



RP 30-12

INSTRUMENTATION AND CONTROL FIELD INSTRUMENTATION FOR CHEMICAL PROCESSING PLANT

February 1997

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SCOPE AND PURPOSE This Recommended Practice defines all BP minimum requirements for the selection, design and installation of all field instrumentation. When available the practice uses the requirements of International Standards, or where no widely accepted standard is available the requirements of British Standards are referenced. In many cases the local National Standard will be equivalent and acceptable. Any specific project should review the acceptability of the local National Standard. It is intended that the document be used by both BP personnel as a guidance and by competent design contractors as a statement of requirements. It is not expected that any section of the document be issued directly to individual instrument suppliers.											
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FOREWORD

Introduction to BP Group Recommended Practices and Specifications for Engineering

The Introductory Volume contains a series of documents that provide an introduction to the BP Group Recommended Practices and Specifications for Engineering (RPSEs). In particular, the 'General Foreword' sets out the philosophy of the RPSEs. Other documents in the Introductory Volume provide general guidance on using the RPSEs and background information to Engineering Standards in BP. There are also recommendations for specific definitions and requirements.

Value of this Recommended Practice

This Recommended Practice defines all BP minimum requirements for the selection, design and installation of all field instrumentation. Its implementation will result in safe and effective instrument installation.

Application

Text in italics is Commentary. Commentary provides background information which supports the requirements of the Recommended Practice, and may discuss alternative options.

This document may refer to local, national or international regulations but the responsibility to ensure compliance with legislation and any other statutory requirement lies with the user. The user should adapt or supplement this document to ensure compliance for the specific application.

Qualifications to Applicability

This Guidance for Specification although a Group document has been prepared and developed by BP Chemicals and is specifically designed for use in Chemical Plants.

Feedback and Further Information

Users are invited to feed back any comments and to detail experiences in the application of BP RPSE's, to assist in the process of their continuous improvement.

For feedback and further information, please contact Standards Group, BP International or the Custodian. See Quarterly Status List for contacts.



1. SCOPE AND PURPOSE

This Recommended Practice defines all BP minimum requirements for the selection, design and installation of all field instrumentation.

Where available the practice uses the requirements of International Standards, or where no widely accepted standard is available the requirements of British Standards are referenced. In many cases the local National Standard will be equivalent and acceptable.

Any specific project should review the acceptability of the local National Standard. It is intended that the document be used by both BP personnel as a guidance and by competent design contractors as a statement of requirements. It is not expected that any section of the document be issued directly to individual instrument suppliers.

2. MEASUREMENT

2.1 Pressure Measurement

This section specifies the requirements of BP for process pressure measurement.

The practice shall apply to process package equipment, including mechanical machines and Boiler systems.

2.1.1 Process Gauges

2.1.1.1 Process gauges shall be specified in accordance with BS 1780 Bourdon tube gauges and vacuum gauges.

With the following additions:-

2.1.1.2 Safety pattern gauges as detailed in [BS 1780](#) shall be used on all duties above 25 Barg.

2.1.1.3 The use of over-range protection devices shall be avoided.

2.1.1.4 U-tube manometers shall not be used on permanent process measurement.

2.1.1.5 Tapered threads on process measurement gauges shall be avoided.

2.1.1.6 Direct mounted gauges shall be 150mm diameter.

2.1.1.7 Direct mounted gauges shall have 15mm (or 1/2") connections. No thread adaptors shall be used.



- 2.1.1.8 Panel mounted process gauges shall be a minimum diameter of 100mm. Process connection shall be a minimum of 10mm (or 3/8"). No thread adaptors shall be used.
- 2.1.1.9 *Consideration should be given to the use of Shaffer diaphragm gauges when the measurement of viscous, corrosive, powders, or slurry type fluids is required.*
- 2.1.1.10 *Consideration should be given to the use of Shaffer diaphragm gauges when a greater over-range protection is required.*
- 2.1.1.11 *Where measurement oscillations are anticipated consideration should be given to the use of restriction orifice or damping devices.*
- 2.1.1.12 *The use of any type of differential pressure gauge should be avoided.*
- 2.1.2 Pressure switches
- 2.1.2.1 Irrespective of the process fluid the metallurgy of all wetted components shall be 316 stainless steel as a minimum.
- 2.1.2.2 All process connections shall be a minimum of 15mm (or 1/2"). No thread adaptors shall be permitted.
- 2.1.2.3 Differential switches shall not be used.
- 2.1.2.4 No switches of any type shall be used on category 1 or 2A shut-down systems as described by BP Group [RP 30-6](#). The use of switches in conjunction with DCS systems should be avoided. Pressure transmitters should be the preferred device.
- 2.1.2.5 Switches shall not be used on pressures less than 25 mBar.
- 2.1.2.6 Pressure switches shall not be used on pulsating pressure duties.
- 2.1.2.7 Switches shall not be used with any form of over-range protection device.
- 2.1.2.8 *Because of the hidden nature of some failures the use of switches should be avoided where high integrity is considered essential.*
- 2.1.2.9 *The manufacturers use of internal threads should be carefully considered.*
- 2.1.3 Pressure transmitters
- 2.1.3.1 Transmitters shall not be used on measurements ranges of less than 4mBar.



- 2.1.3.2 Transmitters should be used on pressure trip inputs to a category 1 and 2A system as defined by BP Group [RP 30-6](#).
- 2.1.3.3 Irrespective of the process fluid the metallurgy of all wetted components shall be 316 s.s as a minimum.
- 2.1.3.4 *Where high integrity pressure measurement is required transmitters should be used as the preferred method.*
- 2.1.3.5 *Pressure transmitters should be considered where large over-range conditions exist.*
- 2.1.4 Pressure Measurement installations
- 2.1.4.1 [BS 1780](#) The installation methods detailed shall apply to gauges, switches and transmitters equally.
- The following additions apply:-
- 2.1.4.2 The range of standard hook-up methods are provided for each mechanical line specification (Section 4.3.2.14). These shall be adhered to as required for the process fluid being measured.
- 2.1.4.3 Gauges of diameters greater than 150mm shall be externally supported in addition to the hook-up piping.
- 2.1.4.4 All measurement devices shall be mounted only in the vertical plane with the process connection to the bottom.
- 2.1.4.5 Safety pattern gauges shall not be surface mounted or have their blow-out hole restricted.
- 2.1.4.6 Devices on vapour duties shall be considered analogous to steam with respect to the use of siphon traps.
- 2.1.4.7 Closed drain systems shall be used on toxic duties.
- 2.1.4.8 Restriction orifices should be considered on toxic, corrosive, and flammable duties.
- 2.1.4.9 *The use of secondary isolation valves should be considered where the hook-up length is in excess of 5.0m, or the primary isolation is inaccessible.*
- 2.1.4.10 *Vapour traps on liquid duties should be avoided.*
- 2.1.4.11 *Liquid traps on vapours other than any designed siphon should be avoided.*
- 2.1.4.12 *Switches and transmitters should be supported from permanent structures in addition to the instrument hook-up. Hand-rail or grating supports shall not be used.*



- 2.1.4.13 *Where secondary mechanical support is not provided the hook-up length should be kept to the absolute minimum to avoid unwanted pipe tensions and vibrations. Consideration should be given to the use of direct instrument mounting.*
- 2.1.4.14 *The use of purges should be considered on potential blockage duties.*
- 2.1.4.15 *Purges should not constitute the only metallurgical protection on highly corrosive duties.*
- 2.1.4.16 *The use of fluid seal systems should be considered on potential blockage duties.*
- 2.1.4.17 *The use of a filter should be considered on powder measurements.*

2.2 Temperature Measurement

This section specifies the requirements of BP for process temperature measurement.

The practice shall apply equally to process package equipment, including mechanical machines.

The preferred temperature measurement device should be a PT100 RTD sensor to [IEC 751](#) with a head mounted converter to provide a 4-20 mA or "SMART" signal.

- 2.2.1 Local indication
 - 2.2.1.1 Glass thermometers shall not be used on permanent installations.
 - 2.2.1.2 Gauges shall be of the liquid or inert gas filled type.
 - 2.2.1.3 Capillaries shall be a maximum of 10m.
 - 2.2.1.4 Mercury shall not be used for any type of device.
 - 2.2.1.4 *The bulb and capillary material should be as a minimum ANSI 316 stainless steel.*
 - 2.2.1.5 *Local indication should not be attempted outside the range -40° to 500° Celsius.*
- 2.2.2 Resistance Thermometers
 - 2.2.2.1 Resistance thermometers shall be purchased in accordance with [IEC 751 \(BS 1904\)](#) and sized physically in accordance with [BS 2765](#).

With the following additions:-
 - 2.2.2.2 Uncompensated measurements (2-wire) shall not be used.
 - 2.2.2.3 Resistive elements shall not be used outside the range -200° to 750° Celsius.

- 2.2.2.4 *The diameter of the element should be 6mm with a tolerance of +/- 0.03mm.*
- 2.2.2.5 *The resistance head should terminate in a three or six wire block.*
- 2.2.2.6 *The termination block should be spring loaded to ensure a good thermal contact at the element tip.*
- 2.2.2.7 *The termination head enclosure should be have a minimum rating of [IP 55 \(IEC 529\)](#).*
- 2.2.2.8 *Resistive elements should be considered preferable to a thermocouple device. Operating range and high vibration are two examples when exceptions may occur.*
- 2.2.3 Thermocouples
- 2.2.3.1 Thermocouples shall be specified to comply with [BS 1041](#): Part 4 and [BS 4937](#): Part 4.
- 2.2.3.2 Compensating cables shall be in accordance with [BS 1843](#).
- With the following additions:-
- 2.2.3.3 Type K couples shall be used where the total required working range is within - 100° to 1000° Celsius.
- 2.2.3.4 *The diameter of the element should be 6mm with a tolerance of +/- 0.03mm.*
- 2.2.3.5 *The use of thermocouples other than type K should consider range, accuracy, linearity and cost.*
- 2.2.3.6 *Thermocouples should not be installed without cold junction compensation.*
- 2.2.3.7 *The couple should be terminated in a two or four wire block. The block should be spring loaded to ensure good tip thermal contact.*
- 2.2.3.8 *The head should be protected to [IP 55 \(IEC529\)](#).*
- 2.2.3.9 *The type of thermocouple cable insulation used should consider the operating range of the device.*
- 2.2.3.10 *The failure mode of the device (burnout) should be carefully considered for the duty.*
- 2.2.4 Temperature Transmitters
- 2.2.4.1 *The use of temperature converting transmitter heads (4-20 mA or "SMART") is equally acceptable. The requirements for the pre-converted signal should comply with this practice.*
- 2.2.4.2 *The temperature head should be protected to [IP 55 \(IEC 529\)](#).*
- 2.2.4.3 *Burn-out conditions should be considered.*

2.2.4.4 *Pneumatic temperature transmitters should not be used.*



- 2.2.5 *Temperature switches*
- 2.2.5.1 *Temperature switches shall not be used on category 1/2A shut-down inputs as defined by BP Group [RP 30-6](#).*
- 2.2.5.2 *The use of temperature switches should be avoided.*
- 2.2.6. **Thermowells**
- 2.2.6.1 Temperature elements shall be installed in a thermowell to allow on line maintenance, with the exception of embedded devices in machines, boilers and special duty devices.
- 2.2.6.2 Wells should be of a single forged construction tapered throughout its length to avoid vibration.
- The temperature sensor, head and well should be purchased as a composite unit. Each component should be individually tagged.
- 2.2.6.3 Wells shall be manufactured from [ANSI 316](#) stainless steel as a minimum.
- 2.2.6.4 *The following velocity criterion should not be exceeded:-*
- | | | | |
|-------------------------|------------|------------|------------|
| <i>well length (mm)</i> | <i>225</i> | <i>300</i> | <i>450</i> |
| <i>velocity (m/s)</i> | <i>18</i> | <i>11</i> | <i>5</i> |
- Where the velocity is exceeded the well design should be carefully assessed for resonance effects and approved by BP.*
- 2.2.6.5 *BP approval is required where special (non standard) wells are required. Fast response and small line diameters are examples where specials may be required.*

2.3 **Level Measurement**

This section specifies the requirements of BP for process level measurement.

The practice shall apply equally to process package equipment, including mechanical machines.

- 2.3.1 **General Requirements**
- 2.3.1.1 Level devices associated with boiler systems shall conform to the relevant statutory requirements.
- 2.3.1.2 Control and trip level devices shall not share the same measurement bridge where the process fluid has a risk of fouling.



- 2.3.1.3 Any level device in use as part of a shut-down system defined by BP Group [RP 30-6](#) shall comply with the requirements of that document.
- 2.3.1.4 Where highly corrosive, toxic, or flammable fluids are being measured, all measurement lines to the transmitter should be installed with restriction orifice plates as defined by section 4.3.2.14.
- 2.3.1.5 The preferred method of level measurement should be a differential pressure transmitter.
- 2.3.1.6 *All level devices should provide a facility for routine calibration and test.*
- 2.3.1.7 *A means of process isolation to the measurement device should be provided at the vessel.*
- 2.3.1.8 *Local level control should be avoided.*
- 2.3.1.9 *The operating length of a sight glass should represent the full physical working range of the vessel. Any associated instrument level measurement should be calibrated to indicate over the same length.*
- 2.3.1.10 *Where level switches are installed the continuous device should operate over a distance at least equal to the distance between the switches.*
- 2.3.1.11 *The potential error should be considered when differential transmitters and displacer systems are used on vessels where the contents are subject to changes in density.*
- 2.3.1.12 *The use of level bridles should be avoided. Dedicated nozzles for each individual level device are preferred.*
- 2.3.1.13 *Any bridle installation should be installed with isolation valves if there is any risk of fouling.*
- 2.3.2 Displacers and switches
- 2.3.2.1 Displacers shall not exceed 2.0m in length.
- 2.3.2.2 Displacers and switches shall not be direct mounted into pressurised or agitated vessels.
- 2.3.2.3 Float operated level switches shall be glandless and installed in separate float chambers.
- 2.3.2.4 Irrespective of the process fluid the metallurgy of any float and linkage shall be [ANSI 316](#) stainless steel as a minimum.
- 2.3.2.5 *Where level displacers installed in chambers are used to provide a level measurement of a hot liquid, care should be taken to ensure that the hot/cold density difference between the vessel and the chamber does not create errors which are unacceptable.*



- 2.3.2.6 *Float chambers should always be provided with drains and vents.*
- 2.3.2.7 *Displacers and switches should be avoided on duties subject to measurement line blockages.*
- 2.3.2.8 *Displacers should be considered the preferred method for liquid liquid interface measurement.*
- 2.3.3 **Differential Level Transmitters**
- Irrespective of the process fluid, the metallurgy of all the wetted components of the transmitter shall be [ANSI 316](#) stainless steel as a minimum.
- 2.3.4 **Transmitter Installation Requirements**
- 2.3.4.1 Where a purged system is used. The purge shall not constitute the only means of metallurgical protection against corrosion.
- 2.3.4.2 *A dry gas purge should be used where it is impractical to maintain a filled reference leg or where the fluid may produce fouling.*
- 2.3.4.3 *Where the top measurement line is dry and there is a vapour present, a condensation bend of at least 0.6m should fall vertically into the top isolation valve.*
- 2.3.4.4 *Where any measurement lines are liquid filled and the installation is winterised, the winterisation should be carefully selected to avoid vaporising the filled leg. Inefficient winterisation techniques are advised*
- 2.3.4.5 *The use of a liquid purge should be considered only when the use of a gas purge is impractical or not economic.*
- 2.3.4.6 *When purges are used, the design must ensure that the pressure drop created by the purge does not cause unacceptable measurement errors. A purge velocity in the region of 20cm/sec for gas and 2cm/sec for liquid is advised.*
- 2.3.4.7 *The purge velocity should be adjustable to facilitate commissioning and prevent excessive pressure drop across and pipe or installed restriction.*
- 2.3.4.8 *The use of bridles and chambers should be avoided where hot/cold density difference will create unacceptable errors.*
- 2.3.5 **Other devices**
- Shall not be used as category 1 shut-down inputs as defined by BP Group [RP 30-6](#).
- 2.3.5.1 *Capacitance and Resistance probes should be considered only:-*
- a) *on viscous fluids*
 - b) *on dirty fluids where purges are not possible*
 - c) *on powders*
 - d) *on overall or interface where the fluid may be subject to density changes.*



- e) *Where a purge is not practical or process acceptable.*
- f) *Where the vessel is below grade.*

Care should be taken to determine the dielectric constants of the fluids being measured over their full range of possible compositions and operating conditions.

2.3.6 *Sonic devices*

2.3.6.1 *Should not be used on pressurised vessels without a process isolation valve.*

2.3.6.2 *The design should ensure that changes in the density of the vapour space do not create unacceptable errors.*

2.3.6.3 *Should be considered only for:-*

- a) *powder duties*
- b) *storage vessels*
- c) *effluent pits.*

2.3.7 *Nucleonic Level systems*

2.3.7.1 *Shall comply with all appropriate statutory requirements.*

2.3.7.2 *Shall be used only with BP authority.*

2.3.7.3 *Shall be designed to minimise the activity of the radioactive source. The statutory radiation exposure limitations shall be the minimum requirement*

2.3.7.4 *The source shall be suitably protected against fire.*

2.3.7.5 *The source holder shall incorporate a lockable, source isolation method.*

2.3.7.6 *The source shall be encapsulated in [ANSI 316](#) stainless steel as a minimum.*

2.3.7.7 *Control and shut-down systems must use independent detectors. Source diversity is not a requirement.*

2.3.7.8 *Should be considered only when :-*

- a) *the fluid is subject to changes in density*
- b) *a totally non-intrusive device is required*
- c) *on powder duties*

2.3.7.9 *Caesium 137 should be the preferred source type.*

2.3.7.10 *Scintillation crystals or plastics should be used in preference to all other industrialised detector types.*

2.3.7.11 *Where continuous level measurement is required, a line detector should be used in preference to line source.*



2.3.7.12 *Any selected source size should allow at least a 10 year operating life.*

2.4 Flow Measurement

This section specifies the requirements of BP for process flow measurement.

This practice shall apply equally to process package equipment, including mechanical machines.

2.4.1 Classification of flow measurements

All flow measurement installations shall be classified depending on the purpose of its application. Although "fit for purpose" for the accuracy required is the primary criterion for classification, there shall be three guidance divisions:-

Class 1 - fiscal and commercial

Class 2 - internal accounts and plant mass balance

Class 3 - plant control and operator aids

It should be recognised that the divisions do not indicate any reliability requirement.

2.4.2 Choice of flow metering method

This practice states a requirement to use a differential flow meter generally an orifice plate whenever technically acceptable. BS 7405 should be used as a guidance as to when a different measurement technique should be used.

2.4.3 General Requirements

2.4.3.1 For class 2/3 measurements the preferred device should be a square edged orifice plate with a differential pressure transmitter providing either a 4-20mA or Smart signal output. Smart devices are preferable.

2.4.3.2 All wetted components of any flow device shall be 316 stainless steel as a minimum.

2.4.3.3 All in line flow devices shall comply with the requirements of the mechanical line specification as a minimum.

2.4.3.4 The flow metering installation shall not cause flashing or cavitation at any position in the line.

2.4.3.6 The flow installation shall not cause an unacceptable restriction to the process fluid.

2.4.3.7 Any device installed as part of a category 1 shut-down system shall comply with the requirements of BP Group [RP 30-6](#).



- 2.4.3.8 Where highly corrosive, toxic or flammable fluids are being measured, all measurement lines to the transmitter should be installed with restriction orifice plates, see section 4.3.2.14. Alternatively the orifice plate measurement holes should be of a reduced diameter equivalent to the restriction plate.
- 2.4.3.9 *The required reliability of the flow installation should be carefully considered. Reliability should generally not be traded for accuracy.*
- 2.4.3.10 *Careful consideration should be given to the maintenance requirements of any flow installation. Total meter isolation and by-pass systems are one consideration.*
- 2.4.3.11 *The full flow installation from primary element to display, process noise and speed of response should all be considered when predicting accuracies.*
- 2.4.3.12 *Where a device other than a differential meter is being considered on economic grounds. Any economic assessment should compare installed cost and life-time costs.*
- 2.4.4 Differential devices
- 2.4.4.1 All differential flow elements shall comply with the requirements of [ISO 5167 \(BS 1042\)](#).
- With the following additions:-
- 2.4.4.2 The preferred primary device for 2/3 class installation should be a concentric square edged orifice plate.
- There are many local site preferences as to types of tappings and to the use of carriers. Local preferences should generally be accepted.*
- 2.4.4.3 The orifice plate sizing detail shall be in accordance with [ISO 5167](#).
- 2.4.4.4 All tappings shall be installed with line specification mechanical isolation valves. This includes when they are installed as blind flow elements.
- 2.4.4.5 Plates sized 50mm and below shall be carrier type.
- 2.4.4.6 Plates above 200mm should be of the standard type.
- 2.4.4.8 Plates 25mm and below shall be installed with precision pipe assemblies in accordance with [ISO 5167](#).
- 2.4.4.9 Measurement differentials ranges less than 4 mBar shall not be attempted.

- 2.4.4.10 The [ISO 5167](#) stated requirements for upstream and downstream straight lengths should be accepted with the minimum stated values if the associated accuracies are considered fit for purpose.
- 2.4.4.11 Care should be taken when the inlet to the flow device is direct from the atmosphere. The requirement for upstream and downstream straight lengths must consider measurement interference from the wind.
- 2.4.4.12 For very low flow rates, small bore special purpose meter runs or integral orifice transmitters should be used. They should be specified with extreme care; considerations should include:-
- a) their compatibility to line specification
 - b) their proof of accuracy from the manufacturers
 - c) throat blockage, both probability and consequences.
- 2.4.4.13 The preferred measurement differential for sizing is 250 mBar. Other ranges should be selected from the following:
- a) 50 mbar
 - b) 100 mbar
 - c) 500 mbar
- 2.4.4.14 The type of all tapping isolation valves should be chosen to facilitate rodding free any measurement line blockages.
- 2.4.4.15 Non-concentric plates should not be used.
- 2.4.4.16 Venturi, Dall. Pitot and Nozzle type devices should be used only when the fluid pressure loss including any recovery must be minimised. Their specification should comply with the requirements of [ISO 5167](#).
- 2.4.4.17 Where there is a requirement to be able to drain the process line, drain holes should be considered.
- 2.4.4.18 Variable area devices (constant differential) should be used when a simple local economic meter is required. Instrument purges and analyser sample systems are examples.
- 2.4.4.19 Variable area devices should be installed with a method of total isolation.
- 2.4.4.20 A glass tubed variable area device shall not be used on toxic or flammable process duties.
- 2.4.5 Turbine and positive displacement meters
- 2.4.5.1 Turbine meters shall be installed with the requisite lengths of upstream and downstream straight pipe, as defined by the supplier, or as an alternative a flow straightener should be used.
- 2.4.5.2 Should be avoided where high reliability is required, typically on closed loop control and inputs to shut-down systems.

- 2.4.5.3 *Maintenance by-pass systems should be considered. They should not be provided on safety interlock systems.*
- 2.4.5.4 *The requirement for a flow limiting device should be considered.*
- 2.4.5.5 *Should not be used with abrasive fluids.*
- 2.4.5.6 *Care should be taken to ensure the signal type is acceptable when used in conjunction with a DCS system.*
- 2.4.6 Other measurement techniques
- 2.4.6.1 The requirements of the mechanical line specification shall still apply.
- 2.4.6.2 *The guidance of [BS 7405](#) is critical here.*
- 2.4.6.3 *Fit for purpose reliability should be specifically considered.*
- 2.4.6.4 *The use of maintenance by-pass loops should be considered.*
- 2.4.6.5 *Special care should be taken to ensure the suppliers are given the exact fluid data.*
- 2.4.7 Class 1 meters additional requirements
- 2.4.7.1 The accuracy requirements shall be stated specifically for each installation.
- 2.4.7.2 The accuracy requirement shall consider all local customs and excise, trading standard and commercial requirements.
- 2.4.7.3 Accuracy calculations shall be made formally and shall demonstrate the requirements of above. Calculations shall consider the full system.
- 2.4.7.4 The full metering system should be installed with a permanent method of on line system proving.
- 2.4.7.5 The proof period and pass criteria shall comply with the requirements of 2.4.7.2.
- 2.4.7.6 Class 1 measurements shall not be attempted on two phase or pulsating flows.
- 2.4.7.7 *Dual redundant system should be installed where high reliability is required.*
- 2.4.7.8 *The requirements for on line maintenance should be specifically considered.*
- 2.4.7.9 *Pressure and temperature measurement should be provided irrespective of any compensation requirements.*



2.5 On-Line Analytical Measurement

This section specifies BP requirements for the procurement and installation of on-line analysers. It is not intended to be used in the laboratory environment or as an aid to the installation of manual sampling systems.



- 2.5.1 General Requirements
- 2.5.1.1 The design and installation of on-line analyser systems shall comply with the Engineering Equipment and Material Users Association (EEMUA) [document number 138](#).
- With the following additions:-
- 2.5.1.2 Any analyser in use as part of a category 1 shut-down system shall comply with the requirements of BP Group [RP 30-6](#).
- 2.5.1.3 Any measurement used directly for shut-down inputs shall be hard wired. Serial communication is not permitted.
- 2.5.1.4 Consideration should be given to the communication method for signals used for closed loop control or critical alarms. Hard wired is again the recommendation. Redundant serial communication may be fit for purpose. On such occasions the authority of the responsibility of the BP analyser engineer is required.
- 2.5.1.5 Any vents or drain emissions shall specifically consider all local environmental legislation.
- 2.5.1.6 Any vent or drain emissions continuous or otherwise shall be kept to the practicable minimum.
- 2.5.1.7 All sections of the fast sample system shall comply with the mechanical line specification of the process line to which it is connected. Any failure to meet this requirement shall be with the agreement of the responsible BP mechanical engineer.
- 2.5.1.8 A restriction orifice plate shall be considered immediately adjacent to the main line isolation valve when the analyser system is being used to monitor flammable, toxic or corrosive fluids. Guidance is provided in section 4.3.2.14.
- 2.5.1.9 Any sample pressure reduction should be done as close to the main line take-off point as practicable.
- 2.5.1.10 All other lines after the fast sample system shall be installed using 316 stainless steel tube with compression fittings, unless otherwise specified by the BP analyser engineer.
- 2.5.1.11 All materials used as part of the sample system shall be 316 stainless steel as a minimum requirement.



- 2.5.1.12 All fluid/gas lines of the analyser and its sample system shall be provided with pressure protection.
- 2.5.1.13 All flammable or toxic bottled gases shall be stored with the minimum practicable inventory.
- 2.5.1.14 The analyser shall be designed to allow frequent routine maintenance without opening any enclosure which forms part of the hazardous area certification.
- 2.5.1.15 The composite analyser system shall be designed to have a maintenance or calibration interval of ten days or longer.
- 2.5.1.16 The analyser design shall allow routine maintenance in situ.
- 2.5.1.17 All main line isolation valves shall be easily accessible.
- 2.5.1.18 In addition to the main line isolation valve a second isolation valve shall be provided in the vicinity of the analyser.
- 2.5.1.19 *An alarm indication of analyser failure (or out of service) should be provided direct wired to the main control system or area.*
- 2.5.1.20 *An alarm indication of low analyser sample flow should be provided direct wired to the main control system or area.*
- 2.5.1.21 *Where a measurement is used for closed loop control the requirement for set point constraints should be considered.*
- 2.5.1.22 *The number of joints and fittings should be kept to a minimum within the total analyser system. This shall apply specifically within the analyser house and enclosure.*

3. INSTRUMENT VALVES

This section describes the requirements of BP for the specification and usage of instrument valves, their actuators and auxiliary equipment. Safety relief valves are not included in this practice.

3.1 General Requirements for all Instrument Valves

- 3.1.1 Generally valves shall be either globe, butterfly, angle, ball or plug. Any other special valve requirement shall be subject to BP approval.
- 3.1.2 All pressure containment parts of the valve shall comply with the requirements of the mechanical line specification.
- 3.1.3 Flanged valves shall be in accordance with [ANSI B16.5](#).



- 3.1.4 The valve body shall be a rated to [ANSI B16.5](#) CL300 as a minimum.
- 3.1.5 The valves body shall be sized 25mm and above. Sizes less than 25mm shall be used only with the authority of BP instrument engineer.
- 3.1.6 Nominal valve sizes 1 1/4, 2 1/2, 3 1/2 and odd sizes above 4 inches (in metric equivalent) shall not be used.
- 3.1.7 All components of the valve trim shall be 316 stainless steel as a minimum.
- 3.1.8 The body of the valve shall be suitably marked with the direction of flow.
- 3.1.9 All valves shall be fitted with local position indication.
- 3.1.10 All valves shall consider their noise level output at full design flow. The noise level shall not exceed any local statutory requirements, site or specific project agreements. Valve noise emission levels shall not be achieved through secondary insulation.
- 3.1.11 All valves shall be specified with a leakage requirement. Leakage's should be specified in accordance with [ANSI B16.104](#). Where leakage's better than class 6 are required, these should be specified with the acceptable leakage rate at the required process conditions.
- 3.1.12 *The valve material selection should consider effects of wear, erosion, corrosion, temperature and pressure drop.*
- 3.1.13 *Valves should be specified to have typically a ten year overhaul period. In the most extreme cases a maintenance period at a minimum of two years should be expected.*
- 3.1.14 *Consideration to the use of extension bonnets, cryogenic bonnets and bellow seal devices, should be subject to the supplier's advice.*
- 3.1.15 *The requirement for a lubrication gland should be considered.*
- 3.1.16 *Soft seats should be employed only when hard components will not achieve a satisfactory shut-off.*
- 3.2 Regulating Valves**
- 3.2.1 *The pd be considered when the nature of the control duty allows continuation of the process through the by-pass line to facilitate valve maintenance.*
- 3.2.5 *Where large volume flows and tight shut-off is required against a large pressure differential a full bore ball valve should be considered.*

- 3.2.6 *Where large volume flow and low pressure differential head loss at flow is a requirement a butterfly valve should be considered.*
- 3.2.7 *Self-acting valves should be considered only where local non-critical fixed gain only control is required.*
- 3.2.8 *Self-acting temperature control valves should not be used.*
- 3.2.9 *The shaft on any butterfly valve should be continuous through the vane.*
- 3.2.10 *The minimum size of a butterfly valve should be 50mm.*

3.3 Shut-off and Interlock Valves

- 3.3.1 Any valve in use as part of a category 1 shut-down system shall comply with the requirements of BP Group [RP 30-6](#).
- 3.3.2 Shall be specified with a leakage requirement defined by [ANSI B16.104 CLASS 5](#), or better.
- 3.3.3 Protection duty shut-off valves shall not be fitted with any process bypass line.
- 3.3.4 When the valve has no required control functionality the valve shall not create unacceptable process restriction.

3.4 Valve Actuators

- 3.4.1 Where hydraulic or electrical actuators are proposed on any valve the authority of the BP instrument engineer shall be required.
- 3.4.2 Actuator for regulating valves should be diaphragm type.
- 3.4.3 Actuators for regulating valves should generally operate with a signal pressure of 0.2 to 1.0 barg to the actuator diaphragm. The signal shall not exceed 4.0 barg.
- 3.4.4 Double pneumatic acting piston actuators shall be used only where long strokes or high forces are required.
- 3.4.5 Double acting pneumatic actuators shall not be used where the air failure mode is critical. Air cylinders may be used to achieve a none critical failure mode.
- 3.4.6 All actuators shall be specified with the required failure mode on loss of operating utility, with due regard to safe valve operation and shut-down.



- 3.4.7 Actuators shall not be used with any operating utility other than instrument air.
- The use of Nitrogen is not permitted.
- 3.4.8 Shut-off valves actuators shall be either diaphragm or piston type, spring operated on loss of air supply.
- 3.4.9 The use of actuator cv stroke stops should be avoided. Where cv stroke stops are used for safety reasons specific BP authority shall be required.
- 3.4.10 The valve end to end stroke time shall not exceed 3 times body size in seconds or be less than the body size in seconds.
- 3.4.11 The maximum stroke time of any valve shall be 30 seconds.
- 3.4.12 Consideration shall be given to the process dynamics. Where the process time constant is less than 60 seconds the maximum valve stroke time shall be less than half that of the process time constant.
- 3.4.13 Actuators shall be sized to be able to fully open and close the valve at maximum operating pressure differential across the valve and at maximum working temperature.
- 3.4.14 Actuators in use on rotary shut-off valves shall be sized to deliver twice the maximum valve torque throughout the full stroke in both directions.
- 3.4.15 Actuators in use on rotary interlock valves shall be sized to deliver one and a half times the required torque throughout the full stroke length in both directions
- 3.4.16 Actuator power available for normal valve operation shall be sized at minimum normal air pressure.
- 3.4.17 All components of the actuator, actuator linkage and valve shall be sized to withstand maximum actuator power, sized at maximum normal air pressure.
- 3.4.18 On-off actuators which rely on spring power to return the valve to the safe position should be fitted with multiple springs to effect operation.
- 3.5 Auxiliary equipment**
- 3.5.1 All solenoids shall be installed to operate directly on the actuator air supply or associated rapid vent relay.



- 3.5.2 The electro pneumatic converter and solenoid operated pilots valves shall not be mounted on the valve.
- 3.5.3 Positioners shall be provided for all regulating valves.
- 3.5.4 Positioners shall be provided with gauges to indicate supply pressure, signal in and signal out.
- 3.5.5 Valve split ranging should not be achieved within the positioner. The phasing should be achieved electronically within the main control system.
- 3.5.6 Shut-off valves shall not be fitted with a hand wheel.
- 3.5.7 *The use of booster and vent relay should be considered to obtain the required valve response times. The requirement for booster should be considered for control loops with short time constants; flow and pressure control are examples.*
- 3.5.8 *The requirement for feed back position switches should be considered.*
- 3.5.9 *Any position switches should be installed as directly on the valve shaft as practicable.*
- 3.5.10 *The requirement for a hand wheel should be considered. Considerations should include : availability of a total by-pass, valve criticality with respect to the process, controllability on hand wheel, requirement for signal maintenance and the total economics.*
- 3.5.11 *Any hand wheel should have a positive mechanical linkage method.*
- 3.5.12 *Any hand wheel should have independent position indication.*
- 3.5.13 *All auxiliary equipment should be supplied and tested in conjunction with the valve.*

4.0 GENERAL FIELD INSTRUMENT REQUIREMENTS

This section describes the requirements of BP for the selection of field instrumentation and their minimum installation specification.

4.1 Instrument Selection

- 4.1.1 Instruments shall be selected in accordance with the general principles detailed throughout this appendix.
- 4.1.2 Equipment for use in hazardous areas shall comply with the requirements of [IEC-79](#).
- 4.1.3 Certification shall be by a nationally recognised body, acceptable to the authority of the country of installation.



4.1.4 Where electrical equipment fails to comply with IEC-79 these shall be subject to BP approval.

4.1.5 Equipment for outdoor usage shall have a minimum IP rating of 55; as defined by IEC 529.

4.1.6 Equipment shall be suitable for its intended operating environment.

Considerations should include:-

- a) Geographical location
- b) Range of operating temperatures
- c) Atmospheric conditions including pollutants
- d) Humidity
- e) Dust
- f) Vibration
- g) Thermal and radiation degradation
- h) Lighting levels

4.1.7 Equipment quality shall be considered.

Fit for purpose criteria should include :-

- a) Consequence of component failure
- b) Life expectancy
- c) Maintenance frequency
- d) Maintenance accessibility

4.2 Electrical Requirements

4.2.1 Electrical Installation Requirements

4.2.1.1 Electrically powered instrumentation shall be installed in a manner to comply with the requirements of BP Group RP 12 series.

4.2.1.2 Signals used as part of a shut-down interlock system as defined by BP Group RP 30-6 shall be physically segregated from other signals throughout their installation. This includes all cables and marshalling areas.

4.2.1.3 Analogue signal types shall be in accordance with IEC 381 and 382. The preferred signal type for current transmitting devices should be 4-20 mA at 24v DC. "Smart" communication protocols are considered equally acceptable.

4.2.1.4 Low (below 5v d.c) and high level signals shall be installed in separate multicore cables to any 24DC carrier signal.



- 4.2.1.5 All individual instrument loops shall be provided with a suitable means of over current protection. The design of the circuit protection scheme should ensure any short circuit fault on one loop does not remove the supply to any adjacent loop or system.
- 4.2.1.6 All instruments in hazardous areas shall be installed and maintained in a manner to comply with the requirements of [BS 5345](#) or equivalent locally accepted standard.
- 4.2.1.7 The minimum earthing and bonding requirements to protect personnel and plant shall comply with the requirements of BP Group [RP 12-16](#).
- 4.2.1.8 Earthing and bonding shall ensure signal integrity against RF, or any form of electromagnetic induction should be reduced to a practicable minimum.
- 4.2.1.9 The earthing strategy of both tape shields and metal armour shall avoid the creation of circulating earth current loops.
- 4.2.1.10 The arrangement for earthing of intrinsically safe equipment shall comply with the requirements of the system certification and any national requirements ([BS 5345](#)).
- 4.2.1.11 *The cable routing strategy should consider:-*
- a) *The requirement for route diversity on critical related systems e.g. DCS highways and control and trip functionality.*
 - b) *The risk of attack from corrosive materials.*
 - c) *The risk of fire.*
 - d) *The risk of damage from heavy plant access, general maintenance personnel, and others.*
 - e) *Segregation from other electrical systems to avoid interference or identification errors.*
- 4.2.2 Cable Requirements
- 4.2.2.1 All cables in a hazardous environment subject to the risk of mechanical damage shall be overall steel wire armoured.
- 4.2.2.2 The insulation and sheathing of all cables shall be either PVC or low density polyethylene. Other insulation materials may be required for high temperature duties or on specialised solvent production units; these shall be used only subject to BP approval.
- 4.2.2.3 Conductor sizes shall be compatible with the required loop impedance for the instrument which it is to supply, subject to the minimum conductor sizes detailed.

- 4.2.2.4 The minimum conductor size for field installed cables shall be 0.5mm² for stranded cores or 1.0mm² for solid cores.
- 4.2.2.5 *The colour coding of cables should comply with EIC CCI P/4, although established local practices should be considered.*
- 4.2.2.6 *Cables for high level analogue signals (above 5v DC. e.g. 4-20mA) should have stranded conductors, and a twisted pair with tape screen and drain wires. Multicore may be overall screen only.*
- 4.2.2.7 *Conductors for high level digital signals should be sized to consider the volt-drop subject to the minimum sizes detailed. Screening is not a requirement.*
- 4.2.2.8 *Cables for low level signals (below 5v DC) shall have twisted pairs with tape screens. Multicores should have individual pair and overall screen.*
- 4.2.2.9 *Cables for resistance thermometer duties shall be :*
- a) *for 3 wire systems, uniformly twisted with a screen for each triplet.*
 - b) *for 4 wire systems, 2 twisted pairs with overall quad formation tape screen and drain wire. Multicores should have individual group and overall screen.*
- 4.2.2.10 *Cables for thermocouples should have twisted pairs with tape screens and drain wires.*
- 4.2.2.11 *Serial and co-axial cables should consider any vendor requirements.*

4.3 Process Connections and Measurement lines

4.3.1 Process Connections

- 4.3.1.1 All instruments requiring process measurement lines shall have an isolation valve immediately adjacent to the main process line.
- 4.3.1.2 The first isolation valve shall be under the ownership of the mechanical discipline. Reference should be made to BP Group [RP 42-1](#).
- 4.3.1.3 Isolation valves should be full bore straight through for ease of cleaning.
- 4.3.1.4 Branches for level chambers shall have a minimum diameter of 50mm.
- 4.3.1.5 Details of branches for temperature wells are provided in section 2.2 of the practice.
- 4.3.1.6 Consideration should be given to the use of restriction orifice plates on measurement lines in use on corrosive, flammable or toxic duties. Reference 4.3.2.14.



- 4.3.2 Measurement Piping
- 4.3.2.1 All measurements lines shall be either by flanged and welded schedule pipe, or tubing and compression fittings. Choice guidance is given below.
- 4.3.2.2 All flanged and welded measurement lines shall comply with the requirements of the mechanical line specification as a minimum.
- 4.3.2.3 Line specification welded lines to the instrument manifold should be by a proprietary made machined butt weld kidney flange of the same material specification as the connecting line.
- 4.3.2.4 Flanged and welded measurement lines shall be a minimum size of 15mm schedule pipe.
- 4.3.2.5 All instrument valve manifolds shall be 316 stainless steel as a minimum.
- 4.3.2.6 Compression tubing for process duties applications shall be seamless 316 stainless steel as a minimum. Guidance is provided in BP Group [RP 30-10](#).
- 4.3.2.7 Tubing should be 12mm outer diameter. Smaller diameters may be used for specific technical reasons generally analyser related duties, subject to BP approval.
- 4.3.2.8 Line specification flanges to compression fittings should use proprietary 316 stainless steel machined flanges terminating in compression fittings.
- 4.3.2.9 Compression fittings to instrument manifolds should use a proprietary 316 stainless steel machined kidney flange terminating in a compression fitting.
- 4.3.2.10 Screwed connections on measurement lines for process duties shall not be used.
- 4.3.2.11 The length of all measurement lines shall be kept to the practical minimum.
- 4.3.2.12 All measurement lines shall be adequately supported.
- 4.3.2.13 A guide to the mechanical requirement for the measurement line for fluid type is shown in the following tables :-

Class 150 Systems

Duty	Minimum Connection Size to run pipe DN (NB)	Valve Isolation (Line Spec.)	RO Needs	Interface (Line to Impulse)	Impulse Line
A	20 (3/4)	Single	No	Screwed	Compression
B	20 (3/4)	Single	No	Flanged	Compression (For condensate leg only)
H	20 (3/4)	Single	No	Flanged	Compression
I	20 (3/4)	Single	No	Flanged	Compression
K	25 (1)	Single	No	Flanged	Compression
L	25 (1)	Single	Yes	Flanged	Compression
M	25 (1)	Double	No	Flanged	Compression
N	25	Single	No	Flanged	Compression

Class 300 Systems

Duty	Minimum Connection Size to Run Pipe DN (NB)	Valve Isolation (Line Spec.)	RO Needs	Interface (Line to Impulse)	Impulse Line
A	20 (3/4)	Single	No	Flanged	Compression
C	20 (3/4)	Single	No	Flanged	Compression (for condensate leg only)
H	20 (3/4)	Single	Yes	Flanged	Compression
I	20 (3/4)	Single	No	Flanged	Compression
K	25 (1)	Double	No	N/A	Line Spec.
L	25 (1)	Single	Yes	Flanged	Compression
M	25 (1)	Single	Yes	Flanged	Compression
N	25	Single	Yes	Flanged	Compression

Key to Duties

A	Innocuous	H	Gas (Flammable)
B	LPS (NP 3.4 barg (50 Psig))	I	Liquid (Flammable)
C	MPS (NP 13 barg (188 psig))	J	Ethylene (P)
D	HPS (NP 34 barg (493 psig))	K	Hydrogen, Sulphuric Acid & Caustic Solutions
E	VHPS Saturated (BP 79.3 barg (1150 psig))	L	LPG
F	VHPS Superheated (NP 79.3 barg (1150 psig))	M	Toxic
G	EHPS (BP 128 barg (1856 psig))	N	Corrosive



Class 600 Systems

Duty	Minimum Connection Size to Run Pipe DN (NB)	Valve Isolation (Line Spec.)	RO Needs	Interface (Line to Impulse)	Impulse Line
A	20 (3/4)	Single	No	Flanged	Compression
D	20 (3/4)	Single	No	N/A	Line Spec.
H	20 (3/4)	Single	Yes	Flanged	Compression
I	20 (3/4)	Single	Yes	Flanged	Compression
J	25 (1)	Double	No	N/A	Line Spec.
K	25 (1)	Double	No	N/A	Line Spec.
L	25 (1)	Single	Yes	Flanged	Compression
M	25 (1)	Double	No	N/A	Line Spec.
N	25	Single	Yes	N/A	Line Spec.

Class 900 Systems

Duty	Minimum Connection Size to Run Pipe DN (NB)	Valve Isolation (Line Spec.)	RO Needs	Interface (Line to Impulse)	Impulse Line
A	20 (3/4)	Double	No	Flanged	Compression
E	25 (1)	Double	No	N/A	Line Spec.
H	25 (1)	Double	No	N/A	Line Spec.
I	25 (1)	Double	No	N/A	Line Spec.
J	25 (1)	Double	No	N/A	Line Spec.
K	25 (1)	Double	No	N/A	Line Spec.
L	25 (1)	Double	No	N/A	Line Spec.
M	25 (1)	Double	No	N/A	Line Spec.



Class 1500 Systems

Duty	Minimum Connection Size to Run Pipe DN (NB)	Valve Isolation (Line Spec.)	RO Needs	Interface (Line to Impulse)	Impulse Line
A	20 (3/4)	Double	No	Flanged	Compression
F	25 (1)	Double	No	N/A	Line Spec.
H	25 (1)	Double	No	N/A	Line Spec.
I	25 (1)	Double	No	N/A	Line Spec.
J	25 (1)	Double	No	N/A	Line Spec.
K	25 (1)	Double	No	N/A	Line Spec.
L	25 (1)	Double	No	N/A	Line Spec.
M	25 (1)	Double	No	N/A	Line Spec.

Class 2500 Systems

Duty	Minimum Connection Size to Run Pipe DN (NB)	Valve Isolation (Line Spec.)	RO Needs	Interface (Line to Impulse)	Impulse Line
A	25 (1)	Double	Yes	N/A	Line Spec.
G	25 (1)	Double	Yes	N/A	Line Spec.
H	25 (1)	Double	Yes	N/A	Line Spec.
I	25 (1)	Double	Yes	N/A	Line Spec.
J	25 (1)	Double	Yes	N/A	Line Spec.
K	25 (1)	Double	Yes	N/A	Line Spec.
L	25 (1)	Double	Yes	N/A	Line Spec.
M	25 (1)	Double	Yes	N/A	Line Spec.

4.3.2.15 This practice states the requirement to comply with the mechanical line specification as a minimum for all welded measurement lines. Consideration should be given to a specification above the minimum. The following is provided for consideration.

With the exception of the first line isolation valve and adjacent measurement line connecting flange, all welded lines should be as a minimum :-

- 316 stainless steel
- ANSI CL300 flanged
- Schedule 80 pipe
- ANSI CL 300 valves throughout



The increased cost of components and fabrication, dependant on project size and complexity are off-set by reduced design, rework and commissioning costs.

4.4 Pneumatic installation requirements

4.4.1 System requirements

4.4.1.1 All pneumatic instrumentation shall operate on a dedicated instrument air utility header system.

4.4.1.2 The system shall contain dried, oil free air at a pressure of nominally 7 Barg.

4.4.1.3 The system shall have a minimum capacity of 20 minutes to provide a reduced pressure of 4.0 Barg after any supply failure.

4.4.1.4 The supply and header line capacity shall have a minimum rating of 120% of normal volume usage of the total system.

4.4.1.5 The air shall have a maximum dew point of 5° Celsius below the lowest design ambient temperature.

4.4.1.6 The air headers should be filtered to a maximum of a 3 micron particular size.

4.4.1.7 *The requirements for supply failure and low pressure alarms should be considered.*

4.4.1.8 *A pneumatic isolation valve should be provided for each individual instrument user.*

4.4.1.9 *All instruments should be fitted with individual filter regulators.*

4.4.1.10 *The requirement for compressor and drier system redundancy should be considered.*

4.4.1.11 *For sizing of the header lines the following sizes should apply:-*

up to 5 users 15 mm

nominal size - a user is considered to be 0.015 m³/min

20	25
50	40
100	50
200	80

4.4.1.12 *All unused header distribution points should be fitted with isolation valves and be suitably blanked.*



- 4.4.2 Instrument air piping
- 4.4.2.1 All header distribution lines above shall comply with the requirements of the mechanical line specification.
- 4.4.2.2 All lines from header to individual lines to instruments shall be suitably identified with the user tag number.
- 4.4.2.3 Lines to individual instruments or group of instruments (5 users) shall be run in tubing, either copper or stainless steel.
- 4.4.2.4 *Typical specification for copper should be:- Tubing should be half-hard in accordance with [BS 2871](#). Fittings should be copper alloy compression type A in [BS 2051](#).*
- 4.4.2.5 *Consideration should be given to the use of PVC or low density polystyrene sheathing where environmental contaminants exist. This point is considered to be essential where a risk of H₂S exists.*
- 4.4.2.6 *Typical specification for stainless steel should be:-*
- a) *Tubing should be seamless type 316.*
 - b) *All associated fitting should be 316 stainless steel. The exact type of fittings to be used follow many different local practices and should be agreed with BP.*
- 4.4.2.7 *The use of PTFE tape or compound should be avoided throughout.*
- 4.4.2.8 *Consideration should be given to the use of armoured flexible tubing when connections are made to a equipment prone to vibration or movement.*

DEFINITIONS AND ABBREVIATIONS

Definitions

Standardised definitions may be found in the BP Group RPSEs Introductory volume.

Dual purpose valve	Any regulating valve which is also used as part of a shut-down or interlock system.
Flow device	Any device used to measure flow, continuous or switched, local indication or with transmitted signal.
Hard wired	The use of a cable pair to transfer one item of information. Either analogue or a digital switch.
Hazardous area	Is an area which may contain an explosive atmosphere either due to flammable gas or dust.
Interlock valve	Any valve in use as part of a process interlock system with no safety related requirements as defined by BP Group RP 30-6 .
Instrument valve	Any actuated valve, including valves in use on regulating duties, interlock systems and safety shut-down systems.
Level device	Any device used to measure level, continuous or point.
Process Gauge	A process gauge, is considered to be a gauge on any duty with the exception of gas bottle duties and instrument air duties less than 25 mm line size.
Regulating valve	Any actuated valve which automatically responds to a change in analogue control signal.
Shut-off valve	Any valve in use as part of a safety related interlock system as defined by BP Group RP 30-6 .
Temperature element	Any device used to measure temperature.



LIST OF REFERENCED DOCUMENTS

A reference invokes the latest published issue or amendment unless stated otherwise.

Referenced standards may be replaced by equivalent standards that are internationally or otherwise recognised provided that it can be shown to the satisfaction of the purchaser's professional engineer that they meet or exceed the requirements of the referenced standards.

International Standards

[ISO 5167](#) (BS 1042) Methods of measurement of Fluid Flow in Closed Conduits.

[IEC 79](#) Electrical apparatus for explosive gas atmospheres.

[IEC 381/382](#) Analogue signals for process control signals.

[IEC 529](#) Classification of degrees of protection of enclosures.

[IEC 751](#) Industrial platinum resistance thermometer sensors.

[EIC CCI P/4](#) Cable colour coding

British Standards

[BS 1041](#) Code for temperature measurement Part 4 thermocouples.

[BS 1780](#) Bourdon tube gauges and vacuum gauges.

[BS 1843](#) Colour code for twin compensating cables for thermocouples.

[BS 2051](#) Tube and pipe fittings.

[BS 2765](#) Dimensions of temperature detecting elements and corresponding pockets.

[BS 2871](#) Part 2 Copper tubes for general purpose.

[BS 4937](#) Part4 Thermocouple reference tables type K.

[BS 5345](#) Installation and maintenance of electrical apparatus in explosive atmospheres.

[BS 7405](#) Selection and Application for the Measurement of Fluid Flow in closed conduits.



No equivalent IEC or wholly acceptable international standard is available to the BS numbers quoted. It is recommended that the equivalent ANSI and DIN standards are taken as acceptable dependent on the geographical location.

Industry Standards

[EEUMA 138](#) Design and installation of on-line Analyser systems (formerly OCMA INP -3).

BP Group Documents

[RP 12](#) Electrical Systems.

[RP 42-1](#) Piping Systems.

[RP 30-6](#) Design philosophy for Protective Instrumentation.

