TECHNICAL SPECIFICATION

INSTRUMENTATION DOCUMENTS AND DRAWINGS

DEP 32.31.00.34-Gen.

December 1995
(DEP Circular 39/99 has been incorporated)

DESIGN AND ENGINEERING PRACTICE

PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of:

Shell International Oil Products B.V. (SIOP)
and
Shell International Exploration and Production B.V. (SIEP)
and
Shell International Chemicals B.V. (SIC)

The Hague, The Netherlands,

and other Service Companies.

They are based on the experience acquired during their involvement with the design, construction, operation and maintenance of processing units and facilities, and they are supplemented with the experience of Group Operating companies. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good design and engineering practice applied by Group companies operating an oil refinery, gas handling installation, chemical plant, oil and gas production facility, or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual operating companies to adapt the information set forth in DEPs to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use DEPs they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will expect them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the DEPs. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal or its technical advisor.

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All administrative queries should be directed to the DEP Administrator in SIOP.

NOTE: In addition to DEP publications there are Standard Specifications and Draft DEPs for Development (DDDs). DDDs generally introduce new procedures or techniques that will probably need updating as further experience develops during their use. The above requirements for distribution and use of DEPs are also applicable to Standard Specifications and DDDs. Standard Specifications and DDDs will gradually be replaced by DEPs.

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1. INTRODUCTION

1.1 GENERAL

This DEP specifies requirements and gives recommendations for instrumentation documents and drawings prepared or completed during the basic design and detailed engineering stages of a project.

The requirements for as-built documents and drawings in the construction or commissioning phases and during the life-time of the plant are given in Appendix 1.

This is a revision of an earlier DEP of the same number dated December 1987. In this revision, software-based electronic design tools and the standardisation of exchange of electronic documents and drawings have been given extra attention.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by SIOP and SIEP, the distribution of this DEP is confined to companies forming part of or managed by the Royal Dutch/Shell Group. It may be distributed to Manufacturers/Suppliers nominated by them (i.e. the distribution code is "F", as defined in DEP 00.00.05.05-Gen.).

This DEP is intended for use in oil refineries, chemical plants, gas plants and, where applicable, in exploration and production facilities and supply/marketing installations.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this DEP, 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, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this document 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 document as closely as possible.

1.3 DEFINITIONS

1.3.1 General Definitions

The **Contractor** is the party which 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 which manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party which initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific Definitions

Distributed Control System

A configurable microprocessor based control system

Instrumented Protective System

The (electrical and/or electronic and or programmable electronic) logic solver component of the Instrumented Protective Function complete with input and output equipment.

1.4 ABBREVIATIONS

CCTV	Closed circuit television
CR	Control room
CRAR	Control room (Auxiliary room)
DCS	Distributed Control System
EPC	Engineering, Procurement and Construction contract
IPS	Instrumented Protective System
MDF	Main Distribution Frame
MESC	Materials and Equipment Standards and Code
MIS	Management Information System
MTBF	Mean time between failure
MTTR	Mean time to repair
SPIR	Spare Parts and Interchangeability Record

1.5 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets. Other documents referenced by this DEP are listed in (4).

2. GENERAL REQUIREMENTS

2.1 GENERAL

A set of instrumentation documents and drawings shall be prepared for each project, which shall include those specified in this DEP.

These documents and drawings shall be issued such that sufficient time is allowed for activities such as instrument design and engineering, purchasing and installation, taking into account the procedures and the time required for review and comment by the Principal.

The content of each document or drawing shall be such that it will allow other activities; purchasing and installation of all instrumentation at the construction site and serve as a reference for future maintenance, changes and/or extension to the instrumentation.

The content of documents and drawings, the number of copies required, the need for additional documents and the procedures for commenting and/or approval, shall be in accordance with requirements which will be stated by the Principal.

Commercially available instrumentation electronic design and drawing (software) tools, shall be used for document and drawing production by the Contractor; however, for exchangeability reasons, approval from the Principal is required on the use of the specific software format.

Self-documenting facilities in DCS and IPS should be used to their fullest capabilities.

2.1.1 Software formats

All documents produced in an electronic form shall be in accordance with Memorandum MFT 168/93.

Generally accepted software formats are:

- "IN"/"INTools" Package (supplied by PID and Software Industries, Belgium, for all instrument drawings, schedules, data sheets, requisitions, hook-ups, in conjunction with:
- AUTOCAD (version 11 or later) for drawings not available in "IN"/"INTools"
- Word for Windows, for all word processing including narrative descriptions.

The compatibility with computer equipment used on site should be verified by the Principal. If not compatible, the required computer equipment should be included in the scope of the project.

All parts and sections of any form, sheet or other document which requires filling in shall be completed. Where a particular part of any document is not applicable it shall be so indicated.

All Instrumentation drawings and documents shall be issued for comments and/or approval to the Instrument design engineer of the Principal.

2.2 IDENTIFICATION

All documents and drawings shall be provided with a registration number from the series of numbers allocated to the project, together with a code number for classification and identification. The code number shall consist of a prefix, project number, group number and a symbol see (4). For further information, refer to DEP 40.10.01.11-Gen.

NOTE: Documents and drawings prepared for a specific indent shall also bear the relevant complete indent number.

All documents and drawings shall bear proper references to related documents, construction drawings, and indent numbers for the materials required. The documents and drawings shall bear the titles as indicated in this publication. In addition, all instrument related layout drawings of control rooms, auxiliary rooms and analyser houses, shall indicate the building and room number as appropriate. Where multi-sheet drawings (2.4) consist of a large number of sheets, revisions can be for each sheet. For each revision, the

cover sheet and the revision index sheet shall be re-issued together with the revised sheets. All the revised sheets shall bear the same revision letter irrespective of the last revision letter on the individual sheets, i.e. all revised sheets shall bear the same revision indicator as the cover sheet.

For multi-sheet drawings where signatures are applied for approval or checking, these shall be indicated on the cover sheet only. Where a full title block is applied this shall be used on the cover sheet only. Continuation sheets shall be sufficiently titled to link them clearly to the cover sheet and include project title, drawing title, project, drawing number and sheet number.

2.3 DRAFTING TECHNIQUES

The drafting techniques, drawing sizes, preparation and, where applicable, microfilming of technical drawings shall be in accordance with DEP 02.00.00.10-Gen.

Drawings should be on A4 sized sheets. The basic format of each type of document produced by the Contractor shall be submitted for review by the Principal prior to large scale application.

NOTE: Many drawings can be quite readily prepared using a word processor. This allows very easy updating and manipulation and is accepted.

However, the contractor may include larger drawing sizes where they would be beneficial, taking the ultimate use for the document into account, e.g. for on-site, day-to-day maintenance.

The following order of preference shall then apply:

- A3
- A3 height (297 mm) x A2 length (594 mm)
- A2
- A1

Drawing size A0 shall not be used for instrument documents and drawings. Special attention shall be paid by the contractor to ensure a consistent drawing and documentation package, particularly for those documents which are associated with equipment package units, (2.8). Copies of drawings issued for comments or information shall have a maximum size of A3. Where the size of a standard form is A3, consideration should be given to reducing by copying to A4 size before dispatch. Drafting techniques should then take into account clear readability of the reduced format.

Where it is anticipated that computer printouts will be employed, the use line plotters or laser printers is preferred. The use of dot matrix printers is subject to approval by the Principal.

For the mechanical, instrument and electrical symbols and identification systems to be used on drawings, refer to the following

Amended per Circular 39/99

Mechanical	:	DEP 31.10.03.10-Gen.
Instrument	:	DEP 32.10.03.10-Gen.
Electrical	:	IEC 617 and Standard Drawing S 64.000

2.4 MULTI-SHEET DRAWINGS

Certain documents shall be made in the format of a drawing with a large number of sheets, consisting typically of:

- a cover sheet
- index to sheets, giving the applicable revision indicator of the sheets contained in the set
- listing of symbols and abbreviations used
- detail sheets (as indicated on the index sheet) giving the required information

- listing of the tag numbers with reference to the relevant sheets.

NOTE: For a typical example, refer to the multi-sheet drawing for instrument impulse lines given in DEP 32.37.10.11-Gen.

Efficiency is improved if extensive use is made of word processing for such documents.

For multi-sheet drawings, only A3 and A4 sizes shall be used. To facilitate reproduction and filing preference is given to the use of A4 size, and A3 documents shall not be intermixed with A4 documents.

All sheets of a multi-sheet drawing shall have the same size; mixing of A3 and A4 sizes in one multi-sheet drawing set is not allowed.

Where the subject cannot be arranged entirely on one sheet, as may be the case with logic diagrams, relay diagrams or instrument loop diagrams, the subject shall be continued on the following sheet(s) with proper cross-references at the demarcation points. The arrangement shall then be such that a continuous presentation of the subject is formed when the separate sheets are laid side by side.

2.5 CONSTRUCTION DRAWINGS

Where constructional details are required to ensure the proper supply of instrumentation equipment, such details shall be shown on a separate construction drawing, to which references shall be made in the requisition.

For standard equipment, such drawings are available in Standard Drawing Groups S 31 to S 37 inclusive.

Where these standard drawings are used in an unmodified form they can be used by referring to their S number, revision indicator and title. However, if for a particular application deviations from the standard drawing are necessary, the Contractor shall prepare an engineering drawing based on the standard drawing. Under no circumstances shall a standard drawing be issued in a modified form.

For non-standard equipment, dedicated engineering drawings shall be prepared showing details and all requirements.

2.6 TECHNICAL SPECIFICATIONS

Where comprehensive descriptions, arrangement drawings and/or construction details are necessary for ensuring the proper supply of equipment, these requirements shall take the form of a technical specification, to which references shall be made in the requisition.

For certain standard equipment, these specifications are available as a DEP publication (e.g. for control valves, system cabling, system cabinets) or MESC specifications (e.g. for transmitters, pressure gauges); where this is not the case a dedicated technical specification shall be prepared in the form of a multi-sheet drawing.

The format of such technical specification shall be based on the lay-out as specified in Appendix 2.

2.7 MANUFACTURER'S DRAWINGS

Drawings received from Manufacturers shall be identified as engineering drawings, see (2.2), and where applicable commented upon and incorporated into the detailed engineering stage of the project.

Manufacturer's drawings shall be fully integrated into the overall project documentation package and incorporated into a dedicated Instrument Summary, see (3.2.1.1).

Manufacturers drawings should be produced in a software format (see 2.1), in addition to any hard copies requested.

Standard Manufacturer's manuals/bulletins shall indicate or delete inapplicable items and details, and highlight those which are applicable by underlining, arrowing or similar.

NOTE: Where applicable, the above requirements shall be clearly stated under Documentation in each

instrument equipment requisition.

Manufacturer's drawings shall only be used to assist in the production of a comprehensive installation drawing package and shall not form a part of the installation package.

2.8 EQUIPMENT PACKAGE DRAWINGS

Drawings of an equipment package shall be identified in accordance with (2.2). The drawings shall be commented upon and incorporated into the detailed engineering stage of the project.

The drawings of an equipment package shall be arranged in separate sets for each equipment package unit.

For details, refer to DEP 32.31.09.31-Gen.

3. THE PREPARATION OF INSTRUMENTATION DOCUMENTS AND DRAWINGS

3.1 GENERAL

The following sub-sections indicate the type of documents and drawings generally applied and give guidance on how they should be prepared.

The sections are divided into the Instrument Group Code Numbers which are applied for administration purposes, and further into the various types of documents and drawings in general use included in these instrument groups.

3.2 GENERAL INSTRUMENTATION - GROUP 30

3.2.1 Summaries

3.2.1.1 Summaries of instrumentation documents and drawings

The summary consists of an index sheet for listing engineering drawings and separate sheets for manufacturer's drawings.

The first issue shall be prepared within two months after award of the contract and shall contain, in numerical order, listings of all instrumentation documents and engineering drawings, complete with the planned dates for the first issue indicated in the relevant columns.

Revisions of the summary shall be issued monthly in updated form and containing all known information.

NOTE: This document, together with the summary of instrument requisitions (3.2.1.2), will form the basis for progress assessment and reporting.

Each revision issued shall contain a complete set of sheets including any non-revised sheet(s). The revision indicator used on the index sheet shall also be used on the attached summary sheets and in the Issue column of each revised item, irrespective of any previous revision indicator(s).

The revision shall include manufacturer's drawings as soon as these have been received.

The use of a database to generate summaries is recommended.

NOTE: The List of Selected Instrument Equipment (Instrument Standard Form DEP 05.00.54.40-Gen.) made by the Principal and which forms part of the Project Specification, shall be included in Group 30.

3.2.1.2 Summary of instrumentation requisitions

This summary consists of an index based on Sheet 1 and a list(s) of requisitions for each group of instruments. Sheet 2 of the Instrument Standard Form (DEP 05.00.54.89-Gen.) gives the headings and content of such a summary, although the sheet does not have to be used as it is the information rather than layout that is important.

The first issue shall be prepared within 2 months after award of the contract and shall contain, in numerical order, a listing of all instrumentation requisitions, complete with the planned dates for the first issue indicated in the relevant columns.

Revisions of the summary shall be issued monthly in updated form and containing all known information.

Each revision issued shall contain a complete set of sheets including any non-revised sheet(s). The revision indicator used for the index sheet shall also be used on the attached summary sheets and in the Issue column of each revised item, irrespective of any previous revision indicators.

3.2.1.3 Instrument engineering data sheets

For each processing unit and/or major equipment package unit in the project, the design and engineering information for the instrumentation shall be listed on Standard Instrument Engineering Data Sheets as contained in the Requisitioning Binder (DEP 30.10.01.10-Gen.).

All instrument engineering data sheets shall be prepared in a software format (see 2.1.1); however, content rather than layout is important. Use of a database is recommended.

It should be recognised that the data sheet instrument database contains information used for project implementation but will later remain a key facility document for maintenance. The Principal may require additional database fields to be added and filled in to suit subsequent later maintenance purposes.

Deviation from the standard printed data sheet lay-out is sometimes required when using computerised design tools; however, this requires approval from the Principal.

The left hand part of these data sheets (including the column Component Listing) shall be completed during the Project Specification stage of a project. For this reason the sheets will eventually form part of the design book DEP 01.00.02.11-Gen.

NOTES: 1) The actual operating data for the processing unit and/or major equipment package unit shall be entered on the instrument engineering data sheets. However, the values given for minimum/normal/maximum of flow/level/pressure/temperature shall take into account the turn-down requirements and the operating/design limits of the processing and equipment package unit.

2) In addition to the instrumentation data entered by the process engineers, all other instrumentation data, such as for utilities, shall be included in the data sheets.

The tag numbers on the printed sheets shall be in numerical sequence, see (4) of DEP 32.10.03.10-Gen. The printed right-hand column shall comprise tag numbers in numerical sequence, the related process engineering (or utility) flow scheme (PEFS) drawing number, and the location co-ordinates of the instrument concerned on the PEFS.

If data has been revised the revision letter shall be placed in the left-hand column.

Data for each process unit and for each major equipment package shall be made up into separate sets and each set shall be supplied with a dedicated printed cover sheet. The set(s) of printed sheets of equipment package(s) shall be combined with and immediately follow the set of printed sheets for its associated process unit. However, the printed cover sheets from each set shall be placed at the front and the combined set shall be numbered accordingly.

Tag numbers for a package unit shall be given in sequence and in a group.

Each set of instrument engineering data sheets shall have a document/drawing number. When more than one processing unit and/or major package unit are involved in the project, a group of consecutive document/drawing numbers shall used for the various sets of data sheets and, if a database is not used, sufficient spare sheets shall be allowed.

The first issue shall be prepared at an early stage of the Project Specification phase and shall specify the components for each instrument loop, with all additional information available at that time. During the detailed engineering period the instrument engineering data shall be further completed with engineering and purchasing data.

Printed revisions of the instrument engineering data sheets shall be issued every two months in updated form and containing all known information.

Each revision issued shall consist of a revised cover and index sheet with attached data sheet(s). The revision indicator used for the index sheet shall also be used on the cover sheet, the attached data sheets and in the left-hand column of each revised line, irrespective of any previous revision indicator(s).

The sequence of the data sheets as an engineering document and their numbering shall be as indicated on the cover sheet. The cover sheet shall list all the sheets and give the latest revision letter.

3.2.1.4 Composite instrument manuals

Composite instrument manuals shall be compiled as follows, but not necessarily limited to the examples given:

- For all in-line instruments such as control valves, positive displacement/turbine meters including accessories, level displacer instruments.
- Equipment packages (including skid mounted units)
- Distributed control systems (DCS)
- Tank gauging, blending, and other Instrument subsystems.
- On-line process stream analysers and sample systems.
- Safeguarding systems(IPF)

- PLC systems
- Process control and logic control systems

The Composite instrument manuals shall incorporate all manufacturer's documents for the instrumentation designed/ordered against a particular indent.

Manuals, including the documentation of equipment ordered against more than one indent, shall be listed in Group 30.

The documentation covering equipment ordered against one particular indent shall be identified by that requisition/indent number.

Composite instrument manuals shall be based on the following structure of chapters:

1. Introduction

   This chapter shall introduce the subject and list a table of contents for each chapter.

2. Drawings and similar documents

   Subdivided as follows:

   - Requisitions
   - Manufacturer's drawings such as:
     - general arrangement
     - construction
     - design calculations
     - wiring diagrams
     - logic diagrams
     - welding and repair procedures.

3. Test and inspection documents

   Subdivided as follows:

   A. Inspection plan
      - Inspection report
      - Hydrostatic test certificates
      - Special procedures such as:
        - X-ray and other weld tests
        - heat treatment.
      - Special reports such as:
        - seat leakage test
        - capacity test
        - low temperature test
        - vacuum test.

   B. Material certificates
      - Compliance with NACE MR0175
      - Certificate of origin
      - Statement of compliance
      - Electrical safety Type of Protection certificate or declaration
      - Calibration reports
      - Performance test reports.

   C. Acceptance report/release note
      - Non-conformance report

4. Spare parts documents

   Containing:
   - Manufacturer's recommended spare parts list
   - SPIR forms

5. Operating and similar documents

   Containing:

- Installation instructions/procedures
- Operating instructions
- Maintenance/calibration instructions
- Trouble-shooting procedures
- Special tool requirements
- Wiring and circuit diagrams for printed circuit boards.

The composite instrument manual, and in particular Chapter (5), shall contain only those documents which refer to the equipment ordered against the indent. General manufacturer's product information shall not form part of this manual.

Composite instrument manuals shall be checked for completeness by the contractor before despatch to site.

NOTES: 1. The requirements for composite instrument manuals, the structure of chapters and the above descriptions shall be clearly stated, where applicable, under the heading Documentation on each instrument equipment requisition.

2. If information is provided in electronic form (e.g. floppy or CD-ROM) this shall be included in the manual.

3.2.2 Diagrams

3.2.1.1 Instrumentation schematic diagrams (block diagrams)

These diagrams shall be arranged as a multi-sheet drawing (2.4), in one complete set for the particular project.

Instrumentation schematic diagrams are generalised drawings showing arrangements without reference to particular project details, and shall clearly state all the design principles to be followed and, if applicable, the division of scope. The diagrams shall show overall signal routing between field devices and all systems and cabinets, including the type of signal cabling, junction boxes, terminals, main distribution frame (MDF) and system cabling. For system cabinets, the type of power supply and the arrangement of system cabinet alarms shall be indicated. These drawings shall be in the form of block diagrams and, if applicable, detail all the battery limits delineating the scope of supply.

Schematic configuration sheets shall also be prepared for any configurable system.

Schematic diagrams shall be prepared at an early stage of the Project Specification phase and shall be fully reviewed and approved by the Principal before detailed design is started.

NOTE: Instrumentation schematic diagrams form the basis for instrument loop diagrams, see (3.2.2.3).

The instrumentation schematic drawings shall be revised throughout the project to incorporate further requirements as they become apparent.

NOTE: Each revision of instrumentation schematic diagrams requires the approval of the Principal.

3.2.2.2 Instrument loop diagrams

Amended per Circular 39/99

Loop diagrams shall be arranged as a multi-sheet drawing (2.4), in separate sets for each processing unit and for each major equipment package unit.

Each set of instrument loop diagrams shall have a drawing number. Where more than one processing unit and/or major equipment package unit are involved in the project, a group of consecutive drawing numbers shall be used for the various sets of diagrams.

For complicated control systems such as surge control, separate diagrams shall be made showing all active instrument components, complete with settings and ranges.

3.2.2.3 Logic diagrams

Amended per Circular 39/99

Logic diagrams shall be arranged as a multi-sheet drawing (2.4), in separate sets for each processing unit and for each major equipment package unit.

For each system for binary logic functions (including those in package units), a functional logic diagram shall be prepared by, or in close co-operation with, process design or process control engineering.

Each logic system as indicated on the process engineering (or utility) engineering flow schemes (PEFS) shall have its own sheet or it may consist of several sheets. Mixing of logic diagrams within one sheet is not permitted.

Each set of logic diagrams, and relay diagrams (if applicable) shall have a drawing number. Where more than one processing unit and/or major equipment package unit is involved in the project, a group of consecutive drawing numbers shall be used for the various sets of logic (relay) diagrams.

3.2.2.4 Function descriptions

Function descriptions, including basic logic diagrams and step charts, shall be made for sequence control or safeguarding systems and other complicated control systems.

Use of GRAPHCET and GEMMA can be considered.

Function descriptions shall include test procedures for testing under operating conditions.

3.2.2.5 Narratives

Amended per Circular 39/99

Narratives shall be prepared for all safeguarding and control loops since PEFS cannot fully reflect the operational and control philosophy. These shall provide the essential process control information for all possible modes of operation, i.e.:

- Commissioning
- Start-up
- Steady state
- Crippled operation (e.g. measurement failure)
- Special operation (e.g. reactor regeneration)
- Trip condition (e.g. setpoint after trip)

This is to expedite a correct system configuration in DCS, IPS and Supervisory system.

Narratives shall be prepared in accordance with Report MF 95-0155, and design information on alarm and trip settings and timer settings shall be laid down on separate lists.

3.2.2.6 Alarm, timer and trip settings list

Amended per Circular 39/99

Alarm, timer and trip setting details shall be printed from the instrument database arranged as a multi-sheet document listing.

Each instrument having an alarm or trip function shall be listed. The printed document drawings shall be prepared so that items forming part of a system are grouped together on one or more sheets.

An alarm/trip/timer setting list shall be made giving all alarms and settings as percentages of transmitter range and in engineering units, together with transmitter range, location of the annunciation point, cabinet, identification and relevant PEFS or logic drawing.

The alarm and trip setting list shall be set out to requirements given by the Principal. The format and layout showing the intended presentation shall be submitted for review by the Principal.

Each set of listed alarm and trip settings shall have a drawing number. Where more than one set of listed alarm and trip settings are involved in the project, a group of consecutive drawing numbers shall be used for the various sets.

3.2.2.7 Arrangement of system cabinets/auxiliary cabinets

Drawings for each system cabinet or auxiliary cabinet shall show:

- the arrangement of all equipment in the cabinet with their tag numbers
- the arrangement of terminals and sockets for the outside cabling with their identification
- assignment of each terminal and socket pin for the outside cabling
- facilities for earthing, outside cable supporting, ventilation and hoisting
- cabinet, equipment and socket/terminal row nameplate details
- cabinet installation details.

3.2.2.8 Instrument/electrical interface cabinet

This drawing shall show the construction and the layout of the interface cabinet, complete with any interface relays and cable termination details for the signals forming part of instrument engineering, and those forming part of electrical engineering.

3.2.2.9 Computing calculations

DCS-based computer functions shall be described in the process control narratives.

3.2.2.10 Distributed control system (DCS) configuration

The system shall be shown in a multi-sheet drawing (2.4), arranged in sets for the configuration of the selected DCS.

For a project, general generic configurations for functions that are regularly repeated (e.g. flow control loop, analogue input, motor point, group display layouts, keyboard configurations) shall be defined in a document. This document, based on the chosen DCS, shall include all parameters that require the user to make a selection. The default choice per parameter shall be filled in and a comment attached as to why this is so. If various choices can be made that are case-dependent, then the comment associated with a parameter shall detail how others are to base their choice.

The document shall be prepared as soon as possible in a project and before any configuration work is carried out. The document shall be approved by the Principal.

The function block configuration diagrams shall provide detailed software information, including an overview of the interrelations of the functional elements which constitute the controls and the interface with input/output circuitry, man/machine interface and supervisory controls as appropriate.

During the preparation of the DCS configuration drawing, care should be taken not to include "volatile" information in the drawing, such as gain setting, group display layouts, graphics. This type of information tends to change continuously during the lifetime of the plant, so that the drawing never reaches the "as built" status.

NOTE: Usually this type of documents are generated using the self-documenting feature of the DCS.

The DCS configuration drawing package shall be completed in detail, to ensure proper configuration execution by the system supplier.

Certain parts of the DCS configuration, such as group display layout, pictorials, historical trend, alarm group listing, shall be prepared in close co-operation with Principal's instrument, process design, process control, maintenance and operation specialists.

Each set of DCS configuration drawing sheets shall have a drawing number. A group of consecutive drawing numbers shall be used for the various sets of DCS configuration drawings.

DCS drawings and documents:

The following supplier drawings and documents are required and classified to the use which the Principal and the Engineering Contractor will make of the data. The drawings/documents are grouped according to the type of information they convey.

Interface information:

Drawings and documents within this group shall comprise all data which may interface with other facilities of the Principal and are required by the Contractor for design, such as:

- General arrangement drawings
- Single line diagrams
- Circuit diagrams
- DCS console lay-out
- System cable schedule
- Description
- Interface block diagrams
- System grounding drawing(s)

Design information:

Drawings and documents within this group shall provide detail design information to allow for verification of overall compliance with Principal specifications, such as:

- System description, including standard/optional function blocks, applications, programs
- System communication links characteristics including communication speed, protocols, access/control principles, error detection/recovery, network logging, failure identification/repair, back-up principles.
- Configuration documents

Testing procedure:

These documents shall demonstrate to the Principal that manufacturing and testing methods are acceptable, such as:

- Inspection and testing plan, including inspection tests by Supplier and/or Sub-supplier, production/test procedures and Factory Acceptance Test (FAT), Integrated Systems Test (including all related DCS sub-systems)

Records, reports and certificates:

These documents are required in order to demonstrate that material and equipment comply with specifications.

- Functional test report
- Performance test report
- Equipment hazardous area certificate
- Inspection/calibration test report
- Other reports, records and certificates

Instruction for installation, Operation and Maintenance:

These documents should comprehensively cover the delivered equipment, and shall give necessary and sufficient information for safe, correct and efficient installation, operation and maintenance of the equipment and systems, such as:

- Instruction for installation
- Instruction for commissioning
- Instruction for operation
- Operator interface manual
- Instruction for maintenance
- User/operating manuals

3.2.2.11 Instrument utility consumption calculations

For each required instrument utility, the calculation sheets shall give a detailed calculation which shall include but not necessarily be limited to:

- instrument air, both the baseload and the maximum air consumption based on selected equipment manufacturer's quoted consumption rates
- secured air supply buffer vessel capacity/sizing
- nitrogen, steam, cooling water consumption, e.g. for analysers
- electrical power load requirements, e.g. for Distributed control system (DCS), safeguarding systems, emergency shutdown systems (ESD).
- purge fluid consumption, e.g. for instrument impulse lines.

The calculation shall indicate the required and the installed capacity.

During the detailed engineering stage, the instrument utility consumption calculations shall be updated and issued at regular intervals to ensure that the requirements can be met.

3.2.2.12 Heat dissipation calculation

This calculation sheets shall contain a detailed heat dissipation calculation for all electrically powered instrument equipment which will be installed in the instrument auxiliary room and/or Field Auxiliary Rooms (FAR), Analyser Houses (where applicable), and control room, in view of total heat load for the air-conditioning system(s). During the detailed engineering stage, the heat dissipation calculation shall be updated and issued at regular intervals to ensure that the requirements can be met.

3.2.2.13 Noise calculation

The calculation sheets shall contain a detailed noise calculation and/or spectrum for all instrument equipment which will be installed in the Plant and control room and contribute to a noise level higher than the allowed limit. Typical examples are control valves, printers, typewriters, cooling fans of instrument equipment, refer to DEP 31.10.00.31-Gen.

3.3 ANALYSERS AND SUNDRY INSTRUMENTS - GROUP 31

Documents and drawings in this group are concerned with the selection, specification and ordering of on-line process stream analysers and sundry instruments such as those classified as belonging to Group 31.

For guidance on the preparation of such documents and drawings, refer to the following publications:

- On-line process stream analysis

Part 1: Sample take off and transport	- DEP 32.31.50.10-Gen.
Part 2: Sample conditioning	- DEP 32.31.50.11-Gen.
Part 3: Analysers	- DEP 32.31.50.13-Gen.

3.4 FLOW INSTRUMENTS - GROUP 32

This sub-section concerns the documents and drawings relating to the selection, specification and ordering of flow instruments classified as belonging in Group 32.

Typical examples are:

- flow meter calculations
- restriction orifice calculations
- construction drawings for special flow meters
- construction drawings for restriction orifices
- flow computer calculations
- custody transfer flow metering stations.

Flow meter and restriction orifice calculations shall be arranged as a multi-sheet drawing (2.4), in sets for each processing unit. Each set shall have a drawing number and, where more than one processing unit are involved in the project, a group of consecutive drawing numbers shall used for the various sets of flow meter and restriction orifice calculations.

3.5 LEVEL INSTRUMENTS - GROUP 33

This section concerns documents and drawings relating to the selection, specification and ordering of level instruments classified as belonging in Group 33.

Typical examples are:

- calculations for differential-pressure instruments
- calculations for radioactive sources
- construction drawings for special level measurement.
- calculations for interface measurement

Calculations for differential-pressure transmitters shall be arranged as a multi-sheet drawing (2.4), and show in detail all the required data such as transmitter elevation, type of leg and sealing fluid (if applicable), calculations of temperature effect on the sealing medium (if applicable), calibrated range and zero elevation/suppression for each application.

NOTE: These calculation sheets shall be attached to the particular requisitions when such a transmitter is specified.

3.6 PRESSURE INSTRUMENTS - GROUP 34

This section comprises all documents and drawings relating to the selection, specification and ordering of pressure instruments requisitioned in Group 34.

Typical examples are:

- selection of diaphragm seals
- selection of over-range protection devices.

3.7 TEMPERATURE INSTRUMENTS - GROUP 35

This group comprises all documents and drawings relating to the selection, specification and ordering of temperature instruments requisitioned in Group 35.

Typical examples are:

- construction drawings for special temperature measurement devices
- construction drawings for multiple temperature measuring elements.

3.8 FINAL CONTROL ELEMENTS - GROUP 36

This section concerns documents and drawings relating to the selection, specification and ordering of final control elements classified as belonging in Group 36.

Typical examples are:

- ESD valve /actuator torque calculations
- control valve sizing calculations
- control valve noise calculations
- control valve stroking time calculations.

Control valve sizing and noise calculation sheets shall be arranged as a multi-sheet drawing (2.4), in sets for each processing unit, using the applicable Instrument Standard Forms (DEP 32.36.01.41-Gen. and DEP 32.36.01.42-Gen.).

Each set of control valve sizing and noise calculations shall have a drawing number. Where more than one processing unit is involved in the project, a group of consecutive drawing numbers shall be used for the various sets of control valve sizing and noise calculations sheets.

3.9 INSTRUMENT INSTALLATION - GROUP 37

3.9.1 Summaries

Summaries shall be generated from a database.

3.9.1.1 Summary of instrumentation cables

The summary consists of an index sheet and separate summary sheets for pneumatic signal cables, electric signal and power supply cables (which form part of instrument engineering), thermocouple signal cables, system cables, using the Instrument Standard Form DEP 05.00.54.90-Gen. The summary shall contain a listing of all instrumentation cables. The relevant sheets shall be completed at a later date, with the manufacturer's cable reel identification code.

The first issue of the summary shall be made as soon as possible after cable supplier selection, and thereafter it shall be revised at regular intervals, with the final issue at such a time that the cable deliveries are not endangered.

Each revision issued shall consist of a revised index sheet with attached summary sheet(s). The revision indicator used for the index sheet shall also be used for the summary sheet(s) and in the Issue column of each revised item, irrespective of any previous revision indicator(s).

3.9.1.2 Summary of instrument installation materials

The summary consists of a table of contents and an index sheet together with sheets listing standard materials, sheets for specifying other materials and sheets for summarising material quantities, using Instrument Standard Form DEP 32.37.02.80-Gen.

The sheet, Section 5 for material specification, contains the material item numbers complete with the description and the MESC number where applicable. The same item numbers shall be used on the sheet for material quantities to summarise the required materials.

Where numbers have not been allocated for specific items on the List of Section 4, the material specification Section 5 shall be extended to include these items using numbers from 1001 onwards.

The first issue of the summary shall be available two months after award of the EPC or Detailed Engineering contract.

Revisions of the summary shall be issued at regular intervals but at least once every two months. Each revision issued shall consist of a revised index sheet with summary sheet(s) attached. The revision indicator used for the index sheet shall also be used on the summary sheet(s) and in the Issue column of each revised item, irrespective of any previous revision indicator(s).

3.9.1.3 Instrument nameplates

Details of the type of nameplate and the description of the instrument service shall be arranged as a multi-sheet document/drawing (2.4).

3.9.2 Control room

3.9.2.1 Layout

The control room drawing shall show in detail, true to scale (preferably electronic and three-dimensional), the general arrangement and location of DCS consoles, computer consoles, supervisory consoles/panels, printers, including console/panel numbering as applicable.

It shall also show openings for bottom entry into instrument consoles and indicate the grid of the cavity floor and openings in the wall or floor between control room and auxiliary room, (if applicable).

3.9.2.2 Computer/Engineering room drawings

When a project includes (a) digital computer(s) for supervisory/maintenance/management information functions, the computer/engineering room shall be clearly covered in documents and drawings as follows:

- a layout of the computer/engineering room

These drawings shall show the arrangement of all equipment, cabinets and desks.

- air conditioning of computer/engineering rooms

This drawing shall show the layout of air distribution ducting and direction of airflow.

- a layout of the cavity floor in the computer/engineering room

This drawing shall show the construction of the cavity floor, with an indication of the openings therein.

3.9.3 (Field) Auxiliary room

3.9.3.1 Layout

The drawing of the auxiliary room shall show in detail, true to scale, the arrangement and identification of all equipment such as system cabinets, auxiliary, distribution and riser cabinets. It shall also show the location and size of the air-conditioning equipment and ducting arrangement.

This drawing shall indicate the grid of the cavity floor and the openings required in this floor, e.g. for bottom entry into cabinets.

3.9.3.2 Layout of supports, instrument signal cables and air-conditioning ducting in the auxiliary room

This drawing shall show:

- the arrangement of all cable supports under the ceiling and cavity floor of the auxiliary room.
- the arrangement of the air-conditioning ducting in the auxiliary room
- the plant instrument signal cable entries into the auxiliary room in the correct position together with the relevant cable numbers.
- the position of the plant instrument signal cable termination facilities, with their identification, and the routing of the plant instrument signal cables to these facilities.
- the openings in the walls, and floors.

NOTE: For detailed identification of the termination facilities, see (3.9.10).

3.9.3.4 Arrangement for main distribution frame (MDF) cabinets

Drawings for electrical instrument signal cables shall show:

- the arrangement of the terminal rows for outdoor cables, complete with row/terminal identification.
- the arrangement of the system cable termination boards for indoor cables, complete with row/terminal and socket identification.
- the facilities for interconnecting the cable screens.
- the facilities for earthing the armouring/lead sheathing of outdoor cables, if applicable.
- the facilities for supporting the indoor and outdoor cables.
- the facilities for routing/supporting the cross wiring.
- Elco plug/socket interconnections. including location, pin connections, signal type, polarising details, source and destination details.

Drawings required for thermocouple signal cables are similar to the above, but shall also

include the arrangement of cold junction compensation boxes and their identification.

3.9.3.5 Arrangement of riser cabinets

Drawings shall show, for each cabinet, the fixing facilities for cables entering from the bottom and leaving via the top.

NOTE: Riser cabinets should be used only in those cases where the auxiliary room is located underneath the control room. Other cabinets shall not be used for this purpose.

3.9.3.6 Arrangement of earthing system(s)

The drawing shall show:

- the arrangement of earth bars for instrument system earth and safety earth of instrument equipment, complete with earth bar/terminal identification, and other special instrument earthing arrangements.
- the facilities for supporting the indoor earthing cables.

3.9.3.7 Signal cabling diagram

This drawing shall show in diagrammatic form all signal cabling in the auxiliary room and its connection to equipment in the (Field) auxiliary room, to the consoles in the control room and to the plant. The drawing shall indicate the exact signal cabling routing, including cable crossing details, and generally follow the actual layout of equipment in the auxiliary room, but need not necessarily be true to scale.

The cable terminations shall be coded such that a clear distinction is made between cables terminating on rail-mounted terminals, plugs, and sockets. The drawing shall also include the identification of the equipment, the cables, and the system cable sockets mounted in the equipment.

3.9.3.8 Layout of earthing in the (Field) auxiliary room

Separate drawings shall be prepared for DCS earth, instrument earth, instrument intrinsically safe earth, any required system earths and electrical safety earth of instrument equipment.

These drawings shall show in diagrammatic form all earth cabling from the earthing cabinet in the auxiliary room and its connections to equipment in the auxiliary room and consoles in the control room. They shall also include the identification of equipment and earth cables.

The drawing shall generally follow the actual layout of equipment in the auxiliary room, but need not necessarily be true to scale.

3.9.4 The main instrument console

3.9.4.1 Fire and gas detection display panel

Drawing(s) shall show the layout (full scale) of the fire and gas detection display panel, giving main dimensions. The display shall consist of a geographical plant representation for flammable gas, fire, smoke and hydrogen sulphide detection with indication lights for alarms, maintenance override status indication, manual call points together with start/stop switches and other related operator interface equipment for fire water systems

For guidance in the preparation of the fire and gas detection display panel, refer to DEP 32.30.20.11-Gen.

3.9.4.2 Utility display (panel)

Drawing(s) shall show the layout (full scale) of the utility display panel, giving the main dimensions. The display shall consist of simplified single line representation of main electrical power supply distribution facilities, indicating voltage, current, and frequency, and showing synchronous meters, with indication lights for alarms and single line status indication.

For guidance in the preparation of the utility display (panel) drawing(s), refer to the Principal.

3.9.5 Local panels

3.9.5.1 Layout

Drawings shall show the layout (to scale) of each local panel, with the instruments in outline and giving the tag number for each instrument.

3.9.5.2 Construction

Construction drawings shall give all information required for manufacturing the local panels. Fully dimensioned cut-outs for all instruments shall be included, either on the same drawing or presented separately.

3.9.6 Plant instrumentation

3.9.6.1 Location

The location of instruments and instrument equipment shall be shown, superimposed on sections of a simplified plot plan as follows:

- all plant mounted instruments, including local indicators and temperature indicators
- all local panels
- all field-mounted junction boxes for instrument signal cabling
- all trunking/cable-tray systems for instrument cabling and its riser points from (underground) trenches
- all instrument air supply piping from its demarcation points with mechanical engineering to the relevant (group of) consumers. Isolating valves, branch-off points and pipe sizes shall be clearly indicated.

In general, separate drawings shall be provided for the location of instruments relating to:

- Audible plant alarm systems
- Plant telecommunication facilities
- Flammable gas, toxic gas, fire and smoke detection, and deluge systems
- Depressuring systems
- Plant security/access
- Marine instrumentation systems
- CCTV systems
- Analysers, analyser houses, sample take-off points
- Plant information network systems, see DEP 32.71.00.30-Gen.

Each drawing shall contain a list of all instruments and junction boxes. Each list shall show, in sequence of tag number, the (plant) co-ordinates for location of the equipment and its elevation above plant grade level.

Where instrumentation in structures is involved, preference shall be given to the preparation of layout drawings for different levels, e.g. for each platform or deck, and/or drawings showing such structures in side-view (elevation) containing all the above information.

Complicated cable trunking shall also be shown in isometric form if plan/elevation drawings would not be sufficiently clear for fabrication of trunking systems.

Where the cable trunking will be of fire resistant construction, it shall be shown on detailed construction drawings.

Where the cable trunking requires special supports, these shall be shown on detailed construction drawings, and a decision shall be taken whether they can form part of the installation activities or whether they should be requisitioned separately for prefabrication.

3.9.6.2 Trenches for instrument cables

Drawings shall show the location of trenches for instrument cables complete with indication of size and branch-off points. Details of trench construction, methods of back-filling and trench closure shall also be indicated.

NOTE: These drawings shall be prepared in close co-operation between instrument, electrical and civil engineering. The ultimate drawing(s) may form part of civil engineering, provided detailed references are made on the instrumentation drawings.

3.9.6.3 Layout of instrument cables in the plant

Drawings shall show the aboveground and underground routing of all instrumentation cables from their termination point in the plant to their termination point in the (Field) Auxiliary building, complete with the laying pattern for cable segregation.

Cables for similar applications, such as for plant telecommunication, fire, gas and smoke detection, plant information and deluge systems shall also be indicated on the drawings.

Where it is permitted to have instrument electricity supply cables close to instrument signal cables, the supply cables shall also be shown on this drawing. Where this is not permitted, such cables shall be shown on the drawings for the trenches of high-voltage electrical cables for power and lighting, with a cross-reference on the instrument cable drawings.

Special attention shall then be paid to the need for additional branches and riser points in these power cable trenches for accommodating the instrument electricity supply cables.

All riser points for instrument electricity cables shall also be indicated on the drawings 'Layout of instrument cables in the plant', complete with the aboveground cable routing to the individual consumers. Cross-references shall then be made on both drawings.

3.9.7 Instrument electricity supply

3.9.7.1 Single-line diagram for instrument electricity supply

The instrument electricity supply shall be shown diagrammatically, from the electrical distribution switchboards to the consumers, and shall include:

- arrangements for AC and DC supply (vital and non-vital)
- special provisions for DCS (and other systems) electricity supply
- all instrument switchboards, switches, fuses including ratings and characteristics
- demarcation points at the interface between electrical engineering and instrument engineering.

3.9.7.2 Layout of instrument electricity supply cables in the control building, (Field) Auxiliary rooms

Drawing(s) shall show the layout of the instrument electricity supply cables, complete with the cable numbers, from the distribution board(s) forming part of electrical engineering, under the cavity floor and up into the system and auxiliary cabinets, and up through riser (cabinets) into the instrument systems.

3.9.7.3 Layout of instrument electricity supply in analyser house(s)

The drawing shall show in detail, the instrument electricity supply connections for the individual consumers. Complete with de-energising facilities for each consumer, socket outlets for electrical tools and test equipment, and the cable routing from point of entry to the consumers.

3.9.8 Instrument air lines

Instrument air lines shall be prepared as a multi-sheet drawing (2.4), showing in detail, the arrangement of the individual air supply for each pneumatically operated instrument, using the appropriate sheets of Instrument Standard Form DEP 32.37.02.83-Gen.

For guidance in the preparation of instrument air lines, refer to DEP 32.37.51.11-Gen.

Dedicated instrument air line details shall be provided for instruments related to fire detection facilities and deluge systems.

3.9.9 Instrument signal lines

Instrument signal lines, prepared as a multi-sheet drawing (2.4), shall indicate:

- cross sections of trenches showing the location and laying pattern of each group of cables
- procedures for laying cables in trenches, and methods of backfill
- procedures for laying cables in trunking, and methods for fixing the cables.
- details/procedures for termination of cables in cable joints, if applicable
- details/procedures for laying cables entering the auxiliary room with respect to their termination point (MDF)
- details for covering/sealing/fire proofing of cable entries into the auxiliary and control room
- details/procedures for stripping length and finishing touch of cables in particular with respect to cable glands and MDFs
- methods for identification of wires, pairs or quads in multi-element cables
- procedures for termination of cables in thermocouple heads, transmitters, converters, solenoid valves, manual switches, plant telecommunication equipment, CCTV systems, junction boxes, distribution cabinets.
- construction details of signal cabling crossings (bridges).

The drawing shall also give dedicated earthing principles and details for instrument equipment such as:

- instrument earthing, for signal cable screen continuity and earthing point (MDF), system cables, reference system earth bar (DCS).
- instrument earth star point
- safety earthing for signal cable armouring/lead sheathing, system cabinets, frames, instrument desks/consoles, recessed floor(s), instrument cable trunking, junction boxes, local panels, power distribution boards.
- safety earth distribution
- earthing of galvanic isolators, safety barriers,

A full cable pulling schedule shall be provided clearly referencing the specific cable entry into any building.

3.9.10 Instrument cable terminations

Instrument cable terminations in the form of a multi-sheet drawing shall be prepared. These drawings shall be set out to the requirements given by the Principal. The format and layout shall be submitted for review by the Principal, prior to full scale application.

The multi-sheet drawing shall indicate the requirements of the following sub-sections:

3.9.10.1 For each junction box:

- junction box number
- the actual numbering of the terminals
- the (multi-element) signal cable(s) connected to these terminals with full identification by cable number(s), pair/quad number, colour or number coding of wires.
- the connections to plant instruments specified by the tag number.

If more than one signal is related to a tag number, the following code shall be added:

- TX in the case of a measured value signal
- CV in the case of a controller output signal.

3.9.10.2 For each electric signal cable distribution cabinet:

- the terminal rows for plant cables complete with row and terminal identification and cable numbers
- terminal rows and system cable sockets for indoor cables complete with row/terminal and socket/pin identification
- the cross wiring between the terminal rows
- the direct wiring between the terminal rows for indoor cables and the system cable sockets.

3.9.11 Instrument impulse lines

Instrument impulse line details shall be prepared as a multi-sheet drawing (2.4), in sets for each processing unit, using the appropriate sheets of Instrument Standard Form DEP 32.37.02.81-Gen. (for metric tubing), or Instrument Standard Form DEP 32.37.02.82-Gen. (for Imperial tubing).

For guidance in the preparation of the instrument impulse line drawing sets, refer to DEP 32.37.10.11-Gen.

Each set of instrument impulse lines shall have a drawing number. Where more than one processing unit is involved in the project, a group of consecutive drawing numbers shall be used for the various sets of instrument impulse lines.

3.9.12 On-line process stream analysers

Documents and drawings giving details of analyser and sampling systems shall be prepared as follows, arranged in sets for each on-line analyser.

3.9.12.1 Sample take-off

- the sample take-off/return assembly, preconditioning and transport system
- sample transport system line size calculations
- sample lag time calculations
- selection and sizing of sample pump calculations
- calculations of the ratio of the sample line flow and the normal process line flow
- layout drawing(s) of analyser sample transport system in isometric form showing the routing of the sample transport lines from the sample take-off/return points in the plant, to the sample conditioning system at the analyser house.

For guidance in the preparation of the above documents and drawings, refer to DEP 32.31.50.10-Gen.

3.9.12.2 Sample conditioning

- the sample conditioning system
- calculations of the conditions at the inlet and outlet of the sample conditioning system
- calculations of the percentage of flow which is vented (flared) or drained.

For guidance in the preparation of the above documents and drawings, refer to DEP 32.31.50.11-Gen.

3.9.12.3 Analysers

- the analyser and related equipment such as programmers, peak pickers, recorders, converters.

- calculations for auxiliary equipment such as heaters, coolers, pumps, tracing/lagging, to obtain the required sample inlet conditions.

For guidance in the preparation of the above documents and drawings, refer to DEP 32.31.50.12-Gen., using analyser data sheet DEP 32.31.50.92-Gen., for analyser arrangements requiring a sample conditioning system.

The range of the instruments shall also be specified on the appropriate documents and drawings.

Each set of in-line analyser documents and drawings shall have a drawing number. Where more than one analyser are involved in the project, a group of consecutive drawing numbers shall be used for the various sets of documents and drawings.

3.9.12.4 Layout of the analyser house(s)

A drawing, true to scale and on the same scale as the drawing The 'Layout of instrument electricity supply in the analyser house', (3.9.7.3), shall show in detail the arrangement of all equipment in and around the analyser house.

A cross sectional drawing shall be provided to allow review of maintainability.

Equipment such as sample lines and conditioning systems, drain/vent systems, air conditioning, heating/ventilation systems, analysers and related equipment, junction boxes, initiating elements of safeguarding systems, sink, workbench, shall where applicable be identified by line and/or tag numbers.

For guidance in the preparation of the layout of analyser house(s), refer to DEP 32.31.50.13-Gen.

4. REFERENCES

In this DEP reference is made to the following publications:

NOTE: Unless specifically designated by date, the latest edition of each publication shall be used, together with any amendments/supplements/revisions thereto.

Amended per Circular 39/99

SHELL STANDARDS

DEPS:

Index to DEP publications and standard specifications	DEP 00.00.05.05-Gen.
Compilation of design books	DEP 01.00.02.11-Gen.
Preparation and microfilming of technical drawings	DEP 02.00.00.10-Gen.
Requisitioning Binder	DEP 30.10.01.10-Gen.
Noise control	DEP 31.10.00.31-Gen.
Symbols and identification system - Mechanical	DEP 31.10.03.10-Gen.
Instrumentation symbols and identification on Process Engineering flow schemes	DEP 32.10.03.10-Gen.
Fire, gas and smoke detection systems	DEP 32.30.20.11-Gen.
Instrumentation for equipment packages	DEP 32.31.09.31-Gen.
On-line process stream analysis:	
Sample take-off and transportation	DEP 32.31.50.10-Gen.
Sample conditioning	DEP 32.31.50.11-Gen.
Analysers	DEP 32.31.50.12-Gen.
Analyser houses	DEP 32.31.50.13-Gen.
Instrument impulse lines	DEP 32.37.10.11-Gen.
Instrument air lines	DEP 32.37.51.11-Gen.
Coding system for the administration and control of capital projects	DEP 40.10.01.11-Gen.

INSTRUMENT STANDARD FORMS (contained in binder DEP 00.30.10.05-Gen.):

List of selected instrument equipment	DEP 05.00.54.40-Gen.
Summary of instrumentation requisitions	DEP 05.00.54.89-Gen.
Summary of instrumentation cables	DEP 05.00.54.90-Gen.
Control valve calculation form: Compressible fluids	DEP 32.36.01.41-Gen.
Control valve calculation form: Incompressible fluids	DEP 32.36.01.42-Gen.
Summary of instrument installation materials	DEP 32.37.02.80-Gen.
Instrument impulse line assemblies, Metric version	DEP 32.37.02.81-Gen.

Instrument impulse line assemblies, Imperial version	DEP 32.37.02.82-Gen.
Instrument air lines	DEP 32.37.02.83-Gen.
REQUISITIONS AND DATA SHEETS (contained in binder DEP 30.10.01.10-Gen.):	
Data sheet for analyser systems	DEP 32.31.50.92-Gen.
STANDARD DRAWING: Electrical symbols in addition to IEC 671	S 64.000
MEMORANDA AND REPORTS:	
EP/MF/CMF Interim Standard For the Electronic Exchange Of Facilities Documents and Drawings	Memorandum MFT 168/93
Guidelines for the preparation of control and instrumented protective function narratives	Report MF 95-0155

AMERICAN STANDARDS

Standard recommended practice sulphide stress cracking resistant - metallic materials for oil field equipment	NACE MR0175

Issued by:
National Association of Corrosion Engineers
PO Box 218340
Houston, Texas 77084, USA

INTERNATIONAL STANDARDS

Graphical symbols for diagrams	IEC 617

Issued by:
International Electrotechnical Commission
3, Rue de Varembé
CH 1211 Geneva 20
Switzerland.
(Copies can also be obtained from National Standards bodies)

APPENDIX 1 AS-BUILT REQUIREMENTS FOR DOCUMENTS AND DRAWINGS

Category A - documents and drawings, should remain **as built** during the lifetime of the plant, for plant change, maintenance and safety audit purposes.

After commissioning, particularly in the case of plant changes, however small, plant management is responsible for the updating of the **Category A** documents and drawings concerned, and this function shall be clearly defined within the plant organisation.

Category B - **as-built** documents and drawings, **after construction** shall include all changes/additions which have been made during the construction/commissioning and start-up phase of the project.

Group No.	Document/drawing title	As-built category	Cross-reference
30	General instrumentation:		(3)
	Summaries of instrumentation documents and drawings	A	(3.2.1.1)
	Summary of instrumentation requisitions	B	(3.2.1.2)
	Instrument engineering data sheets	A	(3.2.1.3)
	Composite instrument manuals:		(3.2.1.4)
	- Chapter 1	A	
	- Chapter 2 Section A and B	B	
	- Chapter 3 Section A and C	B	
	Section B	A	
	- Chapter 4	A	
	- Chapter 5	A	
	Instrumentation schematic diagrams	B	(3.2.2.1)
	Instrument loop diagrams	A	(3.2.2.3)
	Safeguarding and control narratives	A	(3.2.2.6)
	Logic diagrams including relay diagrams	A	(3.2.2.4)
	Function descriptions	A	(3.2.2.5)
	Alarm and trip settings	A	(3.2.2.7)
	Arrangements of system cabinets/ auxiliary cabinets	B	(3.2.2.8)
	Instrument/ electrical interface cabinet	A	(3.2.2.9)
	Computing relay calculations	A	(3.2.2.10)
	Distributed control system (DCS) configuration	A	(3.2.2.11)
	Instrument utility consumption calculations	B	(3.2.2.12)
	Heat dissipation calculation	B	(3.2.2.13)
	Noise calculation (CR)	B	(3.2.2.14)
31	Analysers and sundry instruments:		(3.3)
	On-line process stream analysers and sample systems	A	(3.9.12.1)

Group No.	Document/drawing title	As-built category	Cross-reference
32	Flow instruments:		(3.4)
	- Flow meter calculations	A	
	- Restriction orifice calculations	A	
	- Construction drawings for special flow meters	B	
	- Construction drawings for restriction orifices	B	
	- Flow computer calculations	A	
33	Level instruments:		(3.5)
	- Calculations for differential pressure instruments	B	
	- Calculations for radioactive sources	B	
	- Construction drawings for special level instruments	B	
34	Pressure instruments:		(3.6)
	- Selection of diaphragm seals	B	
	- Selection of over range protection	B	
35	Temperature instruments:		(3.7)
	- Construction drawings for special temperature measurement devices	B	
	- Construction drawings for multiple temperature measuring elements	B	
36	Final control elements:		(3.8)
	- Control valve sizing calculations	B	
	- Control valve noise calculations	B	
	- Control valve stroking time	B	
37	Instrument installation:		(3.9)
	Summary of instrumentation cables	B	(3.9.1.1)
	Summary of instrument installation materials	B	(3.9.1.2)
	Summary of instrument process connections	B	(3.9.1.3)
	Instrument nameplates	B	(3.9.1.4)
	Layout of control room	A	(3.9.2.1)
	Computer system drawings	B	(3.9.2.2)
	Layout of auxiliary room	A	(3.9.3.1)
	Layout of cable supports and instrument signal cables in the auxiliary room	B	(3.9.3.2)
	Instrument air/ filter reducer stations in auxiliary room	B	(3.9.3.3)
	Arrangement of main distribution frame (MDF) cabinets	B	(3.9.3.4)
	Arrangement of riser cabinets	B	(3.9.3.5)
	Arrangement of earthing cabinet	B	(3.9.3.6)
	Signal cabling diagram	B	(3.9.3.7)
	Layout of earthing in the auxiliary room	A	(3.9.3.8)
	Layout of instrument consoles	A	(3.9.4.1)
	Cut-out dimensions for instrument consoles	B	(3.9.4.2)
	Construction of instrument consoles	B	(3.9.4.3)
	Alarm display panels	A	(3.9.4.4)

Group No.	Document/drawing title	As-built category	Cross-reference
37 (continued)	Fire and gas detection display panel	A	(3.9.4.5)
	Utility display panel	A	(3.9.4.6)
	Layout of local instrument panels	A	(3.9.5.1)
	Construction of local instrument panels	B	(3.9.5.2)
	Location of plant instruments	B	(3.9.6.1)
	Trenches for instrument cables	B	(3.9.6.2)
	Layout instrument cables in the plant	A	(3.9.6.3)
	Single-line diagrams for instrument electricity supply	A	(3.9.7.1)
	Layout of instrument electricity supply cables in the control building	B	(3.9.7.2)
	Layout of instrument electricity in analyser house(s)	B	(3.9.7.3)
	Instrument air line details	B	(3.9.8)
	Instrument signal lines	B	(3.9.9)
	Instrument cable terminations;		
	- For each junction box	A	(3.9.10.1)
	- For pneumatic cable distribution facilities	A	(3.9.10.2)
	- For each electric signal cable distribution cabinet	A	(3.9.10.4)
	Instrument impulse lines	B	(3.9.11)
	Critical instruments and systems:	A	
	Depressuring systems	A	
	All documents and drawings such as layouts, MDF arrangement, installation details, fire proofing, which are not already covered by as-built Category A requirements.	B	

APPENDIX 2 TYPICAL LAYOUT OF A TECHNICAL SPECIFICATION

Each specification should contain the following headings if applicable:

I. Introduction, general

2. Standards
   - Local standards
   - International standards

3. Definitions and nomenclature, list of abbreviations, "shall" and "should", parties involved, i.e. Company, Principal, Vendor, Contractor.

4. Environmental conditions
   - Storage and transportation conditions
   - CR, CRAR, FAR conditions
   - Area classification
   - Protection class
   - Tropicalisation.
   - Access to site.

5. Design information to be given to the Manufacturer:
   - PEFS
   - Control narratives
   - Safeguarding narratives
   - Cause and effect matrix
   - Type of reports, calculation methods, display building rules.

6. Engineering tools and design criteria, i.e.
   - Standardisation
   - Approvals or certification, e.g.
   - Availability, reliability, MTTR, MTBF criteria
   - Redundancy, fault tolerant, (lool. loo2, 2oo2, 2oo3)
   - Noise immunity
   - System performance requirements, e.g. response time(s), refresh rates of screens, invocation time, cycle time in PLCs, SER time stamping, time-synchronisation with other systems.
   - Structure of the system, capacity.
   - Tools to be used for engineering, configuration

7. Scope of supply

8. Technical specifications

   Hardware requirements
   - Consoles, hardwired switch panels, alarm display panels, printers, CHCU, fibre-optic amplifiers and transmission, system cables
   - Wiring and termination
   - Type of input and output cards.
   - Type of cabinet, doors, cable entry, nameplate, lifting eye lugs, drawing pocket, painting.
   - Power supply system requirements, fusing
   - Earthing requirements
   - Spare positions, cards, wiring
   - Batteries used in the system, life time
   - List of approved instruments/vendors/materials

   Software
   - Standard software
   - Application software - License fees

   Functional requirements
   - Functionality of DCS, SGS.
   - Mass data storage system, history capacity, recording facilities, reports and logging facilities, control functionality, data acquisition and monitoring functions, functions for calculation/sequential and timed functions, custom displays, maintenance displays, engineering work stations, printers, copiers (CHCUs), secured gateway to MIS,

computer systems
- System faults and failures
- Alarm handling, alarm messages, logs, acknowledgement,
- System windows (overview/group/loops), system status/x-window displays
- System communication highways, communication busses
- Communication foreign serial links
- Listing of APC applications in DCS

9. Spare parts
   - Consumables for SAT
   - Initial (commissioning) spare parts
   - Guarantee period spare parts
   - Spare parts for two years of operation (maintenance spares)

10. Project management
    - Planning
    - Organisation
    - Progress meetings

11. Inspection and testing:
    - General requirements
    - Manufacturing test
    - System staging
    - System burn-in

12. FAT, test equipment, availability of staff for assistance from manufacturer

13. SAT, field services, installation, start-up assistance.

14. Maintenance proposal
    - Remote maintenance
    - On site maintenance

15. Warranty

16. Quality requirements

17. Training (courses)

18. System quotation, pricing of equipment, information to be submitted with the tender, payment terms

19. Documentation

    System operating manuals, installation manuals, data books.
    - Software reference manuals
    - Cabinet layout drawings
    - Diagrams
    - Power requirements calculation
    - Loop diagrams
    - FAT and SAT procedures
    - Approval of drawings, as-built drawings.

20. Transportation
    - Shipping details, (sea, air, road)
    - Packing
    - Insurance
    - Off loading

21. Table of compliance (Enhancement, conforms, variation, alternative, exception, noted)

    Appendices:
    a. Block diagrams
    b. List of I/O
    c. Plant, CR, CRAR, FAR Lay-outs

In order to be able to make a proper table of compliance, all chapters and sub-chapters shall be numbered.