

PETRONAS TECHNICAL STANDARDS

MANUAL

ON-LINE PROCESS STREAM ANALYSIS - SAMPLE TAKE-OFF & TRANSPORTATION

PTS 32.31.50.10

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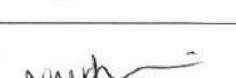
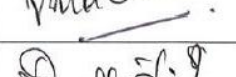
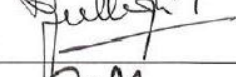
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This revision of PTS **32.31.50.10- On-Line Process Stream Analysis – Sample Take-Off & Transportation** has been updated incorporating PETRONAS Lessons Learnt, Best Practice and new information issued by relevant industry code and standards.

The previous version of this PTS **December 2008** will be removed from PTS binder/ e-repository from herein onwards.

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Summary of Changes

Date	Version	Description of Updates	Author

PREFACE

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TABLE OF CONTENTS

1.	INTRODUCTION	1
1.1	SCOPE	1
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS	1
1.3	DEFINITIONS	1
1.4	CROSS-REFERENCES	3
2.	INSTALLATION OF SAMPLE TAKE-OFF CONNECTIONS, SAMPLE PROBES AND SAMPLE PRE-CONDITIONING SYSTEMS	4
2.1	LOCATION	4
2.2	PRE-DESIGN ASPECTS	4
2.3	INSTALLATION OF SAMPLE TAKE-OFF CONNECTIONS AND TRANSPORT LINES ...	5
2.4	CIVIL ASPECTS	8
2.5	ELECTRICAL ASPECTS	8
3.	DESIGN OF SAMPLE PROBES, SAMPLE TRANSPORT LINES AND SAMPLE PRE- CONDITIONING SYSTEMS	9
3.1	GENERAL	9
3.2	SAMPLE PROBE SELECTION AND SAMPLE TAKE-OFF CONNECTIONS	9
3.3	SAMPLE PRE-CONDITIONING	9
3.4	SAMPLE TRANSPORT SYSTEMS	12
4.	SAMPLE RECOVERY AND DISPOSAL	14
4.1	GENERAL	14
4.2	GASES	14
4.3	LIQUIDS	14
4.4	SHUTDOWNS	14
5.	EMERGENCY ISOLATION AND SHUTDOWN	15
6.	INSPECTION AND TESTING	16
7.	REFERENCES	17

APPENDICES

APPENDIX 1 TYPICAL ARRANGEMENTS OF ANALYSER SAMPLE SYSTEMS	1
APPENDIX 2 EXAMPLES OF SAMPLE TAKE-OFF ASSEMBLIES	1
APPENDIX 3 TYPICAL EXAMPLES OF COMPOSITE SAMPLE TRANSPORT SYSTEMS	1
APPENDIX 4 TYPICAL DETAILS FOR THE ROUTING OF SAMPLE TRANSPORT SYSTEMS ..	1

1. INTRODUCTION

1.1 SCOPE

This PTS specifies requirements and gives recommendations for the design and construction of systems for sample take-off and transport of the sample to on-line process stream analysers. This PTS is a revision of the PTS of the same title and number dated December 2008.

This PTS is one of a series of on-line process stream analysis PTSs. The other publications are:

PTS 32.31.50.11 Sample conditioning

PTS 32.31.50.12 Analysers

PTS 32.31.50.13 Analyser Houses

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by PETRONAS, the distribution of this PTS is confined to companies forming part of PETRONAS or managed by a Group company, and to Contractors nominated by them.

This PTS is intended for use in oil refineries, chemical plants, gas plants, exploration/production and supply/marketing installations. When PTSs are applied, a Management of Change (MOC) process should be implemented. This is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this PTS the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable as regards safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this PTS which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned with the object of obtaining agreement to follow this PTS as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates, and ultimately pays for, the project. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant, authorised to act for the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions and abbreviations

Abbreviation/ Terminology	Definition
Analyser application engineering	The activity of detailing the scope of the analytical measurement and its application
Analyser data sheet	Compilation of technical details as a direct result of analyser application engineering.
Fast loop	Refers to a sample transport system that takes a sample from the process at one point and returns the withdrawn sample back to the process at another point
LNG	Liquified Natural Gas
PEFS	Process Engineering Flow Scheme.
Piping class	An assembly of piping components, suitable for a defined service and design limits, in a piping system. Piping classes for refining and chemicals are contained in PTS 31.38.01.12; piping classes for exploration and production are contained in PTS 31.38.01.15
Process line	The piping used for transport of fluids (other than sample lines).
Sample	A representative portion of the product or process stream having all relevant properties of the product or the process stream itself
Sample conditioning system	One or more devices that properly prepare a portion of the sample from the sample transport system for testing by the process analyser to meet the requirements of the analyser.
Sample line	The tube or pipe used for transporting the sample.
Sample pre-conditioning system	Consists of one or more devices that condition the sample (pressure, temperature, flow, change of state) so that it is suitable to be transported to the sample conditioning system. The sample pre-conditioning system forms part of the sample take-off system.
Sample probe	A device (usually in the form of a special tube) that is inserted into a defined point in the bulk of the process stream to extract a small portion as a sample.
Sample recovery system	A system that collects waste sample and/or by-products from the analyser system for the purpose to either return them to an assigned point of disposal or to a suitable point in the process.

Sample take-off connection	A piping connection for the extraction of the sample from the process line and through which a sample probe may be inserted into the process.
Sample take-off point	The exact location from where the sample is extracted in the process, i.e., the location of either the tip of the sample probe or the pipe wall connection from where the sample fluid leaves the process piping.
Sample take-off system	The system that includes the sample probe and downstream components up to the connection with the sample transport system.
Sample transport system	A system used to transport a sample from the sample takeoff, either to the sample conditioning system (and from there to the analyser) or directly to the analyser, and to return the waste sample, if any is collected, from the sample conditioning system, either to a suitable point in the process or to a suitable utility system.
Sampling system	The complete system that includes the sample take-off, sample transport and sample conditioning systems.
Secondary loop	A circulating loop, part of the sample transport system, which is fitted to reduce the lag time caused by components such as filters, coalescers, etc., and/or to reduce the quantity of a sample entering the analyser house. The secondary loop is part of the sampling conditioning system.
Single line sample transport	Refers to a sample transport system that returns the waste sample to a utility system.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this PTS are made, the referenced section number is shown in brackets. Other documents referenced by this PTS are listed in (7).

2. INSTALLATION OF SAMPLE TAKE-OFF CONNECTIONS, SAMPLE PROBES AND SAMPLE PRE-CONDITIONING SYSTEMS

2.1 LOCATION

The sampling point shall be selected at a point in the process such that:

- the handling of the equipment will not impair the safety of personnel or the plant;
- representative and timely information on the properties or composition of the process stream is obtained;
- it is optimised for accessibility and maintainability;
- lag times of the process are minimised, e.g., whether from sample upstream or downstream of a process vessel, heat exchanger bank, etc.;
- temperature, pressure, or other conditions are as close as possible to the required specification for the analyser.

Particular care should be taken to avoid locations where there is a possibility of contamination, or where pockets of gas/vapour/liquid or hydrocarbon/water/dirt may accumulate in the process stream.

In order to ensure representative sampling, samples should normally be taken from a point where there is no possibility of a two-phase fluid.

Typically, good locations for sample take-off and sample return connections are the discharge and the suction side respectively of pumps or compressors. The sample point location shall be at a minimum of 5 pipe diameters downstream from any flow disturbance, e.g., a 90° bend in the pipe.

The sample take-off and sample return connections should be clearly identified and tagged on site.

2.2 PRE-DESIGN ASPECTS

For each system, it shall be decided separately whether piping or tubing shall be used for sample transport lines. Tubing shall be used unless:

- the required sample volumes to be circulated can not be accommodated;
- lag times become too long due to relatively small sample volumes.

If tubing is used, refer to (3.4.2). Otherwise, piping shall be in accordance with the piping class; see PTS 31.38.01.12 and PTS 31.38.01.15

To avoid excessive distances between the sample take-off point and the analyser, the Contractor shall prepare, during the detailed engineering phase, adequate drawings for the routing of the system, the location of the sample take-off and return points, pre-conditioning system, booster pumps, etc. For typical examples, see (Appendix 4).

NOTE: Heating of sample transport lines shall be independent of process conditions, i.e., the heat of the process piping shall not be used to heat the transport line.

2.3 INSTALLATION OF SAMPLE TAKE-OFF CONNECTIONS AND TRANSPORT LINES

2.3.1 General

Analysers application engineering shall be conducted before decisions are taken on matters covered in this PTS. Sample lines, block valves at sample take-off/return points, booster pumps, emergency valves, etc. shall be identified with the service, e.g., "Sample from top of V-301", "Sample final gas oil to tankage", etc.

2.3.2 Selection of materials

Both the process conditions and the nature of the fluid shall be taken into consideration when selecting materials. Unless otherwise specified, AISI 316 stainless steel should be used for all wetted parts of the sampling system.

NOTE: Stainless steel shall not be used for high chloride water to prevent chloride stress corrosion cracking.

Sample lines in piping shall be in accordance with the piping class. The use of non-metallic materials requires the Principal's approval.

2.3.3 Sample take-off connections

Sample take-off connections shall be installed in accordance with the branch table of the relevant piping class. Taking a sample from a vertical process line is the preferred method. Sample take-off connections for gaseous products in horizontal process lines shall be installed on the top of the lines. Sample take-off connections for liquid products in horizontal process lines shall be installed on the side of the process line. Lap joint DN15 with tube adaptor shall be used for all sample connection to sample take-off probe. For typical examples, see Appendix 2.

2.3.4 Sample shut off valves

Process shut-off valves shall be in accordance with the piping class and should be ball valves.

NOTE: Ball valves have a temperature limit; see the piping class.

2.3.5 Sample transport lines

If the viscosity of the sample is higher than 1 Pa.s at 30 °C, e.g. long residue, the size of the transport line shall be DN 25 minimum to avoid clogging. Bituminous applications typically require short sample lines with a minimum size of DN 50.

Sample lines in piping shall be terminated at the analyser house by a welded flange with a cover flange. Sample lines in tubing are directly connected via a union or tube connector to the corresponding sample conditioning system at the analyser house.

Tubing (also "bundle tubing") shall be supported by a ladder frame or U profile, routed along the structural steel and supported to meet the load requirements. The tubing shall be fastened with stainless steel clips (grade AISI 316). For ladder frames, appropriate clips shall be used.

For sample lines made of tubing, dual ferrule compression fittings shall be used. The number of joints in sample transport lines shall be kept to a minimum. The method of jointing shall permit an unimpeded flow. To enable easy detection of potential sources of leakage, the location of joints in insulated sample transport lines shall be clearly identified on the outside of the insulation.

Steam tracing of long sample transport line should have steam traps at intervals of approximately 50 m to keep the sample line hot and allow the condensate to be drained. Each steam tracing line should end with its own steam trap.

2.3.6 Flushing (fluid) connections

Sample transport lines shall have flushing connections at the sample take-off and at the sample return point for the following services:

- products having a pour point higher than the minimum ambient temperature, in which case flushing oil shall be used as the flushing medium, see (Appendix 3, Figure 3.10);
- products (as specified by the Principal) that are to be prevented from coming into contact with personnel.

The flushing medium inlet connection shall be immediately downstream of the sample take-off point. Block and bleed valves shall be provided if there is a risk of contamination of the process medium.

2.3.7 Sample pre-conditioning system

A booster device shall be installed if insufficient process pressure is available, or if the sample viscosity is too high to achieve the lag times specified in the analyser data sheet. Booster selection is a matter of economics and the booster could typically be a pump, compressor, eductor, etc., see (Appendix 3, Figure 3.3 and 3.7).

Lab sample valve shall be installed on the panel to facilitate manual sample collection.

2.3.8 Cooling and heating

Cooling shall be applied to the sample take-off point, the pre-conditioning system and the sample transport lines if at these points evaporation of the liquid sample may occur at maximum specified ambient conditions. Furthermore, cooling may be applied:

- to improve the separation of liquids by coalescence;
- to control the sample temperature as specified for the analyser or sample conditioning system.

Cooling should be applied either by tap water or chilled water from a closed loop system but never connect to drinking water system to avoid contamination leading to health hazard.

Heat tracing by steam, hot water or electricity shall be applied to the sample take-off point, the pre-conditioning system and the sample transportation lines, if at these points freezing or solidification of a liquid sample or condensation of a gaseous sample may occur at minimum specified ambient conditions. Where Joule-Thomson effect is possible due to pressure reduction, a process phase diagram, indicating dew points, vapour pressures, etc., shall be applied to select appropriate components and parameters to mitigate the effect of sample distortion. For examples of transport line with heat tracing, refer Appendix 3 (Figure 3.8 and 3.9).

The sample temperature should be at least 10 °C higher than the highest possible dew point of the sample. Furthermore, heating may be applied:

- for liquid evaporation, refer to (3.3.3.3);
- to reduce adsorption/desorption effects of trace components by the wetted surfaces of the sampling system, refer to (3.4.2.2);
- to control the sample temperature as specified for the analyser or sample conditioning system.

The choice between electrical and steam trace heating shall be governed primarily by the required heating capacity and secondarily by the minimising of life cycle costs. Electrical trace heating shall be in accordance with PTS 33.68.30.32 Steam heating shall be in accordance with PTS 31.38.30.11

Heating components shall meet the area temperature classification as indicated on the area classification drawings. Systems that may contain free sulphur shall be provided with a method to return any entrained liquid sulphur back to the process at the sample take-off point. The sample line shall be kept as short as possible and at least 10 °C above the dew point of the sulphur at any point along the sample transportation line by means of temperature controlled heat tracing.

The cooling water material used shall be appropriate for the applications, e.g. stainless steel shall not be used for high chloride water to prevent chloride stress corrosion cracking.

2.3.9 Pressure protection

The pressure rating of selected components shall cope with the design conditions.

If the pressure in the system may exceed this condition, pressure relief valves shall be used. For example, heated or heat traced lines that may be blocked in shall be provided with a thermal relief valve. Relief fluids shall either be returned to the process, or to the flare, or to an assigned point of disposal. Disposal of relief fluids to atmosphere at a safe location requires the Principal's approval.

These provisions are normally installed at the analyser house end of the sample transport system, unless they are to protect against excessively high pressures in the process. In that case, the relief valves shall be located at the sample take-off location.

2.3.10 Filtration and condensate knock-out

Condensation or liquid droplets presence in gas sample, which is not suitable for analyzer, shall be removed by the pre-sample conditioning components. This can be achieved by membrane, coalescence filter or kinetic separator.

For samples that contain high slurries, filter with by-pass function should be used on the main stream to divert deposit to waste disposal. Sample to analyser should then be taken from filtered side stream.

Automatic drain filters should be used where appropriate.

2.4 CIVIL ASPECTS

Sample take-off connections and/or sample pre-conditioning systems shall be installed so that they are readily accessible from grade or from permanent platforms.

If a booster pump is required, it shall be installed at ground level on a concrete foundation.

Insulation of sampling components shall be in accordance with PTS 30.46.00.31

2.5 ELECTRICAL ASPECTS

PTS 33.64.10.10 shall apply.

Pumps and compressors shall have a local isolating switch, shall have adequate lighting and shall be provided with weather protection as required for that type of pump or compressor.

Electrical apparatus for use in gas hazardous areas shall have a type of protection as defined in IEC 60079-14. Installation shall be in compliance with local regulations.