



Document No.	GP 30-90
Applicability	Group
Date	10 June 2003

Guidance on Practice for Commissioning of Instrument and Control Systems

GP 30-90

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GP 30-90. This Guidance on Practice (GP) is based on parts of heritage documents from the merged BP companies as follows:

Amoco

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| A CO-PCOM-GEN-E | Commissioning—Pre-Commissioning—General—Engineering Specification. |
| A CO-PCOM-GEN-G | Commissioning, Pre-Commissioning—General Guide. |
| A PC-PCOM-IN-C | Process Control, Checkout, and Pre-Commissioning—Instrumentation Construction Specification. |

ARCO

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| Standard 316 | Instrument Calibration, Certification, and Commissioning. |
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1. Scope

This GP provides guidance on commissioning activities to include receiving and storage, installation inspection, loop check, and system checkout of process controls and instrumentation.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

BP

GIS 30-401	Guidance on Industry Standard for Process Automation Systems (PAS).
GIS 30-402	Guidance on Industry Standard for Programmable Logic Controllers (PLC).
GIS 30-451	Guidance on Industry Standard for Human Machine Interface.
GIS 30-801	Guidance on Industry Standard for Safety Instrumented Systems (SIS).
GIS 30-851	Guidance on Industry Standard for Fire and gas Detection.
GP 12-XX	Guidance on Practice for Field Wiring.
GP 12-XX	Guidance on Practice for Heat Tracing.
GP 30-01	Guidance on Practice for Temperature Instruments.
GP 30-05	Guidance on Practice for Pressure Instruments.
GP 30-10	Guidance on Practice for Non-Fiscal Flow Instruments (Class 2 & 3).
GP 30-15	Guidance on Practice for Level Instruments.
GP 30-20	Guidance on Practice for Miscellaneous Instruments.
GP 30-30	Guidance on Practice for Field Communication Buses.
GP 30-35	Guidance on Practice for Control Valves and Pressure Regulators.
GP 30-40	Guidance on Practice for Process Automation Systems (PAS).
GP 30-45	Guidance on Practice for Human Machine Interface.
GP 30-65	Guidance on Practice for Control Panels.
GP 30-70	Guidance on Practice for Control and Instrumentation in Vendor Packaged Equipment.
GP 30-80	Guidance on Practice for Safety Instrumented Systems (SIS) – Implementation.
GP 30-81	Guidance on Practice for Safety Instrumented Systems (SIS) – Operations and Maintenance.
GP 30-85	Guidance on Practice for Fire and gas Detection.
GP 30-95	Guidance on Practice for Control Loop Tuning
GP 31-XX	Guidance on Practice on Analysers
GP 64-XX	Guidance on Practice for Fiscal Flow Instruments (Class 1)

The Instrumentation, Systems, and Automation Society (ISA)

ISA 7.0.01	Quality Standard for Instrument Air.
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3. Symbols and abbreviations

a.c.	Alternating current.
DCS	Distributed control system.
d/p	Differential pressure.
I/E	Instrument/Electrical.
I/P	Current-to-pressure.
IS	Intrinsic safety.
LRV	Lower range value.
P&ID	Piping and instrument diagram.
PAS	Process automation system.
PLC	Programmable logic controller.
RTD	Resistance temperature detector.
SIS	Safety instrumented system.
URV	Upper range value.

4. General

- a. For all checkout and commissioning activities, safety shall be the primary concern and responsibility of all involved personnel. It is required that all commissioning personnel be qualified to perform their assigned activities.
- b. Personnel involved in calibration and commissioning of instrument systems shall have experience and verifiable training to included but not limited to the following:
 1. Calibration of instruments being installed.
 2. Use of compression fittings.
 3. Installation/inspection of electrical equipment in hazardous areas.
- c. Commissioning personnel shall review, be familiar with, and adhere to all relevant portions of Health, Safety and Environmental (HSE) documents and procedures.
- d. Prior to commencing any work, a Job Safety Analysis (JSA) or other equivalent, site specific, procedure shall be conducted to confirm that persons involved are trained and competent, ensure that appropriate Personal Protection Equipment (PPE) is worn, review emergency response plans, and emphasize that each person is empowered to stop the work if it is perceived to be unsafe.
- e. If hazardous materials (chemicals, fluids, etc.) are part of the commissioning procedure, Material Safety Data Sheets (MSDS) shall be reviewed by all involved personnel prior to proceeding with any related commissioning activity.
- f. BP personnel will witness selected pre-commissioning and commissioning activities, at the discretion of BP.
- g. This GP groups tasks by phases of the construction cycle. Some testing and verification steps were combined to facilitate efficient workflow.



- h. The safe and efficient commissioning of any facility requires associated instrumentation to be installed completely, checked for integrity and commissioned for use. The steps involved in achieving this process should be clearly understood and followed.

The intent is to check instrumentation and control systems to ensure proper operation before start-up.

- i. Refer to Annex A for examples of checkout and pre-commissioning of instrument and control systems.

This is an example only; BU or project may modify to suit its specific requirements. The main objective of pre-commissioning is to ensure that instruments have no damage at this stage and are functioning within range.

- j. Prior to initiating any checkout and/or commissioning activities, mechanical completion checklists and other appropriate documents shall be reviewed and confirmed as complete and all components are acceptable for subsequent commissioning efforts.
- k. Defective instruments shall be replaced or repaired.

5. Instrumentation receiving and storage

5.1. General

- a. Upon receipt, instruments shall be checked for:
 - 1. Compliance with purchase specifications.
 - 2. Correct tagging.
 - 3. Shipping damage.
 - 4. Relevant documentation (installation and handling instructions).
- b. After inspection, instruments shall be:
 - 1. Replaced in their original factory boxes.
 - 2. Correctly tagged.
 - 3. Stored on shelves in a dry, enclosed area.
- c. Pneumatic and electrical openings should be closed with proper plugs and screw caps should be securely in place if storing instruments prior to installation.
- d. Integrity of sealed protective covers shall be maintained during storage.
- e. For instruments or control panels that have been pre-mounted on the machinery package and cannot be stored in a dry, enclosed area, special arrangements should be made between representatives from the Manufacturer and BP.
- f. Removal and indoor storage of pre-mounted instruments and control panels may be required if such devices cannot be protected from rain, humidity, temperature, or dusty conditions.

Explosion-proof enclosures are not necessarily weatherproof enclosures. Open conduit connections can allow the entrance of moisture. This subject should have been addressed during the procurement or shop inspection stage, but is sometimes overlooked.

5.2. Electronic instruments

- a. Electronic instruments shall be stored in a dust-free room between 8°C and 45°C (45°F and 110°F).
- b. If humidity is excessive, instruments shall be sealed and stored in plastic wrap, placed in a box with desiccant outside the plastic wrapping, and stored indoors.



The desiccant should not contact any wiring, terminals, or electronic parts.

- c. Manufacturer recommendations shall be reviewed to determine if climate-controlled storage facilities are required.
- d. Electronic instruments that cannot be stored in a protective environment, shall be protected as follows:
 - 1. Desiccant should be placed in instrument enclosures.
 - 2. Instruments should be covered to protect against water entry.
 - 3. Control valve ports should be protected against contamination by solids (example stones, soil, etc).

Large control valves with electronic positioners/controllers, often require outdoor storage.

5.3. Pneumatic instruments

Pneumatic instruments shall be stored in a dry area, protected from the elements.

5.4. Local control panels

- a. Panel labelling should be visible through packaging to avoid opening.
- b. If labelling is not visible, packaging shall be opened just enough to identify the control panel, then resealed and placed in a dry, enclosed or protected area with temperature between 8°C and 45°C (45°F and 110°F).
- c. In high-humidity areas, desiccant shall be placed inside the packaging before resealing.
- d. Panels with internal heaters shall be energized during storage.

5.5. Dial thermometers, pressure gauges, and gauge glasses

- a. Dial thermometers, pressure gauges, and gauge glasses shall be protected against physical damage from construction activities.
- b. Such protection may require tagging and storage in a dry, enclosed area. In that case, process connections shall be capped or plugged with metal caps/plugs until the instruments are installed.

6. Documentation

6.1. General

- a. Pre-commissioning documentation shall be organized either by system or by area.
- b. Commissioning activities shall be performed using the current edition of the following project documents:

- 1. Loop diagrams. *

Though not a design feature, loop diagrams are engineering deliverables that greatly aid the commissioning process and serve as valuable "red-line" marked up drawings to aid communication between the engineering and commissioning communities.

- 2. Piping and instrument diagrams (P&IDs). *
- 3. Instrument index.
- 4. Instrument data sheets and/or specifications. *
- 5. Instrument calculation sheets. *



6. Level transmitter URV and LRV calculations (if applicable). *
7. Orifice inspection records. *
8. Instrument design drawings.
 - a) Instrument location drawings.
 - b) Wiring diagrams.
 - c) Junction box drawings.
 - d) Cable schedules.
 - e) Instrument installation detail drawings.
 - f) Relevant motor schematics. *
 - g) Marshalling cabinet drawings.
 - h) Shutdown schematics (if applicable). *
 - i) Specialized documentation unique to specific loop types (for example, trip point calculation for current switches, panel drawings, etc.). *
9. Instrument supplier data.

Manufacturer information may be required to ensure installation, calibration, and checkout are correct.
10. Factory calibration certification. *
11. Control Strategy Diagrams (if applicable). *

They can be of great use, as they show controls from a system point of view, pointing out control interactions. Similar purpose documents are complex control diagrams or narratives. New control systems may already integrate this documentation as part of the system so it may be just a print out. Ultimately is up to the project or BU.
- c. The items indicated above with an asterisk (*) should be the minimum assembled drawings in a loop check folder for ready reference:

This supports the loop checking activities and speed up commissioning.

6.2. Records

- a. As each instrument is checked, calibrated, and commissioned, a certification record shall be completed. These records shall include the following information:
 1. Complete listing of calibration test equipment being used and acceptable tolerances.
 2. Record of test equipment calibration checks that have been performed.
 3. Readout or output values from the calibration.
 4. Commissioning services performed.
 5. Deficiencies noticed.
 6. Concerns identified.
- b. Factory certification shall be included for factory-calibrated instruments. These instruments should be verified, but not recalibrated, in the field.
- c. For each instrument loop, a separate document file shall be maintained. The following items shall be included in the file:
 1. As-built status of installation.



2. Calibration, testing, and final instrument loop certification of control system components.
3. Subsystems provided for the facility.
- d. A complete set of project drawings, marked up to reflect the as-built condition of all instruments and subsystems, shall be required at the end of the project.
- e. Changes to documents shall be recorded to show the “as-built” condition of the document. The following colour-coded format should be used:
 1. Additions shall be in red.
 2. Deletions shall be in green
 3. Comments should be in blue or grey.

7. Installation inspection

7.1. Prerequisites

- a. Air headers, takeoff lines, and signal tubes shall be cleaned by blowing clean, dry air before connecting to instrument components.
- b. Before the installation of inline instrumentation components, process lines, tanks, and pressure vessels shall be prepared as follows:
 1. Cleaned.
 2. Flushed.
 3. Pressure-tested.
 4. Blown down, if applicable.
 5. Placed in service, if feasible.

This requirement does not apply to thermowells. It is acceptable to isolate, vent and drain the instrumentation components in lieu of removal during flushing and testing, if this is a feasible alternative.

7.2. General

- a. Some installation inspection activities may be deferred and combined with system checkout or loop check.
- b. A mechanical completion documentation (including a punch list) shall be submitted to BP.
- c. Inspection of local gauges shall be performed just before commissioning activities are started.

This practice reduces the potential for damage from continued construction activities after gauges have been inspected.

- d. Miscellaneous and special instruments shall be checked for correct installation in accordance with manufacturer instructions and instrument specifications.
- e. Instruments shall be isolated during initial field inspection as follows:
 1. Signal and process valves shall be closed.
 2. Instruments shall be electrically de-energized.

7.3. Instrument inspection checks

Installation inspection for instruments and associated components (including junction boxes, control valves, relief valves, and meters) shall include checks for the following, as applicable:

