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TECHNICAL REPORT

Design and installation of on-line analyser systems – Guide to technical enquiry and bid evaluation

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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INTERNATIONAL
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DESIGN AND INSTALLATION OF ON-LINE ANALYSER SYSTEMS – GUIDE TO TECHNICAL ENQUIRY AND BID EVALUATION

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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IEC Technical report IEC 61832 has been prepared by subcommittee 65B: Measurement and control devices, of IEC technical committee 65: Industrial-process measurement, control and automation.

EEMUA Publication 226 “Design and Installation of On-Line Analyser Systems; A Guide to Technical Enquiry and Bid Evaluation”[1] has served as a basis for the elaboration of this technical report.

This second edition cancels and replaces the first edition published in 1999. This edition constitutes a technical revision.

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This edition includes the following significant technical changes with respect to the previous edition:

a) Foreword: Foreword amended to indicate that this document covers the general principles but specific requirements must be developed for each project;

b) Clause 1: Clarifications added to requirements for documentation and drawings required with bids;

c) Clause *2*: Further information added on technical information required with bids. Additional clauses added to specify training and spares information required with bids. Technical additions and clarifications made throughout to specific sub-clauses detailing technical information required with bids;

d) Clause 3: Additional information and items added on key areas that need to be included in technical bid evaluations. Additional weighting factor added for engineering services;

e) Annex A: Sample Analyser Specification Template replaced by a more comprehensive and detailed example.

This technical report is to be used in conjunction with IEC TR 61831, *On-line analyser systems – Guide to design and installation*.

The text of this standard is based on the following documents:

Enquiry draft	Report on voting
65B/960/DTR	65B/976/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

DESIGN AND INSTALLATION OF ON-LINE ANALYSER SYSTEMS – GUIDE TO TECHNICAL ENQUIRY AND BID EVALUATION

1 Scope

This technical report is intended as a guide to assist in the development of a specification or material requisition for analysers and their associated support systems. It is intended to be used for enquiry purposes and the subsequent assessment of the bids presented by the prospective vendors. The intention is to cover the general principles and items that need to be addressed when purchasing large analyser systems.

This technical report is not intended as a design specification in its own right and design guidance has been deliberately omitted. It is to be read in conjunction with IEC TR 61831, *On-line analyser systems – Guide to design and installation*, which provides further guidance on specific design details which need to be included in the specification or material requisition used for the purchase of analysers and associated systems.

To simplify the specification and bid process it is desirable to have a standard format for both the enquiry documentation and the response from the analyser vendor. This technical report is intended to provide that framework.

Clause 4, 'Scope of supply' lays out the headings and any relevant associated comments for the specification of a complete analyser system. Analyser systems are not all the same and individual requirements for total content will invariably differ. However this technical report is laid out such that individual clauses can be selected or omitted as required. The recommended approach is to include all clause headings and where relevant state as "Not Applicable".

Clause 5, 'Bid technical evaluation' covers procedures for bid assessment and gives suggested points against which bids should be analysed.

2 Normative references

IEC TR 61831:2011, *On-line analyser systems – Guide to design and installation*

3 Preliminary details

3.1 Brief project description

The specification document should contain a brief description of the project associated with the analyser installations including site location, type and number of analyser houses, tag numbers for the proposed houses and analysers, and the major obligations expected of the systems vendor, e.g. design work, manufacture, procurement, testing, transportation to site, commissioning and training.

The analyser and installation may be supplied by the same or separate vendors. The normal preference is for the analyser vendor to also supply the sample conditioning system and housing of the installation as this gives a single point of responsibility. If several analysers are being installed at the same time, the complete installation can be supplied by a specialised analyser systems sub-contractor. See IEC TR 61831, *On-line analyser systems – Guide to design and installation*, for further information on analyser installation design.

3.2 Type of response expected from the vendor

The type of response required of the vendor should be clearly stated, e.g. answer all sections on an individual basis, highlight deviations from the specification with technical reasons for non-compliance and the alternatives proposed.

It should be made clear that any drawings and data presented with the bid should be relevant to that bid. Standard drawings are only acceptable if applicable for the specific application. Typical drawings or examples from other projects are generally unacceptable.

The language in which the bid is to be submitted should be specified.

3.3 Critical criteria on bid rejection

Consistency of response from all vendors is necessary to provide a fair basis for technical comparison of bids.

It should be made clear to the vendor that non-compliance with the requested response format may lead to automatic rejection of the bid.

A high degree of importance should be placed on technical competence in sample system design as this is the area whereby the analyser systems will most likely fail. Typical drawings or examples of past similar applications are generally not sufficient to determine the competence and quality of design being offered for the specific project.

Design for ease of maintenance should also be emphasised as an important aspect in assessing the bids.

4 Scope of supply

4.1 General

This clause covers typical items and technical requirements that should be included in the enquiry document with examples to emphasise the types of clause that should appear and the associated technical and scope considerations. It does not necessarily include the complete set of clauses or technical requirements that may be required for all projects. These need to be developed on a specific project basis.

The final bid enquiry document should contain an itemised list or table identifying all the major hardware assemblies (with tag numbers and quantities as appropriate) and the engineering services (inspection, testing, site acceptance, documentation, training, etc.) that are included within the vendor's scope. This may also be used as the basis for a commercial breakdown of the costs.

4.2 Vendor/client interfaces

Interface points should be clearly defined in terms of site work tie-ins.

Where testing of the analyser installation is required it should be made clear who is responsible for providing any necessary test equipment and test gases/liquids.

The Vendor should make due allowances within the bid for inspection and quality assurance checks by the client/purchaser.

4.3 Procurement responsibilities

It should be made clear whether the systems vendor is to buy in the analysers or if the client will ‘free issue’ them to the vendor for installation.

When analysers are procured by the systems vendor the right for the client to inspect the analysers prior to dispatch to the systems vendor's works should be reserved. The systems vendor is to inform the client when inspections are due.

The client should reserve the right to override any vendor selection of type and make of analyser or pre-specify the required type and model(s) if only specific types are acceptable. This is also applicable to other systems components where specific equipment is preferred or required for consistency with other equipment already used on site.

When analysers are supplied 'free issue' to the systems vendor, this should not free the systems vendor from obligations to ensure the analysers meet performance requirements when installed within the overall system.

4.4 Standards and codes of practice

The specification should call up all codes and standards relevant to the work. A comprehensive list is given in IEC TR 61831. Additionally, there may be some project specific standards and client specific Codes of Practice which should be attached to the enquiry specification.

The systems vendor should acknowledge full conformity to all listed documents (or highlight any deviations) and be prepared to have all such documents available in the event of a dispute.

4.5 Documentation requirements

4.5.1 Quotation stage

The systems vendor is expected to respond to the specification in a systematic manner in order to be fairly assessed. The specification should identify all the drawings and documentation necessary to assess the bid.

4.5.2 Project stage

During the project the systems vendor should supply drawings for comment or approval by the client.

A test program document should be produced by the vendor to the satisfaction of the client/purchaser. This should incorporate all tests for all aspects of the hardware and software of the system. The object of the test program is to ensure that all testing required is identified and performed. The vendor should be required to produce record sheets for each test. The test program shall encompass, but not be limited to, the verification of compliance with each and every clause of this document calling for specific functions and installation of the hardware and software. All testing should be carried out to a pre-arranged schedule.

Completion and comment/approval of sample system design, house layout, electrical distribution, safety system logic and house/analyser system housekeeping logic and control should form a project milestone and, if required, be part of a stage payment scheme.

General assembly drawings are not a necessity for approval, as it is difficult to translate accurately to actual build, but the client should request the right to see these drawings (or insist on the production of such drawings) for comment prior to build. These are important in gaining a guide for ensuring accessibility for maintenance and correct positioning of drains and vents.

4.5.3 Project completion

The specification should require that the analysers and systems will not be accepted until completion and approval of all documentation requested in the specification. A useful mechanism is to include this requirement as a formal stage payment item.

On completion all tests, inspections and non-conformances wherever they are carried out should be documented and included in the hand-over dossier. The vendor should provide necessary documentation with the analyser. The index should be submitted to the company for approval prior to the manual being produced.

Final documentation requirements should be identified and included in the scope of supply, e.g. number of final operating manuals and as-built drawings. The final operating manuals should contain all operating instructions for the analysers and associated systems including specific instruction manuals and technical data sheets for all analysers and major systems components. The format of the final documentation (numbers of hard copies and/or software copies) should also be specified.

4.6 General specification

4.6.1 Environment

The environmental conditions in which the analysers and systems will be installed should be defined.

Information should include temperature extremes, humidity extremes, indication of salinity (e.g. coastal location) and indication of background contaminants (e.g. low levels of H_2S).

For house design and effects on ventilation requirements, information on wind speeds and directions should be given. Typically wind information should include expected gusting ratios, minimum average speeds exceeded 90 % of time and maximum average speeds exceeded 5 % of time.

4.6.2 Hazardous area classification

The area classification relating to where the analysers and systems are to be installed should be defined. Attention should be paid to any possible influence the analyser installation will impose on this classification. For example the area classification may be Zone 2, Gas Group IIB, Temperature Class T2. Installation of analysers utilising Hydrogen services would impose local requirements for Gas Group IIC or IIB + H_2. Installation of analysers working on samples or requiring services with auto ignition temperatures below 300 °C will impose local requirements for raising the Temperature Class to T3 or higher.

The specification should clearly indicate possible area classification differences inside and outside analyser houses.

4.6.3 Equipment certification

When installing houses the area classification within the house will be dependent on ventilation design, whether sources of internal release are normal or abnormal and samples/services associated with the analyser.

Certification of equipment may also depend on the intended application. For example the ventilation and safety system specified may justify a non-hazardous environment within a house in normal conditions. However if equipment is required to operate in the event of ventilation failure it should be specified to meet the potential hazard.

4.6.4 Utility systems

All utility services – steam, water, air, plant nitrogen and electrical – should be identified. Constraints on these services should be clearly highlighted (e.g. maximum pressures, flows, etc.) as the availability and quality of the utilities will impact on the overall analyser system cost. For example, lack of adequate cooling water may necessitate refrigerated cooling systems or inadequate steam supply may necessitate electrical trace heating when steam heating is acceptable, etc.

Utilities also include services required by the analyser to perform the analysis

(e.g. carrier gases, chemicals). These should be clearly identified as to whether available on site for direct connection or whether a facility is required for bottle storage and access for replenishment.

The expected consumption of all utilities should be clearly indicated in the system vendor's bid to allow overall life cycle costs to also be considered in the bid evaluation.

4.6.5 Labelling

Labels are required for identification of components and as warning devices where hazardous materials/conditions exist.

It should be made clear that labelling is an important part of the installation. Labels should be securely fixed to the part they are identifying by screws or rivets. Sticky backed labels should not be used as these invariably peel off and are lost.

Preference should be expressed for engraved labels either in stainless steel or traffolyte. Printed type labels can be very difficult to read after a few years.

Where it is difficult to mount labels (on small valves for example), the labels should be securely attached with stainless steel wire.

4.7 Analyser house specification

4.7.1 Overall layout, size constraints and location

To supplement the description of layout requirements, etc., it is helpful to include a marked-up plot plan and hazardous area drawings with the enquiry.

When asking the vendor to propose the house dimensions any requirements for future analysers and work facilities (work bench, cupboards, etc.) should be clearly given.

Sizing and analyser system layouts should take into consideration accessibility for maintenance and routine system checks without dismantling equipment.

Sizing of analyser housings should also consider future expansion requirements.

A site survey should be carried out to identify the preferred location and any constraints limiting height, width and length and orientation. Layout of external equipment should be determined and quoted to the vendor to give the maximum dimensions to be worked to.

If constraints result in roof mounted equipment being an option then the enquiry should request means of access and appropriate safety railings.

For safety and to reduce the load on house ventilation requirements it is preferable to limit equipment inside the house to the bare minimum. Sample handling cabinets, electrical switch

gear (other than single phase distribution boards for users inside the house) and junction boxes should be mounted on the external house walls.

4.7.2 Construction

Materials (stainless steel, carbon steel, pre-fabricated concrete, GRP, etc.), type of construction (single skin, double skin, etc.) and insulation requirements should be clearly specified.

The method of lifting prefabricated houses should be considered and the preference clearly given, i.e. top lift or bottom lift. Bottom lift requires less structural strength in the house walls but requires spreader arms which could give height access problems when installing on site.

Ventilation air exit louvers at the top of the house to encourage dissipation of gases and floor drainage to remove spillages and facilitate washing down should be clearly specified. It should not be assumed that the systems vendor will automatically provide such facilities.

The specification should alert the systems vendor to the possibility of restrictions in transport and place upon the vendor the responsibility of ensuring the design can be transported with the minimum of effort, i.e. provision of suitable junction boxes or manifolds if equipment needs to be removed, etc.

Painting is an important aspect and site requirements and practices for colour and surface preparation should be clearly defined. Any damage to paint work in transit to site and installation should be made good and be the responsibility of the systems vendor.

4.7.3 Ventilation

The type of ventilation, forced or natural, should be stated.

The main object of the ventilation is to ensure safe dispersion of any hazardous materials released inside the house. The secondary objective is to provide suitable working conditions for both the analysers and the maintenance personnel. It is common to have redundant fans to ensure continued safe operation in the event of a single fan failure.

Ventilation rates should be based around these criteria and sizing methods are given in IEC TR 61831:2011, 3.6 and 3.7.

Care should be taken in choice of fan systems. It is important to specify requirements for electrical certification of fan motors and specify anti-static provisions for fan blades and fan belts (if used).

The source of the ventilation air should be specified as this will reflect on safety requirements for the house. The ventilation air should preferably be ducted from a non-hazardous location if practical.

4.7.4 Air conditioning

Air conditioning can take the form of heating only, heating and cooling, or cooling only. The choice specified depends on geographical location. For hot climates, redundant air conditioning units may be required.

If electric heaters are chosen due note should be taken of hazardous area classification maximum T rating and care should be taken to ensure over-temperatures in the heater cannot occur on ventilation failure.

4.7.5 Power distribution

Power distribution depends on site services available. However it may be simpler and cheaper to specify the systems vendor to provide the power distribution and voltage transformations and run in three-phase power from the site supply. This is typically 400/440 volts, 50 hertz, three-phase supply.

Power distribution responsibilities should be agreed early on in the project, especially where hazardous areas are concerned. It can be difficult and cause significant delays in the delivery if modifications are required when well into the project.

It is advisable to specify spare power distribution points.

Emergency facilities need to be considered and carefully specified.

Earthing requirements should be detailed in the specification.

Cabling requirements should also be detailed in the specification.

Cable support and protection is important. The type of cable ties that are acceptable should be stated. Use of plastic ties and ‘stick-on’ cable supports should be avoided as these deteriorate over a few years.

4.7.6 Safety systems

Safety systems are provided for the protection of the analyser house and personnel in the event of an equipment failure which can or does lead to a hazardous condition in the house. Safety by design and correct choice of equipment is always to be considered the first line of defence, i.e. correct ventilation rates, correct electrical certification and minimisation of potential sources of hazardous material leakage. Provision of safety systems is additional to correct design criteria.

For forced ventilation houses, fan failure trip interlock functions should be provided to isolate non-certified equipment and convenience outlets as non-certified test equipment can be connected to them.

Flammable gas detection should also be provided with independent alarm interlock functions as above. If toxic or inert gases also enter the house, appropriate toxic gas and low oxygen level detectors should also be provided.

Gas detection (flammable and/or toxic) for monitoring air intake systems may be provided if considered necessary. However this requirement should be carefully looked at on the basis of calculation or experience indicating an unacceptable likelihood of gas entering the air inlet system. ‘Nice to have’ should not be a reason for inclusion in the specification.

When specifying gas detection systems due regard should be taken of the nature of the hazardous materials entering the house so that correct location and calibration requirements can be determined

4.7.7 Monitoring and alarm systems

Alarm contacts should normally be designed to be fail-safe, e.g. opening on alarm with de-energise to trip unless other alarm signal validity monitoring techniques are being used in the external alarm system.

If a local panel is to be used for the alarm logic and annunciation it should be recognised that this panel should normally be expected to continue to function during ventilation failure and

detection of a hazardous condition by the gas detectors. Correct hazardous area certification is essential.

Where systems are tied into a control scheme and the analysers are on closed loop control, data valid status signals to the control system should be provided based on the analyser internal self diagnostics alarm if available and any low flow alarms or other important parameter alarms from the sample system.

Critical safety alarms such as gas detection and ventilation failure should be indicated outside the house at the entrance as well as in a continually manned location.

4.7.8 Signal Interfacing with control systems

Interfacing with control systems may be either hard wired or by data links. Liaison with the control system designer should be made to: ensure compatibility; that suitable interfacing facilities are provided; and that responsibility for their provision has been agreed. See also 4.8.8 on signal interface requirements.

4.8 Sample system specifications

4.8.1 Sample probe design and location

The correct design and location of the sample take-off from the process line can be critical to the successful operation of the analyser.

The specification should request correct tagging of the probes and indication of correct orientation in the line.

It is preferable to make the systems vendor responsible for the final design of the probes.

4.8.2 Sample conditioning

The analyser systems vendor should be responsible for the fabrication and supply of the sample conditioning equipment.

The onus on correct design via calculation, material selection and selection of component parts should be with the systems vendor. To assist the vendor the specifier should provide the correct process data and any special sample conditioning requirements such as maximum delay times, venting and draining arrangements, etc.

In specifications of sample systems due regard should be made to isolation arrangements (from process and vent systems), flow limiting of samples into the analyser house and maintenance aspects.

Systems with threaded joints should be given special attention with respect to maintenance disassembly and assembly.

Items requiring regular maintenance such as filters, flow meters, etc. should be provided with suitable drain and/or vent arrangements to assist in safe removal or disassembly.

With systems requiring heat tracing it is preferable to have the sample conditioning system mounted in a heated enclosure. This assists maintenance.

All sample and vent isolation valves and ends of sample lines should be clearly labelled with stream identity and analyser tag number.

4.8.3 Sample transport

Break points between sections and components deemed necessary to conform to pipe specification and the remainder of the sample system should be clearly defined.

4.8.4 Safety (pressure and temperature considerations)

Sample system safety is an important aspect of design.

Relief valves or bursting discs should be provided to protect lower pressure rated equipment downstream of pressure reduction. The relief valve capability should be demonstrable by the systems vendor. Design calculations should be requested in the specification. All components in the system must be suitable for the process design pressure and temperature conditions unless protected by suitable means such as relief valves or temperature cut-out switches. The maximum process design conditions should be specified as well as the normal range of operating conditions.

4.8.5 Analyser validation

Analyser validation systems are provided to allow correct analyser operation to be periodically verified. They also provide the operator with a means to check on the correct functioning of the analyser in time of doubt. These checks can also be fully automated if required. Sample stability in storage needs to be considered.

A decision needs to be made as to whether standard samples are to be bought in or if process samples will be used. This will affect the system design. Traceability of purchased reference standards is important.

If it is not possible to use a standard reference sample, a suitable laboratory sample point should be specified to be part of the analyser system so the analyser can be cross checked against the laboratory.

4.9 Analyser specification

4.9.1 Description, tag numbers and control

In this section the description of the analyser, where it is to be located and tag numbers should be given. If the analyser has a separate control unit the location and cabling distances should also be provided.

4.9.2 Systems vendor responsibilities

If the analysers are part of a system being provided by a systems vendor then it should be the responsibility of the systems vendor to handle the ordering, procurement and installation. Procuring and supplying to the systems vendor as free issue should be avoided as this can cause difficulties over responsibilities when the system is finally installed on site unless such responsibilities are made clear at the specification stage.

Clear lines of communication should be defined between the vendor and the client with the systems vendor responsible for keeping the client informed of procurement progress and any pre-delivery inspections. The client should request the opportunity to attend these inspections.

4.9.3 Data sheets

Data sheets giving process conditions, analysis requirements, signal outputs, tag numbers, etc. should be provided with the specification.

In the simple case of buying the analyser only direct from the analyser vendor it can be sufficient to use the data sheet as a complete specification of requirements. Such a data sheet would have to be more comprehensive to include for certification requirements, power supply information, etc.

An example of a sample analyser specification template is given in Clause 5.

4.9.4 Analyser certification

The analyser should be electrically certified for the location into which it will be installed. Every effort should be made to ensure compliance with safety in hazardous area applications, e.g. correct certification and conformance with standards.

4.9.5 Analyser performance requirements

Analyser performance requirements should be specified. These may include reliability, accuracy, stability and repeatability.

Performance should generally be within the requirements of the particular analysis with due regard for the reference measurements to be employed in assessing this performance.

4.9.6 Materials of construction

The specifier should ensure that the analyser vendor is aware of all materials likely to be in contact with the analyser. This should include trace components in the sample stream and any corrosive components likely to be present in the atmosphere.

4.9.7 Signal interface requirements

Interfacing with control systems may be hard wired or by data links.

All required signals (analogue and digital) need to be specified. This should include any control signals (e.g. validation system controls and indication) associated with the analyser system.

Care should be taken to ensure that analyser signals are synchronised with the control system especially when using validation systems. Cyclic analysers need to inform the control system when fresh data is available.

Signal interfacing can be between analyser and control system, analyser and alarm annunciator, analyser and safety systems, as well as analyser and sample system/utilities components.

4.10 Inspection and testing

4.10.1 Analysers at analyser vendor's works

Prior to delivery of analysers to the systems vendor or the client, it is advisable to witness certain performance tests. All functions should be checked and the analyser subjected to zero and span drift testing (8 hours minimum, 24 hours preferred).

It is not necessary to carry out comprehensive calibration checks at this stage. The specification to the systems vendor should make clear the inspection requirements.

The specifier should reserve the right to accompany the systems vendor inspector on the final pre-delivery inspection at the analyser vendor’s works. The client/purchaser reserves the right to make troubleshooting visits.

4.10.2 Analysers and systems at systems vendor’s works

Complete checking of the system is required including performance of the analysers. Inspection and testing will require certain consumables such as utilities and test fluids.

The analysers should be tested with the sample systems where possible. Pressure and containment testing should be performed. Calibration checks should also be performed.

The specification should make clear the requirements for testing and calibration materials and who will be responsible for supplying these items.

The vendor should provide factory acceptance tests in its works of all their equipment, and relevant sub-systems and equipment to the satisfaction of the purchaser.

The vendor should be responsible for complete and detailed inspection of all materials, instruments and components of the analyser system. The purchaser should inspect and/or accept all sample systems and analysers before they are shipped unless agreed otherwise by the company’s responsible engineer.

The client and/or purchaser may inspect equipment and system assemblies during the course of fabrication at their discretion with a minimum of 24 hours' notice. A vendor representative should accompany the client and/or purchaser at the supplier facilities. The latest drawings and bills of material of the items should be available to the purchaser's inspector at the time of inspection.

Upon completion of fabrication and assembly, all systems should be thoroughly tested including analyser performance, point wiring continuity check of any electrical components/junction boxes and piping/tubing leak test. These tests should be completed prior to shipment to the client.

Factory acceptance testing should include but not be limited to:

- A visual inspection of the analyser and systems.
- All items supplied by the vendor should be checked against the final approved drawings.
- All dimensions should be checked against final approved drawings.
- Operation of the analyser(s).
- Calibration check of the analyser(s) and repeatability runs.
- Functional check of all hardware and software of the system.
- Operation of certification safety systems, i.e. purge system.
- All alarms or alarm functions, safety systems, and other devices required should be demonstrated for proper function.
- All analyser and sample systems components, tubing and utility piping should be pressurized and leak tested to 1,5 times working pressure.
- Functional testing of sample system operation; including but not limited to pressure reduction, valve switching and heating systems.
- Functional testing and documentation of local analyser communication network, Ethernet links and simulation of configuration to client’s communication package.
- Functional testing of configuration of analyser and sample system ranges and I/O.

All inspections and testing should be documented in writing by the vendor and submitted to the purchaser for approval. Shipment cannot be made without written approval from the purchaser. All costs associated with inspection and customer witness testing should be included in the vendor’s quoted price for the sample system.

Where items fail during testing then a non-conformance report should be produced.

All tests carried out should be carried out by the vendor's qualified personnel at the vendor's site.

4.10.3 Commissioning and site acceptance tests

The Process Analyser Supplier should provide a Start-Up Service Proposal to include a competent Applications Engineer for review of the installation, to supervise calibration and provide initial plant-site start-up. The proposal should state terms of this service. The person should be competent, familiar with project requirements and experienced in trouble shooting, diagnosing the problems and bringing the analyser on line.

All tests should be documented. The vendor should be responsible for powering up the system and demonstrating that the system is configured correctly and communicates with the DCS. These tests should be documented by the vendor.

4.11 Training requirements

Any training that is required to be provided by the vendor should be included in the scope of the enquiry document. This can be classroom training and/or hands-on training during factory acceptance and site commissioning.

The analyser vendors should provide the specific training on the individual analysers themselves rather than the overall systems vendors as they are more knowledgeable on their own equipment. This individual analyser training should be included as part of the analyser purchase if the analysers are being purchased by the overall systems vendor. Alternatively this training may be purchased separately directly from the analyser manufacturers by the end user.

Any specific training required for the associated analyser systems (shelter, HVAC sample conditioning, etc.) should be provided by the systems vendor.

4.12 Spare parts requirements

The systems vendor should provide an itemised start-up spares list including all consumables for all the analysers and associated systems which should be included in the overall initial project scope.

The vendor should also provide a priced itemised list of consumable and recommended critical spares to be held on site covering a two year operational period. These may be purchased as part of the initial project scope or purchased separately by the end user.

5 Bid technical evaluation

5.1 Object

The object of this clause is to lay out the procedure for fair and consistent technical evaluation of the responses made by the systems vendors to the enquiry document.

The filtering procedure outlined below assumes that prospective system vendors have already been assessed financially and have the capacity (organisation, space and manpower) to implement the required work.

The full enquiry package should only be issued to a maximum of three prospective systems vendors to keep evaluation work within reasonable limits. As well as the normal financial and capacity screening above, it may be useful to send out a technical screening questionnaire to confirm experience with specific types of analysers, applications and other associated

equipment required for the project plus capability and plans to provide local site services. This can be sent to 4 to 6 prospective vendors and used to identify the three most appropriate vendors who will be asked to make a full bid.

5.2 Correct response to the bid

The system vendors should respond to the enquiry in a consistent manner.

The bid should be on a section-by-section basis against the enquiry. For each section, the vendor is asked to state compliance. Vendors should be requested to offer options where they think this will result in cost savings to the project. However, they must give costs for both complying fully with the specification and the options so the end user can make the final decision on whether to accept the options or not.

The bid documentation should include tables or spreadsheets identifying the individual equipment items included in the scope including site installation and commissioning services as well as documentation, warranty and training requirements to allow the vendors to do this and to add any other technical comments, information or options. The same tables/spreadsheets can also be used to provide the commercial breakdown of the costs.

For complex systems or where there is a significant amount of retrofit work to existing equipment, it is recommended to hold meetings with the final selected prospective vendors at site prior to the submission of the final bids. This is to ensure the scope is fully understood and to respond to any technical questions (to avoid recycle during the final bid conditioning phase).

5.3 Technical excellence

The bids should be judged on technical content only and assessed on degree of compliance with the client's requirements.

Bids simply responding with a general affirmative to all clauses and offering typical sample system schematics and house layouts should be rejected on the grounds of not complying with the specification.

Technical comparisons should be made on the basis of scoring against key items which should be weighted according to relative importance to the successful design and operation of the analyser system.

5.4 Comparative testing

5.4.1 Allowance for technical interpretation

It is likely that different vendors will place different interpretations on the specification.

The bids should be reviewed carefully to ensure what is being offered will meet the overall requirement in a functional and safe manner.

5.4.2 Assigning key areas

The specification should be split into key areas as applicable, for example:

Item	Area
1	Overall bid quality and understanding
2	Sample system designs
3	House design
4	Layout for maintenance access
5	Utilities
6	Ventilation
7	Power distribution
8	Safety Systems
9	Analysers offered
10	Delivery and project schedule (project management)
11	Engineering services

Based on the highest scores, the lead bids can be short listed and the key items should be judged on a scale of 1 to 5 as follows:

1 = Item omitted.

2 = Item not meeting requirements.

3 = Item needs minor additions to meet requirements.

4 = Item fully meets requirements.

5 = Item exceeds requirements.

Items scoring 5 will flag possible reductions in costs at the bid qualification meetings.

Depending on the scope of the specific project other key areas that may need to be included are: project management and vendor resources (for larger projects where vendors resources may be limited); quality of documentation; software and network architecture (if an analyser communications network is within the scope of the project).

5.4.3 Weighting functions

The key items should be given weighting numbers depending on relative importance in the overall safe and functional design of the system.

Weighting should be applied on a scale of 1 to 10 which will be used for multiplication of the score on the corresponding key item.

After assigning the weighting and totalising the scores, a normalising number is to be determined to allow a final assessment score based on 0 to 100 % of a maximum score equating to the bid meeting requirements (score of 4 for each item). This may result in a score of over 100 % if the bid exceeds requirements in most or all of the key items. This will help to flag areas for negotiation at subsequent bid qualification meetings.

The weighting numbers should be determined by the client before bids are received. For example:

Item	Area	Weighting
1	Overall bid quality and understanding	5,0
2	Sample system designs	10,0
3	House design	4,0
4	Layout for maintenance access	6,0
5	Utilities	1,0
6	Ventilation	5,0
7	Power Distribution	2,0
8	Safety Systems	9,0
9	Analysers offered	6,0
10	Delivery and Project Schedule (project management)	7,0
11	Engineering services	7,0
	TOTAL	62,0

Normalised number = 100/(62 × 4) = 0,4032

The final score will therefore be the sum of (the score × weighting factor of the key items) × normalising number.

Based on the highest three scores the bids can be short listed and more detailed technical assessments can be initiated if required.

Prior to this final step the costs should also now be taken into account and justifications drawn up for dismissing any financially attractive vendor with poor technical scoring. The above filtering methods if agreed prior to bids being received should provide the necessary reasons for justifying the decision.

5.5 Bid qualification meetings

The final stage in selection of the vendor for placing the contract involves bid qualification meetings.

The short listed vendors should be invited to discuss the bids technically to ensure that there is full understanding of the requirements and to clear up any minor design points.

Where non-compliances are concerned these can be discussed in detail.

This meeting should also be used for discussion of the vendor’s project organisation and schedule.

The meetings should be attended on the vendors’ part by the proposed project leader and the design engineer responsible for the technical input into the quote.

After these meetings the vendors concerned should all now have their bids in-line with each other on a technical basis and should be in a position to revert with updated bids reflecting any cost implications.

5.6 Reassessment of comparative testing

The re-quotes should be subjected to a further comparative test. There should now be no need for further technical assessment and the key items will now be cost, delivery, back-up/after sales service capability and other non-technical criteria.

For cost and delivery, scoring should be on a scale of 1 to 5 as follows:

1) 20 % or more over budget estimate
2) 10 % to 20 % over budget estimate
3) Within 10 % of budget estimate
4) 10 % to 20 % below budget estimate
5) 20 % or more below budget estimate

For remaining criteria, scoring should be on a scale of 1 to 3 as follows:

1 = Unacceptable

2 = Acceptable with reservations

3 = Totally acceptable

Weighting will depend on relative importance of the test criteria on a scale of 1 to 3 as follows:

1 = Least important

2 = Important

3 = Very important.

Weighting factors will be used for multiplication of the respective key item score.

Weighting factors should be determined prior to receipt of final bids.

Based on the sum of weighted key item scores a final selection can be made.

6 Sample analyser specification template

Analyser Specification sheet					Rev:
Functional Location:					
Analyser Service:					
Justification of Analyser Measurement					
Reason of Measurement	Yes/No		Reason of Measurement	Yes/No	
Client			Trending		
Legalisation			Monitoring		
Product quality			Control		
Energy efficiency			Alarm		
Environmental			Trip		
Safety					
Analyser Utilities and Specials					
	Yes/No	Specification	Power supply	Voltage	Essential	Vital
Instrument air			Analyser detector			
Purge gas			Analyser controller			
Plant Nitrogen			Conditioning system			
Steam: low / medium / high pressure			Sample pumps			
Carrier gases / specification			Other			
Calibration gases / specification						
Calibration liquids / specification						
Relief Valve fitted		RV Tag No:				
Operating Conditions					
Medium		Min	Norm	Max	Analyser operating window/ limitations
Medium Phase (Liquid/Gas/Mixed)					
Operating pressure barg					
Vapour pressure					
Operating Temperature °C					
Ambient Temperature °C					
Density kg/m^3					
Viscosity cP/cst					
Pressure @ fastloop return barg					
Pressure @ analyser return barg					
Molecular mass					
Dew point °C					
Cloud point °C					
Pour point °C					
Initial Boiling point °C					
Final Boiling point °C					
Colour ASTM					
Particle size µm					
Water content					
%Solids/%Liquid/%gas					

Analyser Performance										
	Component 1		Component 2		Component 3		Component 4		Component 5	
Tag Number										
Component measured										
	Actual	Req'd	Actual	Req'd	Actual	Req'd	Actual	Req'd	Actual	Req'd
Component Range										
Engineering Units										
Accuracy										
Repeatability										
Reproducibility										
Control Limits										
Availability										
Response Time										
Measurement Method										

Process Composition				
Measured stream components	Concentration at normal condition	Concentration at maximum condition	Engineering Units	Remarks

Non-Measured stream components	Concentration at normal condition	Concentration at maximum condition	Engineering Units	Remarks

Location of measuring system / parts			
	Remarks		Remarks
Sample take-off point		Sample conditioning system	
Fast loop return		Analyser / measuring cell	
Analyser return		Analyser / controller	
Sample recovery system		Other	
Sample pre conditioning system			

Area Classification				
	Zone	Gas Group	Temp. Class	Actual Equipment Certification
Analyser House				
Analyser House conditioning				
Field				

Analyser Information			
Manufacturer			
Model			
Type			

Maintenance Requirements			
Activity	Frequency	Maint. Duration – Hours	Remarks
QA calibration check			
Filter changes			
Sample system checks			
Cylinder changes			
Reagent replacement			
Sensing Tape changes			
Oil changes			
Decoke			
Safeguarding checks			

Analyser Spares			
	Main Stores Yes/No	Local stores Yes/No	Remarks
Extensive spares			
Limited spares			

Analyser Obsolescence			
Year of Installation		Date of Obsolescence	
Remarks			
Key History / Learning Events			
Technician Competency			

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

3, rue de Varembé
PO Box 131
CH-1211 Geneva 20
Switzerland

Tel: + 41 22 919 02 11
Fax: + 41 22 919 03 00
info@iec.ch
www.iec.ch