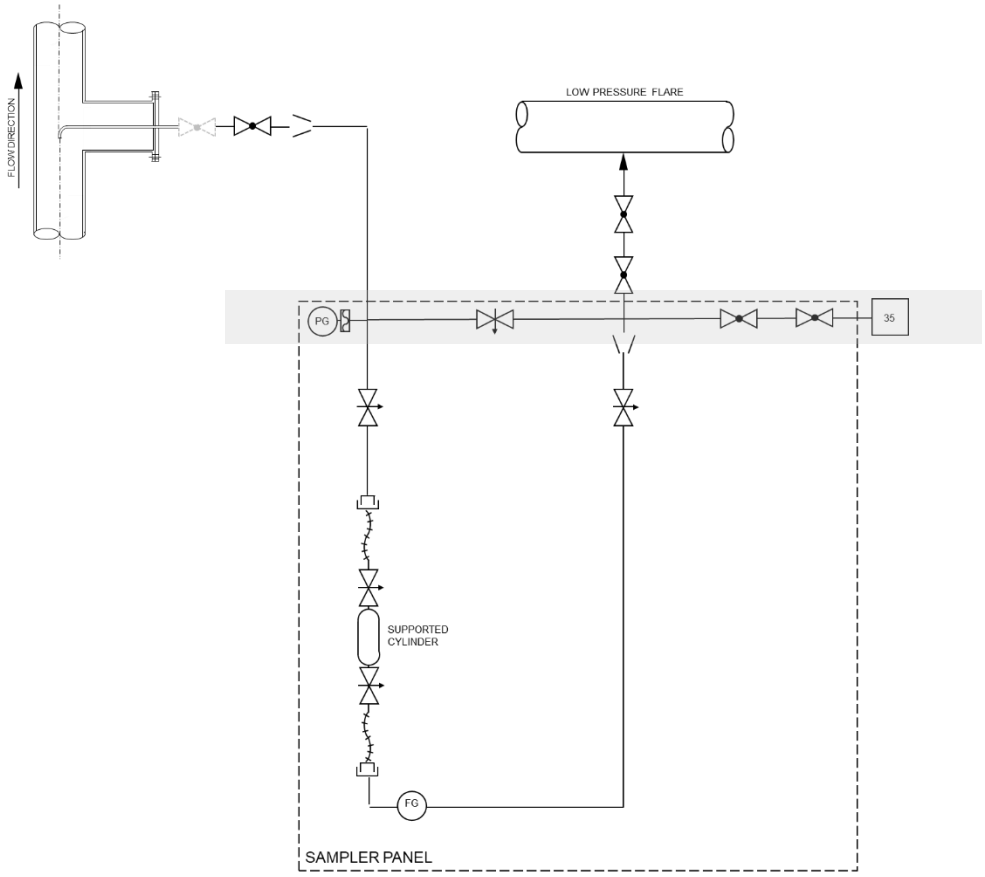

FLOW DIRECTION
LOW PRESSURE FLARE
PG
35
SUPPORTED
CYLINDER
FG
SAMPLER PANEL

4.10.2 SC9I2 - HIGH PRESSURE; LOW TEMPERATURE; CONDENSATE AND BIPHASIC SAMPLING



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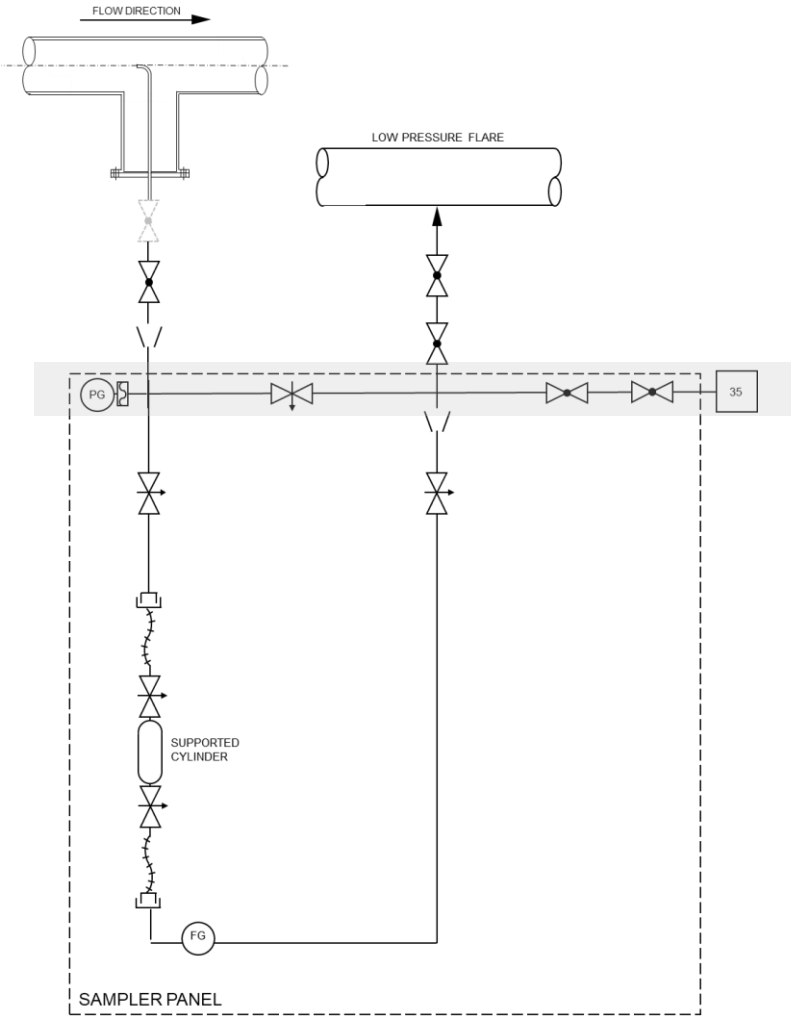
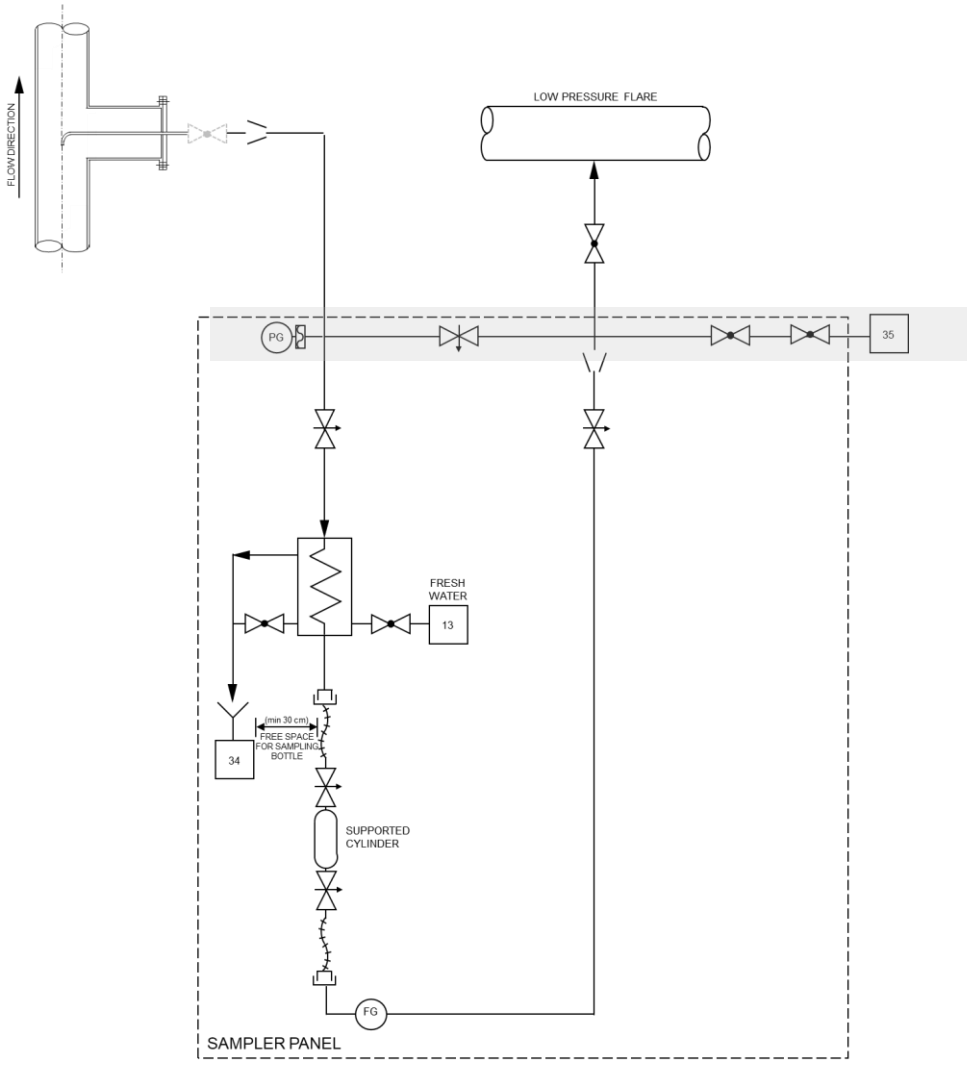

FLOW DIRECTION
LOW PRESSURE FLARE
PG
35
SUPPORTED
CYLINDER
FG
SAMPLER PANEL

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



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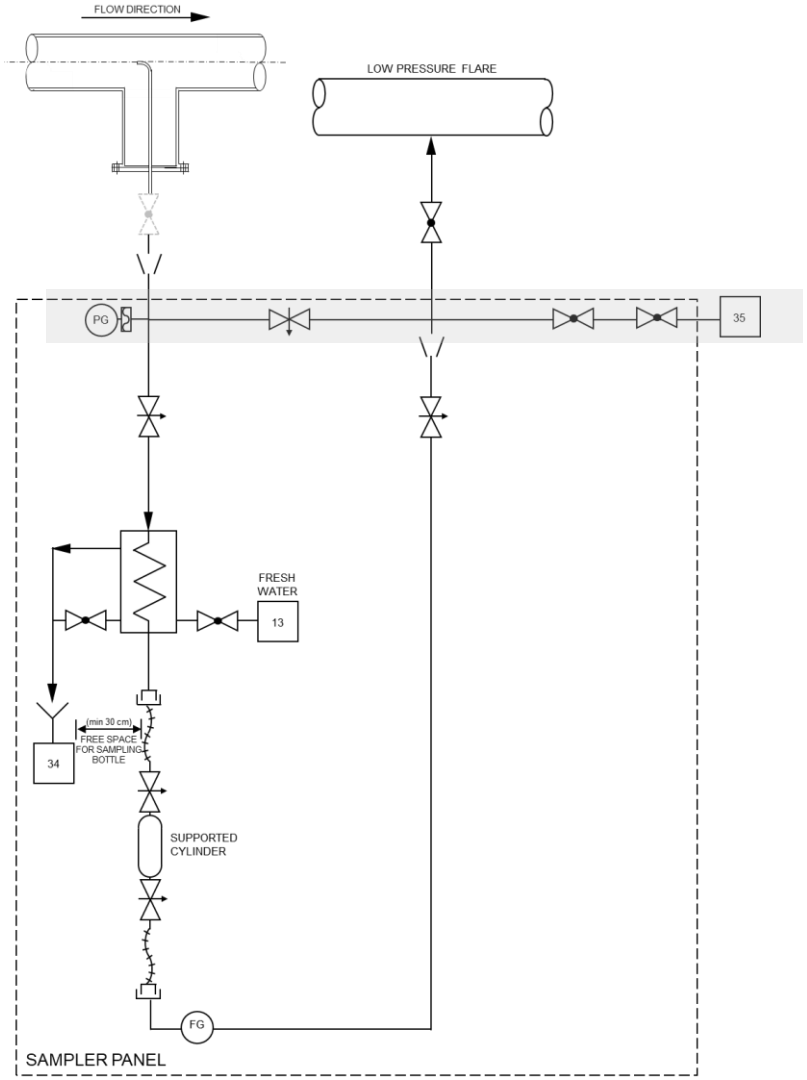
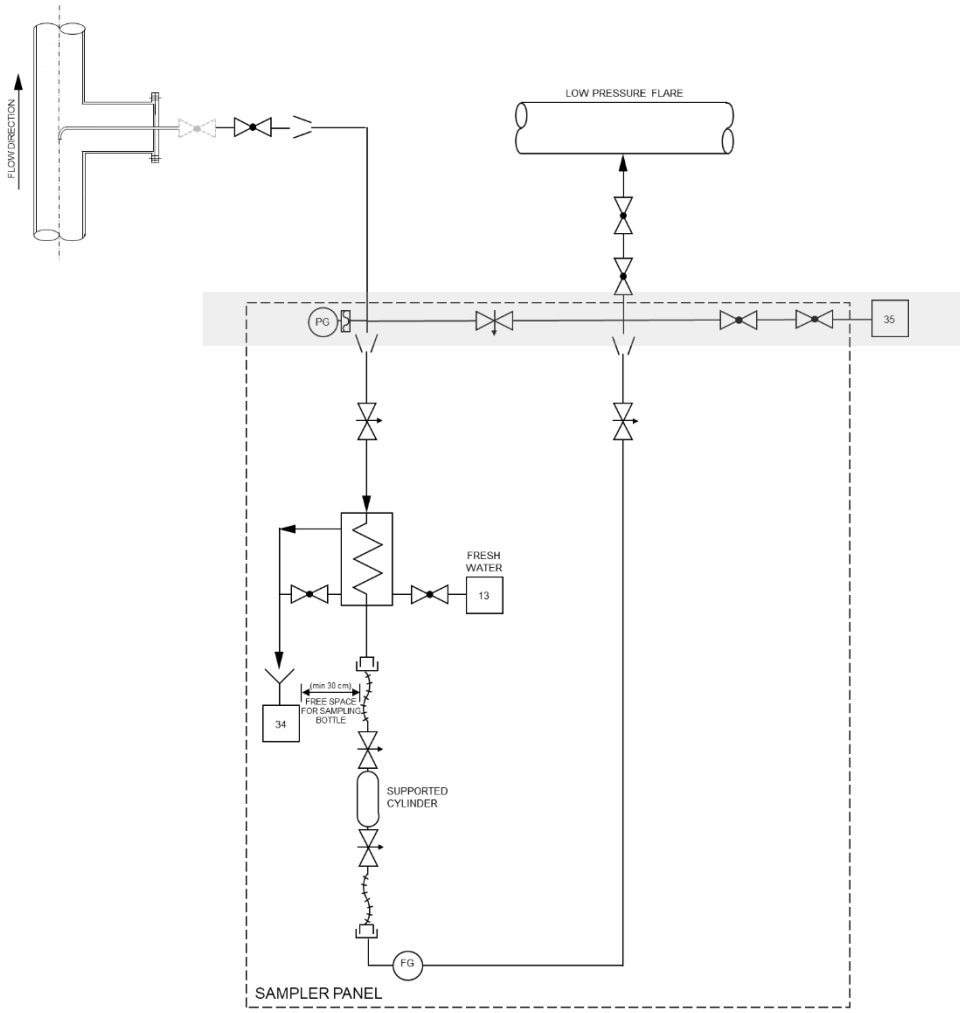

FLOW DIRECTION
LOW PRESSURE FLARE
PG
35
FRESH WATER
13
(min 30 cm)
FREE SPACE FOR SAMPLING BOTTLE
34
SUPPORTED CYLINDER
FG
SAMPLER PANEL

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



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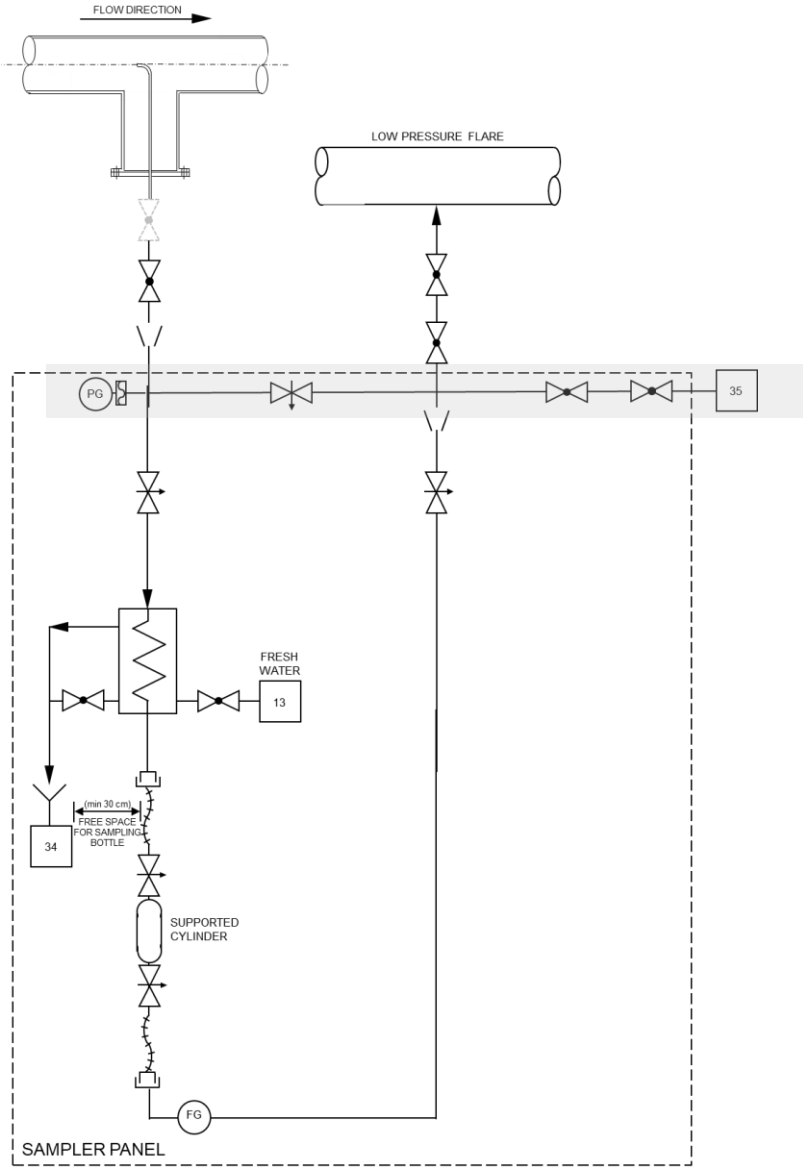
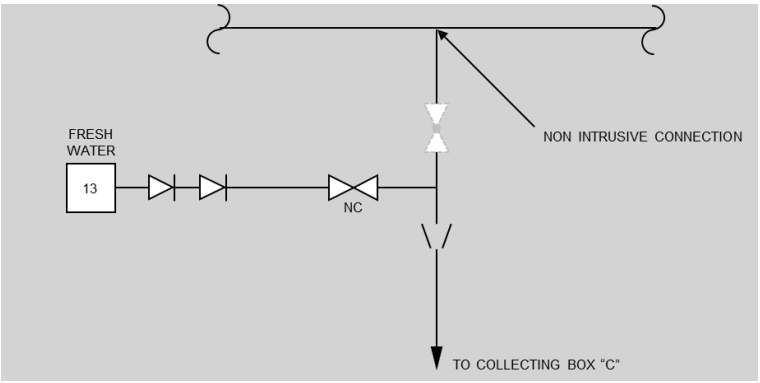

FLOW DIRECTION
LOW PRESSURE FLARE
PG
35
FRESH WATER
13
(min 30 cm)
FREE SPACE FOR SAMPLING BOTTLE
34
SUPPORTED CYLINDER
FG
SAMPLER PANEL

4.11 SC10 - SAMPLE CONNECTION FOR SEWAGE TREATMENT UNIT (STU)

Sampling from Seawage Treatment Unit (STU) shall take place in collecting box type “C”.

4.11.1 SC10J1 - LOW PRESSURE; LOW TEMPERATURE



The sampling point shall be located in a horizontal section, downstream of a change in flow direction caused by elbows, bends etc.

Sampling point shall be located on the upper section of the pipe in order to be self-drained.

Sampling pipe diameter shall be at least 3/4” in stainless steel.

Sampling pipe length shall be as low as possible, preferably less than 4 meters.

Sampling point shall be routed to a collecting box type “C”.

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 shall 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.

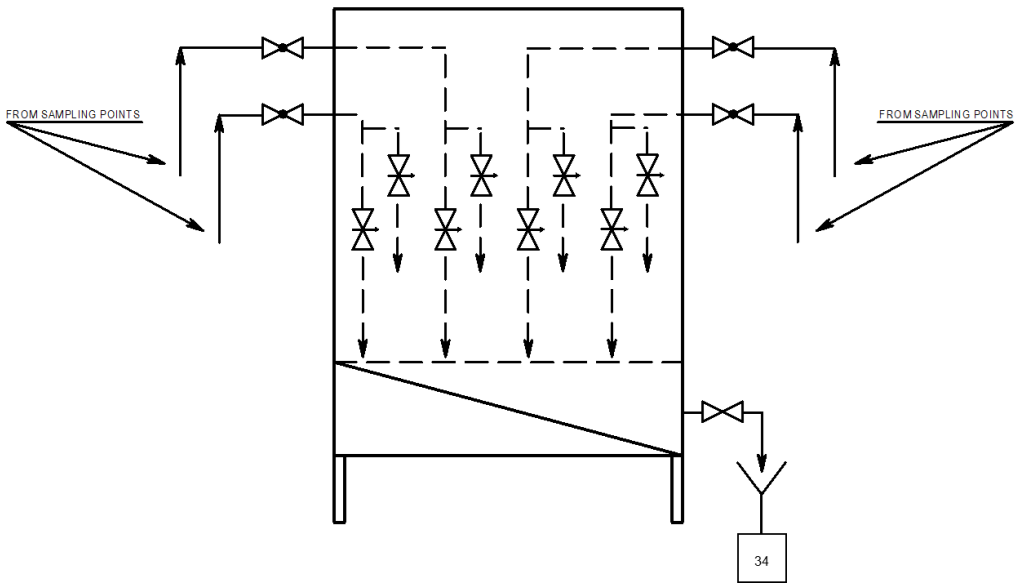
Alternative arrangements may be accepted under previous approval of PETROBRAS.

The sample collector panel and collecting box (casing or enclosure) shall be made of ASTM A351 GR CF8M stainless steel (AISI-316). Other materials shall be submitted to PETROBRAS for approval.

5.1 CLASSIFICATION

5.1.1 COLLECTING BOX TYPE “A”

Collecting box type “A” shall be 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” shall be used for sampling of liquids that classify area and/or release gas with ≥10 ppm_v content.

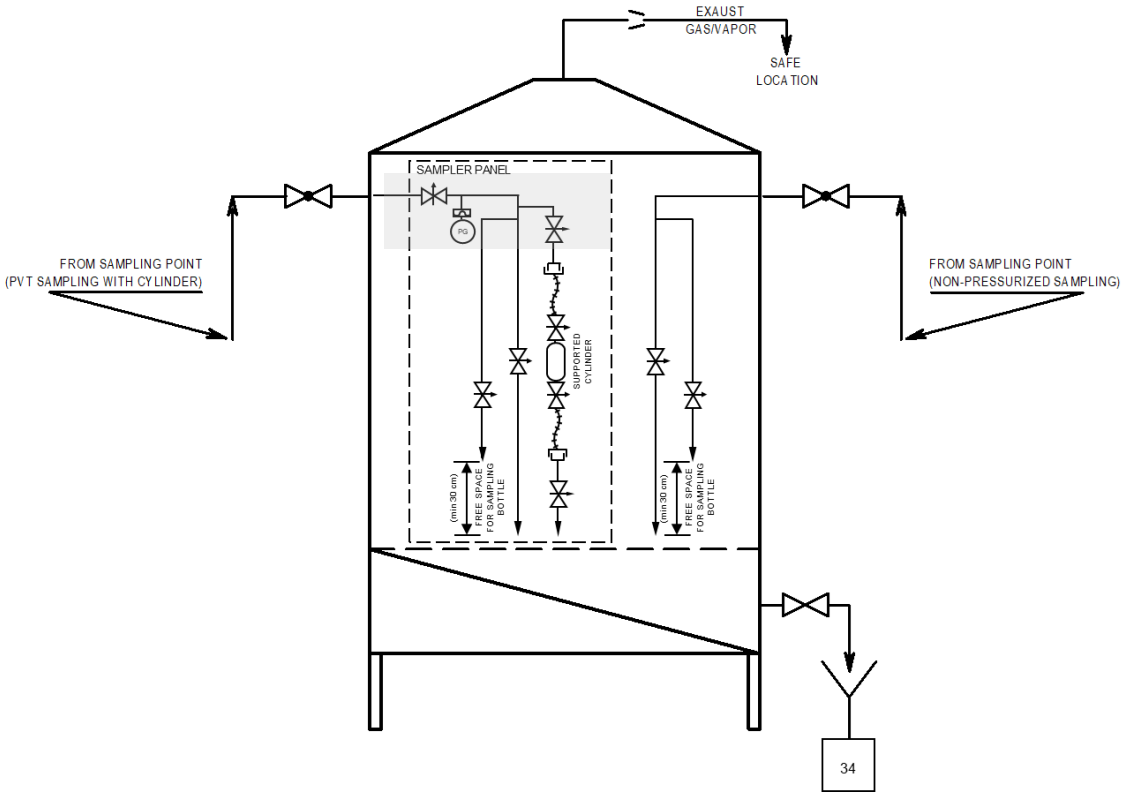
Collecting box type “B” includes:

NON-PRESSURIZED SAMPLING

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

PVT SAMPLING WITH CYLINDER

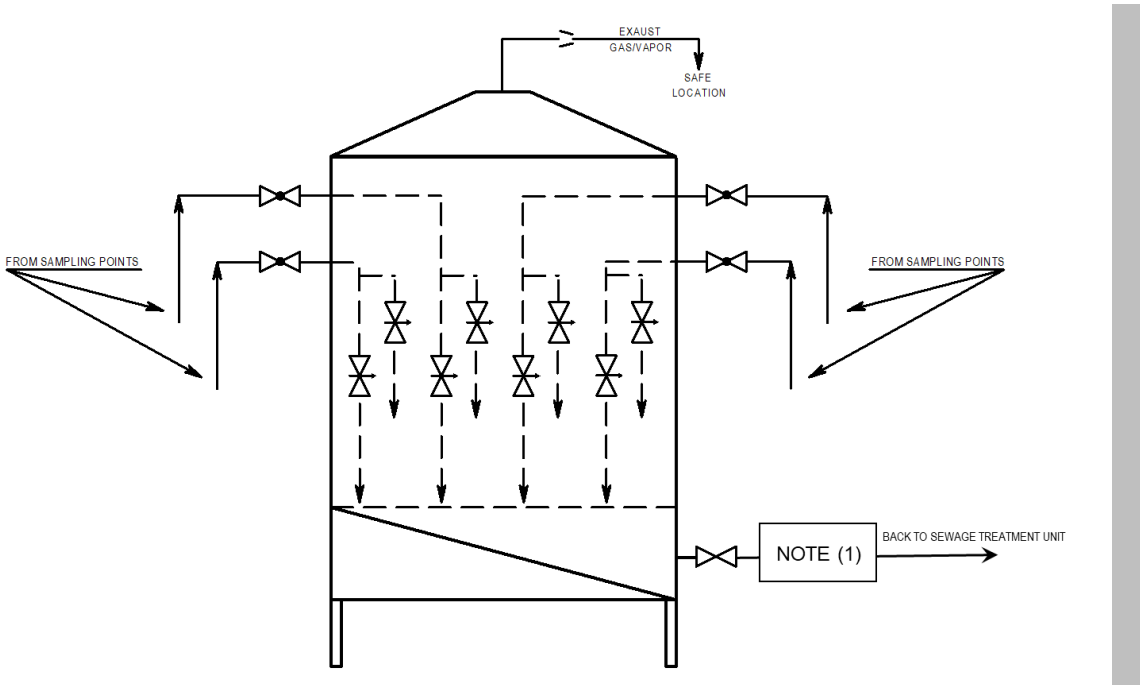
e.g. live oil for fiscal metering downstream TEST SEPARATOR, when PVT sampling with cylinder is required. PVT sampling with cylinder already includes derivation for non-pressurized sampling.



A mechanical exhaust device shall be installed in order to route the exhaust gas/vapor to “safe location”. For “safe location” definition, see “P&ID - GENERAL NOTES” (project document issued by PETROBRAS).

5.1.3 COLLECTING BOX TYPE “C”

Collecting box type “C” shall be used for sampling from Seawage Treatment Unit (STU).



(1) Pumping system shall be installed in order to route the drainage from collecting box type “C” back to Seawage Treatment Unit (STU).

Drainage from collecting box type “C” shall be routed to the inlet of Seawage Treatment Unit (STU).

A mechanical exhaust device shall be installed in order to route the exhaust gas/vapor to “safe location”. For “safe location” definition, see “P&ID - GENERAL NOTES” (project document issued by PETROBRAS).

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. In case the use of stairs is unfeasible, alternative means of access including vertical ladders with a purpose-built standing surface shall only be accepted if submitted to Human Factors analysis and PETROBRAS approval and shall include means of safe sample transport without manual cargo handling via vertical ladders.

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 hand 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.

7 REFERENCE DOCUMENTS

- I-ET-3000.00-1200-940-P4X-001 - TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN
- I-ET-3010.00-1200-813-P4X-001 - GENERAL CRITERIA FOR FLOW METERING SYSTEMS