MANUAL

INSPECTION AND FUNCTIONAL TESTING OF INSTRUMENTS

DEP 62.10.08.11-Gen.

December 1997

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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3) Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) or 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

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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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APPENDICES

1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for inspection and testing of instruments, before and after installation, during the construction and start-up phases of new plants or after planned shutdowns. It deals with activities and requirements to confirm that instrumentation conforms to the Principal's requirements and is installed and functioning according to the approved engineering/construction drawings and data.

The DEP is a guide for the whole process in managing the quality, time and cost of verifying that instrumentation performs as it should. It provides the users with relevant details, or a way to find any details, that support and contribute to the preparation of an overall plan.

This DEP is a revision of the DEP with the same number dated October 1987 and also replaces DEP 62.10.09.11-Gen which is now withdrawn.

The contractor shall use inspection sheets derived from the quality documents. A common database such as "IN-tools" can also be used to generate these sheets automatically.

The document explains five stages of activities:

1. Factory Acceptance Test (FAT).
2. Check on incoming instruments and installation materials.
3. Installation and field inspection, including systems and system cabinets.
4. 'Internal Function Check' (IFC) for control building-based systems and interconnections.
5. 'Operational Function Check' (OFC); comprising the functional testing commissioning and start-up activities needed to bring the plant into production.

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, and to Contractors nominated by them (i.e. the distribution code is "C", as defined in DEP 00.00.05.05-Gen.).

It is intended for use in oil refineries, chemical plants, gas plants, 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 DEP 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 DEP 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, inspection, testing, 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

Process Instruments

All instruments used in process and utility units, including process stream analysers.

In-situ Calibration/Testing

Calibration and testing carried out directly on the plant, using test equipment.

Control Centre Equipment

All instruments and instrument systems in control and auxiliary rooms and field auxiliary rooms.

Inspection of Instruments

Carrying out all the procedures needed to check that instruments and instrument systems conform to the Principal's requirements.

Field Inspection

Verifying that field instruments are installed according to the Principal's requirements.

Internal Function Check

Checking for correct operation of all Control Centre Equipment items and their interfaces. It also means checking that the settings and adjustments of all items are as they should be (as specified) for correct and safe operation of the plant (this includes time delay settings, alarm and trip settings, controller settings etc.).

Operational Function Check

Checking for correct operation of the instruments in a complete section of the instruments, systems and subsystems, in preparation for start-up activities. It includes checking the settings of controlling function, time delays, alarm and trip settings.

On-line Process Stream Analysers

Industrial instruments which continuously monitor the physical and chemical properties of fluids in process and auxiliary plants. They may be installed in analyser houses or mounted locally in the plant. They are also called QMIs.

Commissioning and Start-up Activities

Operational activation of instruments and instrument systems under operating conditions. It often includes handing over the instruments and systems for continued use to the operating and maintenance departments. This activity also includes the tuning of control loops, seal liquid filling of impulse lines, commissioning of Advanced Process Control (APC), surge and condition monitoring applications and final adjustment of settings for all items.

2. QUALITY PLAN

A comprehensive Quality Plan shall be prepared in accordance with ISO 9000 or equivalent. The Quality Plan describes the quality documents (i.e. procedures, specifications (e.g. DEPs) and work instructions) to be used in the dedicated organisation to assure quality in each activity. All documents and drawings that are used shall be listed and properly controlled. **The scheme shown in Appendix 1** shall be used to prepare the Quality Plan.

Changes during the course of activities shall be handled according to the agreed change procedure.

The organisation and reporting hierarchy of all involved in testing and inspecting shall be included in the Quality Plan.

Each activity shall be planned and reviewed with the Principal 2 months (4 to 6 months for large projects) before the instrumentation involved has to be used operationally, especially those activities that interface with other disciplines that carry out radiography inspections, pressure tests and flushing. Time schedule, test plan and progress reporting shall be prepared and agreed with the Principal.

The following items shall be carried out when construction is still on-going, before the activity is completed :

- cable trench inspection;
- underground cable inspection (to be inspected before back-filling);
- cable insulation test (megger test);
- inspection of in-line instruments e.g. orifice plate dimensions;
- impulse-line pressure testing;
- point to point wiring checks;
- earthing integrity tests;
- instrument cabinet inspection;
- check on the straight length requirements for flow meters;
- inspection of process connections;
- ensuring that welding activities shall not affect the electronic instruments already installed.

Appendix 2 shows a complete list of inspection & testing requirements. It shall be completed and agreed with the Principal as it ensures that all parties are aware of the agreed activities. This filled-out scheme (in Appendix 2) is only indicative and is to be used as a suggested approach.

The criteria that are used to decide whether or not a particular activity is to be carried out shall also be documented.

Vendor assistance may be required to test and commission instruments or systems. Depending on the capabilities of the Contractor and the size of the project, vendor assistance may be needed for the following examples:

- DCS
- IPS
- Flow computers
- Tank gauging
- NIR QMIs
- Complex smart in-line instruments

Testing and inspection shall be planned and a procedure covering the skills required shall be followed. Procedures for the testing and inspection of these systems shall be prepared by the specialists employed and approved by the Contractor prior to their being issued to the

Principal.

Adequate communications facilities including (mobile) telephones shall be provided to allow efficient inspection and loop testing.

3. FACTORY ACCEPTANCE TEST (FAT)

The purpose of a factory inspection and factory test is to check whether the instruments and instrument systems to be supplied comply with the requirements stated in the purchase order.

The scheme in Appendix 2, once completed by the Contractor and agreed with the Principal, shows which typical instruments need to be inspected. The same list may be used to indicate where a random check is allowed, for example by using the character "R" instead of "X".

A factory inspection/test, if required, shall be carried out by an inspector who represents the Contractor.

The inspector shall prepare and follow strictly an inspection procedure in accordance with the Quality Plan (Section 2).

The Manufacturer shall prove that equipment used for calibrations is suitable to calibrate the instrument (see also section 5), and is calibrated and traceable to national standards.

The inspector shall use test procedures and inspection sheets for all items. Whenever available, manufacturers' procedures and instructions shall be used. Package units shall conform to DEP 32.31.09.31-Gen.

Final calibration of analyser systems shall be carried out during commissioning, prior to the start-up of the process plant.

The test plan for DCS and IPS shall be prepared by the Manufacturer and agreed with the Contractor and Principal. The test procedure shall be designed specifically for the project. Performance reports shall be generated.

4. INCOMING MATERIALS AT THE WAREHOUSE

The inspection of all incoming materials identified in the Quality Plan shall be carried out immediately upon arrival. All material inspected shall be checked against the requisition and specifications by a competent person. Material certificates and calibration certificates shall be checked and compiled by the Contractor before handing them over to the Principal. The results of the inspection shall be documented. Any material found to deviate from the requirements of the requisition and specification shall be set aside and dealt with according to a non-compliance procedure.

Goods with damaged packaging shall be set aside for further investigation.

Protective covers shall be put back after inspection.

5. WORKSHOP, TOOLS AND TEST EQUIPMENT

The workshop, tools and test equipment shall be in accordance with DEP 70.08.10.14-Gen.

The instrument field workshop shall be adequately equipped with inspection and test facilities and tools capable of repairing and calibrating the instrumentation to be installed to the required accuracy. It shall also be provided with electrical power supply and utilities such as water and dry, clean compressed air.

Sufficient tools and test equipment shall be provided so as not to hold up the work.

The workshop inventory including tools and test equipment shall be included in the Quality Plan and approved by the Principal.

All equipment which will be used for the testing and calibration of instruments shall be calibrated in the units of measurement selected for the project, normally SI units.

The accuracy of test and calibration equipment shall be at least twice as good as the Manufacturer's stated accuracy of the instrument(s) to be tested.

A list of typical test and calibration equipment is included in Appendix 3.

6. TRACEABILITY OF CALIBRATIONS

Check and document the vendor calibration certificates for all instruments and instrument systems, including those supplied with equipment packages. Contractors and the Principal shall agree on a list of instruments for the calibration requirements. Refer to Appendix 2.

All calibration equipment shall be provided with a calibration certificate.

The certificates shall be traceable to a primary standard certified by an accredited laboratory. Field test equipment (including portable equipment) shall be tested against calibration standards at intervals to be determined by the Contractor in accordance with ISO 10012 and shall be approved by the Principal.

An accredited laboratory can be recognised by its 'Certificate of Accreditation' which is awarded by a national or international standards body.

The following are examples of accredited laboratories or bodies:

VSL : Van Swinden Laboratorium, Netherlands

NPL : National Physical Laboratory, UK

PTB : Physikalisch-Technische Bundesanstalt, Germany

BNM : Bureau National de Métrologie, France

ETL : Electrotechnical Laboratory, Japan

NBS : National Bureau of Standards, USA

SIRM : Malaysia

The traceability documents, including calibration certificates of individual instruments, shall be documented and controlled according to the quality system being used.

The method of calibration shall be in accordance with the manufacturer's instructions and can often be found in the equipment's instruction manual.

CALIBRATION MATERIALS AND CHEMICAL STANDARDS.

When calibrating QMIs the various calibration gases, liquids etc. shall be formulated to reflect the concentrations expected in the process streams under normal operating conditions. The quality of the calibration materials shall conform to the agreed requirements as indicated by the supplier of the analyser and the Contractor. All calibration certificates shall indicate the due date for re-calibration or re-certification.

The certificate of gravimetrically prepared calibration materials shall be derived from the "Certificate of Preparation" (weighing procedures) and not from post-preparation analyses and subsequent "Certificate of Analysis". Other calibration materials shall be issued with a "Certificate of Analysis".

Gravimetrically prepared calibration materials shall be used when maximum accuracy is required of on-line analysers that measure composition. For checking and testing (e.g. repeatability test), either a traceable or a secondary standard shall be used.

Once calibration materials have been delivered and installed at site they shall be looked after by the site's plant Laboratory personnel - the ultimate custodian. It is the responsibility of the custodian to ensure that the installed calibration materials remain certified for continued use. Until the plant is finally handed over, calibration materials shall remain in the hands of the Contractor.

7. FIELD INSPECTION - SCOPE AND PROCEDURES

The purpose of field inspection is to ensure that what has been installed will work as needed and can subsequently be maintained. The Contractor shall validate the conformance of the installation with all the approved documents.

The latest revisions of all construction drawings and data, relevant DEPs and procedures as specified in the agreed Quality Plan shall be available before inspection and testing begin and shall be used. These construction documents are used as the primary documents to verify installations and hook-ups. Any changes to these documents resulting from either the construction activity or engineering design shall be controlled by a change procedure as described in the quality system.

Every instrument shall be inspected by the Contractor. Random checks by the Contractor are not allowed. It is the responsibility of the Contractor to ensure that at least 24 hours' notice of any inspection and test is given to the Principal. Instruments fitted at the factory (pre-fabricated units) may be visually inspected provided the relevant factory inspection certificates are available.

Appendix 4 shows some examples of field inspection items.

Inspection sheets and verification forms shall be used to record inspection findings. If an instrument database is being used at site or on the project then the inspection and test results shall be stored in it. The same database shall be transferred to the Instrument Maintenance Management System. The database shall also be utilised to produce progress reports.

Pressure testing shall be carried out on the installed instrument and analyser impulse and transport lines. Leak testing shall be carried out on the installed instrument signal tubing.

The Principal shall audit the Contractor's test and inspection activities. The procedure for this shall be included in the Quality Plan.

The following shall be agreed with the Principal.

1. What the work instructions and inspection sheets are for each item.
2. What the overall time-schedule is and what the detailed daily schedule is.
3. What the relevant engineering and construction drawings are, as needed for inspection and testing.
4. How notification is to be given to the Principal for inspection and testing.
5. How progress shall be reported.
6. The procedure for clearing rejected items (punch list).
7. The procedure for handling changes.
8. The procedure for handling non-conformance materials.
9. The procedure describing how the design can be queried.

As a general rule, the sensors of gas detector systems should be installed during or shortly before commissioning and the sensors should remain powered-up once installed. Proper protection as recommended by the Manufacturer shall be applied to the sensors if powering-down is unavoidable. The possibility may be considered of removing the sensors from their housing and storing them at an appropriate location.

Aspirated, ultra-sensitive smoke detection systems are very susceptible to air-borne dust. Commissioning should therefore be done as late as possible to allow the dust in newly constructed buildings to settle down.

Polyethylene fire-detection tubing shall be installed only after paintwork has been completed so as to avoid chemical attack of the tubing.

8. INTERNAL FUNCTION CHECK

The internal functions of each instrument system shall be tested live (i.e. with power-on). This shall include complete testing of all communications between systems. The limits of an IFC are from and to the Main Distribution Frames field terminals for every signal and between systems within the same building.

The IFC shall include all aspects of the instrument system or tag being tested. This shall include:

- All associated DCS functions, displays and reports.
- All associated IPF functions, displays and reports.

The IFC shall verify all entities or items that are internal to all systems (such as the DCS). This shall include Numerics, Timers, Flags, Matrices and Parameters.

Note Any instrument signals contained within the buildings or within systems contained within the building shall be tested and commissioned once only. These signals shall include system alarms, cabinet alarms, fire detectors, manual call points, smoke detectors, HVAC systems, earth fault detection devices and shall be witnessed in accordance with the QA procedures described above.

9. OPERATIONAL FUNCTION CHECKS

The aim is to verify the installation against the design's functional purpose. Instrument documentation such as loop sheets, data sheets and software block diagrams shall be used. The check is to ensure that components are connected and all function correctly (from the wet-end of measurement, through control schemes to operators' displays and out to the actuated media). The performance of all the instrument system's features shall be functionally verified.

OFC shall be carried out for each instrument, tag or instrument system after field inspection has been completed and accepted. Once the OFC has been done then any subsequent change to the tag, instrument or system means that the OFC has to be done again. The change procedure shall be strictly adhered to.

The test shall not be used for calibrating instruments or systems. Adjustments shall be avoided except when in-situ calibration is necessary.

The OFC shall also include a check that the data on both drawings and the site's Instrument Maintenance Management System (IMMS) is correct and up-to-date. The Principal shall not sign off an instrument, tag or system until he has evidence that this has been achieved

Exactly as for field inspection, the same things shall be prepared and agreed with the Principal.

Testing of analysers and analyser systems shall take place only when:

- the required utilities are available, operational and correctly set;
- an analyser house has been commissioned including its systems, HVAC, safeguarding, electrical system and sample disposal system.

Analyser systems should remain powered-up upon initial calibration and shall remain isolated from the process until the normal operating conditions prevail for which the analyser systems have been designed.

10. 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.

SHELL STANDARDS

Index to DEP publications and standard specifications	DEP 00.00.05.05-Gen.
Instrumentation for equipment packages	DEP 32.31.09.31-Gen.
Instrument technical centre and workshops	DEP 70.08.10.14-Gen.

INTERNATIONAL STANDARDS

Quality management and quality assurance standards	ISO 9000

Issued by:
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Switzerland
Copies can also be obtained from national standards organisations

APPENDIX 1 OVERVIEW OF ACTIVITIES AND RELATED QUALITY DOCUMENTS

Steps & activities	Required documents
Define: - scope of work - criteria for quality requirements - time schedule - communication - reporting system - audits by the Principal	 Project Specification by Principal This DEP & Project specification Refer to overall construction planning Quality Plan Quality Plan Quality Plan
Define: - organisation - personnel competency requirements - accommodation, facilities, workshop - test equipment - internal & external interfaces	Procedures in the Quality Plan
Information flow from Principal to Contractors - requisitions - P&I diagrams (PEFS) - hook-ups; loop sheets; logic diagrams - vendor documentation - calibration certificates of instruments - ex-proof certificates - material certificates - other relevant documents	Construction Package
Implementation - conformance checks on certificates - field inspections - point-to-point checks - internal function checks - operational function checks	Procedures in the Quality Plan
Managing non-conformance & follow ups	Procedure in Quality Plan
Progress control	Procedure in Quality plan
Internal audits	Procedure in Quality Plan
Control of documents	Procedure in Quality Plan
Change control	Procedure in Quality Plan
Hand-over by Contractor to Principal	Procedure in Quality Plan

APPENDIX 2 EXAMPLE OF INSPECTION SCHEME

Instrument Type	Calibr-ation	Config-uration	Inspec-tion	Certifi-cation	Inspec-tion	Workshop Calibration	Insitu Calibration/ Verification	Vendor/3rd party Assistance	Internal Function Test	Operational Function Test
DCS Control System		X	X					X	X	X
PLC System		X	X					X	X	X
Logic System		X	X					X	X	X
System Cabinets (MDF ASU etc)		X	X						X	X
Local Panels		X	X							X
General Instruments (Aux. Room)										
Axial Displacement							X		X	X
Convertor							X		X	X
Heat Detector				X					X	
Humidity Sensor									X	
Smoke Detector							X		X	
Trip Amplifier							X		X	X
Vibration Monitor							X		X	X
General Instruments (Field Mounted)										
Axial Displacement							X			X
Convertor							X			X
Vibration Monitor							X			X
Analytical Instruments										
O2 Content	X			X			X			X
H2S Toxic Gas Detector	X			X			X			X
Flammable Gas Detector	X			X			X			X
Viscosity	X			X				X		X
Density	X			X				X		X
pH	X			X						X
GLC	X			X				X		X
Flow Instruments										
Coriolis	X			X			X			X
Flow Element (Orifice, Venturi etc.)				X						
Flow Switch	X			X						X
Magnetic	X			X			X			X
Ultra Sonic	X			X			X			X
Turbine	X			X						X
Vortex	X			X						X
PD Meter	X			X		X		X		
Level Instruments										
Capacitance	X			X			X			X
Float Switch						X				X
Radar	X			X			X	X		
Tank Gauging	X			X			X	X		
Torque Tube Displacer (E)							X			X
Torque Tube Displacer (P)							X			X
Ultra Sonic	X			X			X	X		X
Radio Active	X			X			X	X		X
Pressure Instruments										
Local Controller	X			X						X
Pressure Gauge	X			X						
Pressure Switch							X			X
Pressure Transmitter (E)	X	X		X						X
Pressure Transmitter (P)	X	X		X						X
Pressure Transmitter (D)							X			X
Temperature Instruments										
Bimetallic Temperature Gauge				X						
Filled System Transmitter (E)	X			X						X
Filled System Transmitter (P)	X			X						X
Fire Detector										X
RTD										
Temperature Switch				X		X				X
Thermocouple				X						
Thermowell				X						
Convertor / Transmitter (E)	X	X		X						X
Convertor / Transmitter (P)							X			X
Convertor / Transmitter (D)										X
Valves										
Ball Valves	X			X			X			X
Control Valves	X			X			X			X
Tight Shut Off Valves	X			X			X			X
Solenoid Operated										X

APPENDIX 3 LIST OF TYPICAL TEST EQUIPMENT FOR A FIELD INSTRUMENT WORKSHOP

1. Bench top unit.
2. Panel with adjustable air supply.
3. Plug and socket panel.
4. Stabilised DC power supply.
5. Analogue precision gauges.
6. Digital Pneumatic Pressure calibrators.
7. Digital multi meters.
8. Digital temperature calibrators.
9. Portable manually operated hydraulic pumps (bucket pumps).
10. Low pressure, hand-held pressure pumps.
11. Vacuum pumps (manually operated).
12. Dead weight tester.
13. Thermostatically controlled temperature bath.
14. Sets of standard (precision) mercury-in-glass thermometers.
15. Decade resistance box.

APPENDIX 4 EXAMPLES OF FIELD INSPECTION ITEMS

1. UNDERGROUND CABLE INSTALLATION.

Trench Inspection.

This inspection is required to ensure, prior to pulling cables, that the trench preparation is complete and in accordance with the specification and route drawings.

Cable Laying.

This inspection is required to ensure that cables have been laid and identified in accordance with the specification and route. This inspection is required for each layer of cables within a trench. Cable ends shall be protected from moisture ingress.

Glanding & Termination.

This inspection is required to ensure that the cables have been glanded and terminated in accordance with the specification and termination drawings. Care shall be taken to ensure that the field cabling is not energised by the instrument systems. The field termination/isolation (knife terminals) shall be opened and clearly labelled.

Cable Testing

Megger test of underground cables should be carried out after laying, trench backfilling, glanding & termination have been completed for the cable and prior to paving.

2. ABOVE GROUND CABLE INSTALLATION.

Cable Supporting Infrastructure.

This inspection is required to ensure that the cable supporting infrastructure is complete (prior to pulling cables) and in accordance with the specification and route.

Cable Laying.

This inspection is required to ensure that the cables are correctly installed to their final destination. Cable ends shall be protected from moisture ingress.

Glanding & Termination.

This inspection is required to ensure that the cables have been glanded and terminated in accordance with the specification and terminal drawings.

Testing.

Testing of above-ground cables should be carried out after laying, glanding and termination activities have been completed.

3. INSTRUMENT AIR SUB HEADER.

This inspection is required to ensure that the instrument air subheaders supporting and infrastructure is complete and in accordance with the specification and agreed route.

A procedure shall be developed and agreed with the Principal for cleaning and leak testing the instrument subheaders. These tests should be carried out for each take-off from the main header.

The test procedure for the secure air system shall confirm that the requirements of the specification are met with regard to the number of operations for the associated equipment.

4. INSTRUMENTS AND INSTRUMENT PANELS.

Impulse/Sample Lines.

This inspection is required to ensure that instrument impulse lines have been installed in accordance with the specification and drawings. Testing should be carried out at a minimum of the relief pressure of the associated system unless otherwise agreed with the Principal.

Cabling.

This inspection is required to ensure that the cables have been glanded and terminated in accordance with the specification and termination drawings.

5. CABINET AND SYSTEM INSTALLATION.

A full inspection of instrument system cabinets shall be carried out to assess any transport damage from transportation prior to installation. Any defects found during this inspection shall be reported to the Principal and noted on the delivery notes of the equipment prior to the supplier being informed.