

**ENGINEERING STANDARD**

**FOR**

**INSTRUMENT WORKSHOP, LAYOUTS,**

**TEST AND CALIBRATION TOOLS**

**FIRST EDITION**

**JANUARY 2012**

**FOREWORD**

The Iranian Petroleum Standards (IPS) reflect the views of the Iranian Ministry of Petroleum and are intended for use in the oil and gas production facilities, oil refineries, chemical and petrochemical plants, gas handling and processing installations and other such facilities.

IPS are based on internationally acceptable standards and include selections from the items stipulated in the referenced standards. They are also supplemented by additional requirements and/or modifications based on the experience acquired by the Iranian Petroleum Industry and the local market availability. The options which are not specified in the text of the standards are itemized in data sheet/s, so that, the user can select his appropriate preferences therein.

The IPS standards are therefore expected to be sufficiently flexible so that the users can adapt these standards to their requirements. However, they may not cover every requirement of each project. For such cases, an addendum to IPS Standard shall be prepared by the user which elaborates the particular requirements of the user. This addendum together with the relevant IPS shall form the job specification for the specific project or work.

The IPS is reviewed and up-dated approximately every five years. Each standards are subject to amendment or withdrawal, if required, thus the latest edition of IPS shall be applicable

The users of IPS are therefore requested to send their views and comments, including any addendum prepared for particular cases to the following address. These comments and recommendations will be reviewed by the relevant technical committee and in case of approval will be incorporated in the next revision of the standard.

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**GENERAL DEFINITIONS**

Throughout this Standard the following definitions shall apply.

**COMPANY:**

Refers to one of the related and/or affiliated companies of the Iranian Ministry of Petroleum such as National Iranian Oil Company, National Iranian Gas Company, National Petrochemical Company and National Iranian Oil Refinery And Distribution Company.

**PURCHASER:**

Means the "Company" where this standard is a part of direct purchaser order by the "Company", and the "Contractor" where this Standard is a part of contract document.

**VENDOR AND SUPPLIER:**

Refers to firm or person who will supply and/or fabricate the equipment or material.

**CONTRACTOR:**

Refers to the persons, firm or company whose tender has been accepted by the company.

**EXECUTOR:**

Executor is the party which carries out all or part of construction and/or commissioning for the project.

**INSPECTOR:**

The Inspector referred to in this Standard is a person/persons or a body appointed in writing by the company for the inspection of fabrication and installation work.

**SHALL:**

Is used where a provision is mandatory.

**SHOULD:**

Is used where a provision is advisory only.

**WILL:**

Is normally used in connection with the action by the "Company" rather than by a contractor, supplier or vendor.

**MAY:**

Is used where a provision is completely discretionary.

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## 1. SCOPE

This Engineering Standard is intended for design, selection of layouts, equipment and tools required for the instrument workshop and on the plant, to cover a normal range of maintenance work on new and existing Petroleum Industries of Iran.

**1.1** Building and layouts of an instrument repair; test and calibration workshop shall be the users' particular needs and shall be furnished with necessary tools and equipment.

As an example, instrument workshop has been sized and illustrated in the Appendices to house the tool and equipment inventory considered necessary for the calibration and maintenance of the instruments and instrument systems, installed in a medium sized plant.

**1.2** The engineering contractor shall develop a tool and equipment inventory and a workshop layout, based on the actual requirements of the operating Company concerned using this procedural specification. The proposal shall then be presented for the user (owner) for his approval in writing.

### Note:

**This is a revised version of this standard, which is issued as revision (1)-2012. Revision (0)-1997 of the said standard specification is withdrawn.**

## 2. REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

### IPS (IRANIAN PETROLEUM STANDARDS)

- [IPS-C-IN-100](#) "Construction and Inspection Standard for General Instruments, Field Inspection Calibration, Testing of Instruments and Instrument Systems"
- [IPS-E-AR-120](#) "Engineering Standard for Building Air Conditioning Systems"
- [IPS-E-AR-160](#) "Engineering Standard Venting, Ventilation and Pressurization System"
- [IPS-E-EL-100](#) "Engineering Standard for Electrical System Design (Industrial and Non-Industrial)"
- [IPS-E-SF-260](#) "Engineering Standard for Automatic Detectors and Fire Alarm Systems"
- [IPS-E-SF-380](#) "Engineering Standard Fire Protection in Buildings"
- [IPS-G-SF-126](#) "General Standard for Hand and Wheel Type Fire Extinguishers"
- [IPS-G-IN-270](#) "General Standard for Instruments of Fire and Gas Detection Equipment"
- [IPS-G-IN-230](#) "General Standard Analyzer"
- [IPS-I-IN-115](#) "Periodical Inspection for Instrumentation"

### ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

- ISO/IEC-17025** "General requirements for the competence of testing and calibration laboratories"

### 3. DEFINITIONS AND TERMINOLOGY

#### 3.1 Satellite Workshop

Satellite workshop is a small workshop under the control of the main instrument workshop.

#### 3.2 Instrument Workshop

This place dedicated to provide services such as test, calibration and repair of instrument equipment.

#### 3.3 Test-Bench

Equipment specifically designed to provide a suitable work surface for testing a unit in a particular test setup under controlled conditions.

#### 3.4 Simulator

A device or program used for test purposes which simulates a desired system or condition providing proper inputs and terminations for the equipment under test.

#### 3.5. Plant Air

Plant air or tool air or service air is used for utility purposes, pneumatic tools, pumps, blowing down hoses, etc. and usually not cleaned /filtered and dried as instrument air.

### 4. INSTRUMENT WORKSHOP

#### 4.1 General

It is necessary to provide engineering maintenance with well equipped and efficiently organized instrument workshop facilities for:

- Pneumatic instrumentation
- Electronic instrumentation
- Analyzer Equipment (If any)
- Others

**Note 1:**

**The accommodation inside the building(s) shall include offices, storage, test/calibration and light machining facilities.**

For small plants, the central/main instrument workshop may form part of a larger maintenance complex together with the mechanical and electrical engineering disciplines, see Appendix A of this Standard. However, for large plants a dedicated instrument workshop should be considered.

Facilities should also be provided in control rooms and analyzer houses, together with the equipment necessary for carrying out certain local maintenance activities.

**Note 2:**

**The mechanical maintenance of items, such as control valves, could be carried out in the mechanical workshop, as mutually agreed by instrument and mechanical engineering.**

#### **4.2 Central/Main Instrument Workshop**

A small plant should operate a centralized maintenance system from a central workshop, with a certain flow pattern of equipment and materials between workshop and plant. The larger plants may require a decentralized maintenance system for closer control and economy, with the minimum number and size of 'satellite' workshops necessary for handling urgent day-to-day maintenance, in conjunction with a main workshop(s) for larger equipment and the long-term planned repairs.

##### **Notes:**

- 1) The internal design of the building should be based on a central corridor providing access to individual offices and work areas.**
- 2) The instrument workshop should be located away from machining areas or other sources of vibration.**
- 3) Special attention shall be given to provide acceptable 'noise levels' inside offices and instrument workshops.**
- 4) The internal partition walls, between rooms, should be removable to allow re-arrangements for future developments.**
- 5) Inside walls should be partially glazed where necessary, to provide a clear view.**

Apart from variations in size and layout of the buildings, the equipment to be installed in central/main and 'satellite' instrument workshops, will ultimately depend on the type and size of the process installations and the number of installed instruments.

#### **4.3 'Satellite' Instrument Workshops**

**4.3.1** The number and size of these workshops will be determined by the size and needs of each location. They may be located independently but should wherever possible also be combined with similar mechanical/ electrical 'satellite' workshops.

**4.3.2** A typical layout of a 'satellite' workshop is shown in Appendix C.

#### **4.4 The Offshore Platform-Instrument Workshop**

Workshop accommodation should be provided for the maintenance of the platform instrumentation together with storage for the necessary spare parts, test equipment and tools, in accordance with the size of the platform and the extent and type of instrumentation installed.

#### **4.5 The Sizing of Instrument Workshops**

**4.5.1** The minimum size required for work areas and offices should be based on an area of 9.5 m<sup>2</sup> as a minimum for each person, also variety and quantity of installed instruments in the plant should be considered.

**4.5.2** For offshore platforms including wellhead, exploration and production, where space is at a premium, the 'instrument workshop' could consist of one or two relatively small areas of say 3m x 6m.

## 4.6 Typical Internal Layout for an Instrument Workshop

### 4.6.1 General

The instrument workshop building, as illustrated in Appendix B, should typically comprise the following:

**1) Office accommodation for:**

- 1.1. engineers/supervisors/foremen

Provisional offices inside the workshop should be allowed to direct supervisory personnel.

- 1.2. maintenance planning personnel

This office should be of an adequate size to accommodate day-to-day planning/meetings.

**2) Workshop facilities for:**

- 2.1. receipt and despatch

This Section of the workshop should have direct access from outside and be divided into:

- receipts, for incoming instruments/material,
- despatch, for repaired instruments/components,

- 2.2. cleaning and painting

- 2.3. heavy duty mechanical/machining shop (handling large control valves, etc.)

- 2.4. pneumatic instrumentation (inspection, repairs, testing and calibration)

- 2.5. electronic instrumentation (inspection, repairs, testing and calibration)

- 2.6. industrial analyzers

**Note 1:**

**When the instrument workshop is part of a mechanical/electrical workshop complex, the sharing of facilities such as machining, welding, cleaning and painting, etc., should be considered to avoid duplication.**

**Note 2:**

**For more details, refer to article 5.**

**3) Storage facilities for:**

- necessary instrument spare parts
- consumable items (gaskets, bolts and nuts, etc.)
- chemical products
- portable analyzers

**4) Special workshop facilities for:**

- standard test equipment (of measuring and calibration, etc.)
- high-precision (machining and instrument fitting, etc.)
- electronic instrument testing
- analyzer-type instrument testing

This room should be located so that it has an outside wall to accommodate:

- an analyzer sample conditioning system
- a compressed gas cylinder storage rack

#### 4.7 Utilities

**4.7.1** The instrument workshops shall be provided with steam, water and plant air, etc., from the plant for workshop utilities system, and an instrument air supply, as appropriate

**4.7.2** Electricity for power and lighting shall be installed in accordance with the requirements. Voltages that may be required are for example, 110/230/400 Volts AC at 50 Hz, 24/110 Volts DC. The voltages required shall be indicated in the project specification and the requisitions.

#### 4.8 Workshop Buildings

##### 4.8.1 Construction

The building shall be designed in accordance with the general requirements of Standard Drawings IPS-D-CE-210 to 222.

##### 4.8.2 Floor finish

The floors in the workshop building should be finished in accordance with the requirements of the above standard and with the following exceptions:

- All rooms with concrete finish shall be sealed with a dust proof epoxy resin.
- The floors of analyzer rooms shall be finished with acid-resistant tiles, in the same way as Analyzer Houses.

**Note:**

**An oil contaminated drainage system will also be required in the analyzer room.**

##### 4.8.3 Heating ventilating and air conditioning (HVAC)

**4.8.3.1** Depending on the installed equipment and the requirements for the comfort of personnel, Heating, Ventilating and Air Conditioning (HVAC) may be considered for the following:

- standards equipment room.

This room should be protected against ingress of dust with an entrance preferably of the air lock-type. The room should also be insulated against the effects of vibration.

- electronic 'shop',
- analyzer test and calibration room,
- other offices, 'shops' and rooms as appropriate.

The HVAC System will then be in accordance with the requirements of:

[IPS-E-AR-120](#) "Building Air Conditioning System"

[IPS-E-AR-160](#) "Venting, Ventilation and Pressurization System"

**4.8.3.2** Ventilation is particularly required for the following rooms:

- cleaning and painting,
- analyzer test and calibration room

**Notes:**

1) Chemical cleaning and painting areas shall comply with national and/or local regulations with regards to ventilation, which should typically give a minimum of 30 to 50 air changes per hour, and static electricity/electrical safety in explosive gas atmospheres.

2) When forming part of a building complex, analyzer workshops and test rooms, etc., should have induced ventilation to maintain a pressure below that of the other rooms, in order to prevent escape of gases. There should also be a minimum of 30 to 50 air changes per hour.

**4.8.4 Fire and gas detection and fire protection**

4.8.4.1 The sections of the workshop building shall be protected in accordance with the following standards:

[IPS-G-IN-270](#) "General Standard for Instruments of Fire and Gas Detection Equipment".

[IPS-G-SF-126](#) "General Standard for Hand and Wheel Type Fire Extinguishers".

[IPS-E-SF-380](#) "Engineering Standard for Fire Protection in Buildings".

4.8.4.2 In addition, analyzer rooms shall be protected with gas detection systems, incorporating the automatic isolation of electric power and ventilation systems in the event of a gas leak, refer to [IPS-G-IN-230](#) "General Standard Analyzer (On Line Process Stream Analyzers)".

**5. EQUIPMENT FOR THE INSTRUMENT WORKSHOP****5.1 General**

5.1.1 The equipment contained in a modern instrument workshop shall be of sufficient quality to ensure that all repaired and re-calibrated instruments will meet the original manufacture's specifications.

5.1.2 The offices, shops and rooms of the workshop considered in this Standard are equipped with a proposed inventory of furniture, equipment, machines and tools.

**5.2 Central Workshop****5.2.1 Office accommodation**

The offices will be equipped with normal office furniture.

**5.2.1.1 Planning office**

This office will be equipped with normal office furniture and specialized planning equipment. A computer network shall be located in this office to provide:

- maintenance assistance;
- storage of instrument inspection and maintenance records;
- availability and requisitioning details for instruments, parts and spares, etc.;
- Internet.

**5.2.2 Workshop facilities****5.2.2.1 Receipt and despatch**

These areas should be suitably equipped for the handling and storage of components and

materials. An appropriate entrance shall be considered for carrying of large sized instruments and equipment.

#### **5.2.2.2 Cleaning and painting**

This shop should be equipped as required with chemical cleaning bath(s), grit blast cleaning and painting booths.

#### **5.2.2.3 Heavy-duty mechanical/machining shop**

Depending on layout and space available, heavy-duty mechanical shop for handling large instruments such as control valves/pipeline instruments for the carrying out of general mechanical work on them, can be either separate from, or combined with the machining shop with sufficient access way to facilitate transportation.

This area(s) should be provided with the appropriate equipment and machines to suit the envisaged applications.

#### **5.2.2.4 Pneumatic shop**

To be provided with tools and equipment necessary for the general repair, testing and calibration of pneumatically operated instruments.

#### **5.2.2.5 Electronic instruments shop and test room**

As clause 5.2.2.4, but for electrically operated instruments. This room should house the special electronic test equipment and contain facilities for carrying out specific tests.

#### **5.2.2.6 Analyzer shop and test room**

As clause 5.2.2.4, but for industrial analyzers. This room will be used for testing and calibrating of industrial analyzers and for development work.

#### **5.2.3 Storage facilities**

Storage rooms and/or areas should be furnished as required for the storage of items such as:

- working spare parts;
- consumable items (such as gaskets, bolts and nuts, etc.);
- chemical products (for analyzer testing, etc.).

#### **5.2.4 Standards equipment room (Cold room)**

This room should house all special tests, measuring equipment and calibration standards. This equipment should never leave the room, all measurements and calibrations made with the equipment to be carried out in the standards room.

### **5.3 The Offshore Platforms-Instrument Workshop**

#### **5.3.1 General work area**

This area should be provided with the tools and equipment necessary for the maintenance and calibration of control valves, transmitters and gages, etc.

### 5.3.2 Electronic/pneumatic work area

This area should be provided with the tools and equipment necessary for the repair and calibration of electronic instruments and pneumatic panel instruments.

Test equipment for pneumatic instruments can be selected from Sub-sections 5.5 to suit the particular requirements.

However, special test equipment for the particular platform will also be required.

**Note:**

**This area should be free from the effects of vibration.**

### 5.4 Small/Special Tools for the Instrument Workshop

Type and quantity of small tools should be selected locally to suit requirements. Machine tools should be kept in the appropriate cabinets in the machine rooms, and craftsmen's hand tools in bench drawers and cabinets located in the various rooms of the workshop.

## 5.5 Equipment Inventory

### 5.5.1 General

The equipment is identified by the item number of the following inventory which is sub-divided according to type. It also includes normal items of office furniture and specific test equipment (see also 5.4.8).

### 5.5.2 Furniture

- work desk
- chairs
- work table
- whiteboard
- shelves
- filing cabinet
- high cabinet (with hinged doors)
- high cabinet (for machine tools)
- low cabinet (for machine tools)
- low cabinet (with sliding doors)
- computer/computer desk
- equipment storage facilities
- planning table, etc.

### 5.5.3 Utilities equipment

- acid resistant sink
- acid resistant sink (combined with a fume hood)
- rack for sample bottles
- storage facilities complete with gas cylinders

- safety shower with eye bath.

#### **5.5.4 Cleaning equipment**

- cleaning table
- grit blasting facilities
- chemical bath
- ultrasonic bath-small size.

#### **5.5.5 Machine tools**

- lathe (instrument type)
- drilling machine (pedestal type)
- grinding machine
- polishing machine
- engraving machine
- mobile pipe threading machine.

#### **5.5.6 Work and test-benches**

##### **1) work-benches**

- light duty work bench
- heavy duty work bench (Mechanical)
- extra heavy duty work bench

##### **2) test-benches**

- pneumatic test-bench
- electronic test-bench
- analyzer test-bench
- control valve test-bench
- hydraulic test-bench (portable type)

#### **5.5.7 Miscellaneous instrument workshop equipment**

- hoisting facilities (electric or pneumatic)
- painting booth
- small welding booth
- mobile hand pump
- portable vise (with folding tripod stand)
- pipe bending machine
- cutting shears (hand lever operated)
- magnifying glass (with light sources)
- ultra violet light facilities

- test rig for storage tank gages
- test stand for control valves
- portable oxy-acetylene welding set
- arc welding set
- heating oven
- electrical heating plate
- pipe vise (chain type)
- portable pipe vise (with folding tripod stand)
- set of laboratory glass ware
- a Faraday cage
- deep freeze (laboratory type)
- trailer (low loader type)
- mobile crane (3 tone max. capacity)
- microscope
- hot air blower

### 5.5.8 Test equipment

The following sub-sections list test equipment which should be available, as applicable, in certain sections of an instrument workshop.

#### 5.5.8.1 Standards equipment room

- high precision dead weight tester (customs design)
- standard gages
- high precision digital multi-meter
- general purpose oscilloscope
- stabilized power supply (high precision-high and low voltage)
- high precision weighing balance
- precision resistance thermometers
- one set of glass thermometers
- precision variable resistance (Decade box)
- high precision barometer
- high precision dew point hygrometer
- standard platinum resistance
- portable calibration unit
- standard thermocouples
- standard Voltage/frequency meter
- pulse generator
- hand held communicator (HART)
- vibration probe tester (non contact type)
- vibration probe tester

- hydraulic pressure pump
- temperature test bath

**Note:**

**All testing equipment in this room shall be certified as primary testing equipment and should not be taken outside the room.**

**5.5.8.2 Pneumatic 'shop'**

- precision pressure regulator
- set of precision gages
- low pressure/vacuum calibration system
- pneumatic calibration unit
- digital pressure calibrator
- high pressure test kit
- portable low pressure pump
- portable calibrator
- electro pneumatic calibrator
- pneumatic calibrator
- absolute pressure unit
- deadweight tester system

**5.5.8.3 Electronic instruments shop and test room**

- variable resistance (decade box)
- frequency meter/counter
- adjustable and portable power supply (high + low voltage)
- signal generator
- programmable pulse generator
- digital oscilloscope with memory
- low-voltage megger (50 Volts)
- high-voltage megger (500 Volts)
- manufacturers' calibrators (special tools)
- cold junction reference
- computer peripherals

**5.5.8.4 Analyzer shop and test room**

- trace moisture generator
- trace moisture analyzer
- H<sub>2</sub>S detector
- portable oxygen analyzer
- hydrogen purifier

- conductivity meter box
- portable pH/MV meter (0.01 pH reading)
- flowmeter kit
- mass flow meter (Suitable for H<sub>2</sub>)
- de-oxo cell purifier
- DC power supply unit (Variable)
- master flex pump set (Peristaltic)
- set of universal thermometers
- portable explosimeters
- turbidity meter (laboratory equipment)
- 'Methrom' titroton and burettes
- digital weighing balance
- digital thermometer
- set of low range manometers.
- test box for pH simulation
- portable oscilloscope
- decade capacitance box
- Dew Point Meter
- Gas Detector
- Precision Digital Flow meter
- RLC Meter
- Multicalibrator
- Oven
- Precision pressure regulator
- Pressure Regulator
- Standard Solution for Conductivity meter
- KCL 3.3 Mol
- Digital Multimeter
- Decade resistance box
- RPM meter
- Water Bath
- Vernier Caliper
- IC tester Digital/ analog
- IC Programmer
- Soldering/ Disordering Station
- Microscope
- signal Generator
- Dew point generator
- Gas Dilution Apparatus

- Digital Counter
- Digital Manometer
- Precision Digital Multimeter
- Standard Pressure Gauge
- Standard Gas Cylinder (50% LEL)
- Nitrogen Cylinder (99.999%)
- Hydrogen Cylinder (99.999%)
- Synthetic Air Cylinder (99.999%)
- Combustible Gas Tester
- Toxic Gas Tester
- Standard buffers for pH meter (4, 7, 9)
- Standard Solution for Conductivity meter

## 6. FIELD MAINTENANCE EQUIPMENT AND TOOLS

### 6.1 General

In addition to the calibration and maintenance of instruments which is carried out in the various workshops, calibration and maintenance is also necessary for certain instruments or instrument systems 'in situ' on the plant and/or in the instrument auxiliary rooms and control rooms. To facilitate this work, a selection from the tools and equipment given in the following section should be available as applicable.

For complete flexibility, separate tools and equipment for the field maintenance team should be considered, however some expensive and/or infrequently used items could be 'borrowed' from the workshop(s) inventory.

The 'maintenance' tools and equipment should be located in the workshop(s), but for convenience, certain items should be available in the 'maintenance room' of control rooms and analyzer houses. However, certain specific and special test equipment should remain in the main instrument workshop.

The quantities of equipment required will depend on the size of the plant, and whether maintenance is to be carried out as a centralized system from a central workshop or independently from 'satellite' workshops in conjunction with a main workshop.

The equipment listed below is typical for the 'in situ' checking of pneumatic and electronic instruments installed in the medium sized plant as considered in this Standard.

### 6.2 Test equipment

- set of precision pressure gages
- low pressure calibration unit (including vacuum)
- set of digital pressure calibrators
- pneumatic portable calibration unit
- portable temperature calibrator (simulator)
- variable resistance (decade box)
- portable oscilloscope (general purpose)
- portable tachometer

- manufacturers' calibrators (special tools)
- portable pulse and signal generator
- portable variable power supply
- special tools for fire, gas, smoke and heat detectors
- hand held communicator (HART)
- calibration set for Vibration Monitoring System (VMS)
- digital infra-red thermometer
- digital thermometer (contact probe set)

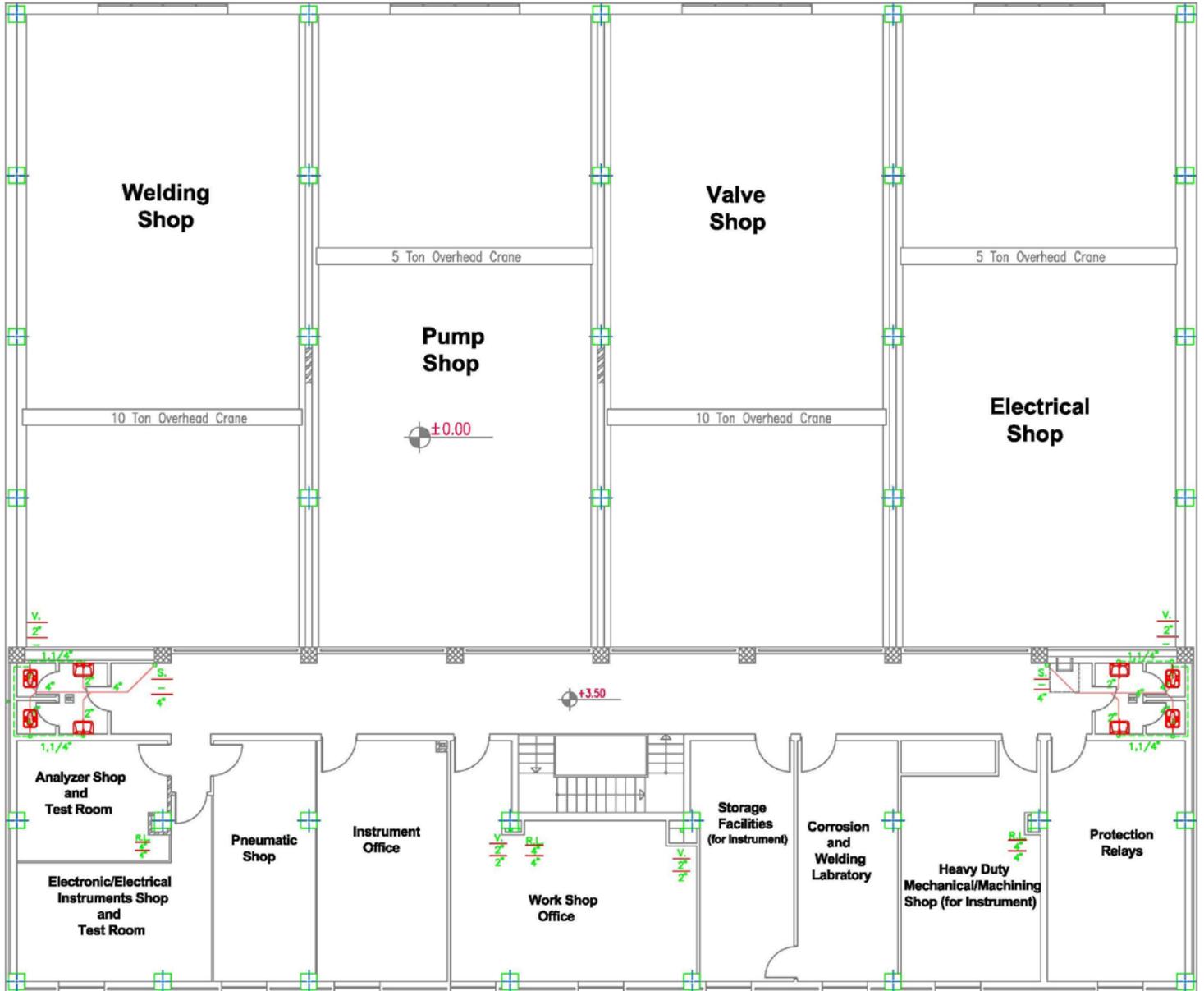
### **6.3 Small/Special Tools for Field Maintenance**

Small tools should be selected locally to suit requirements. The tools should be kept in tool boxes preferably in a storage area reserved for 'field maintenance' technicians, when not in use.

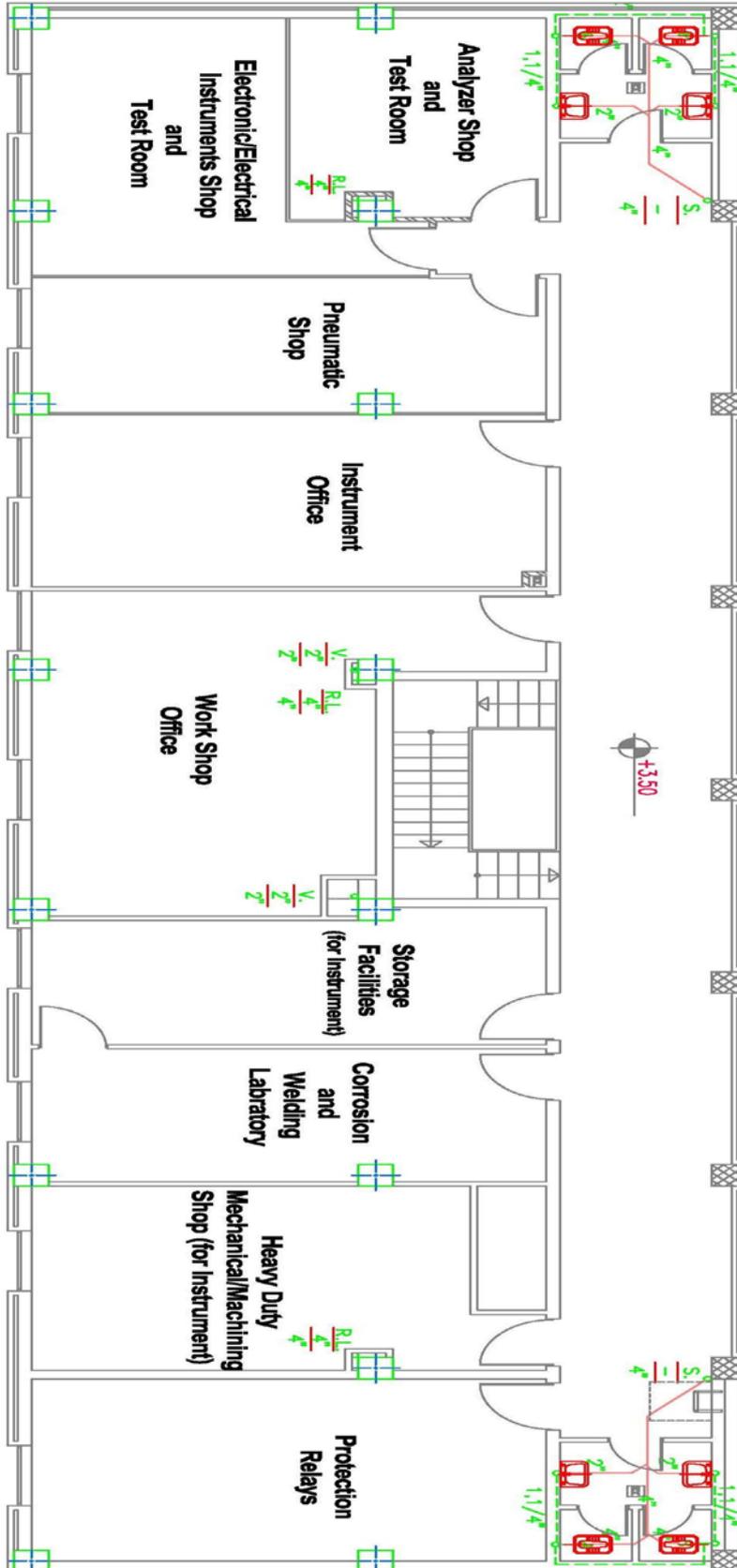
APPENDICES

APPENDIX A  
(INFORMATIVE)

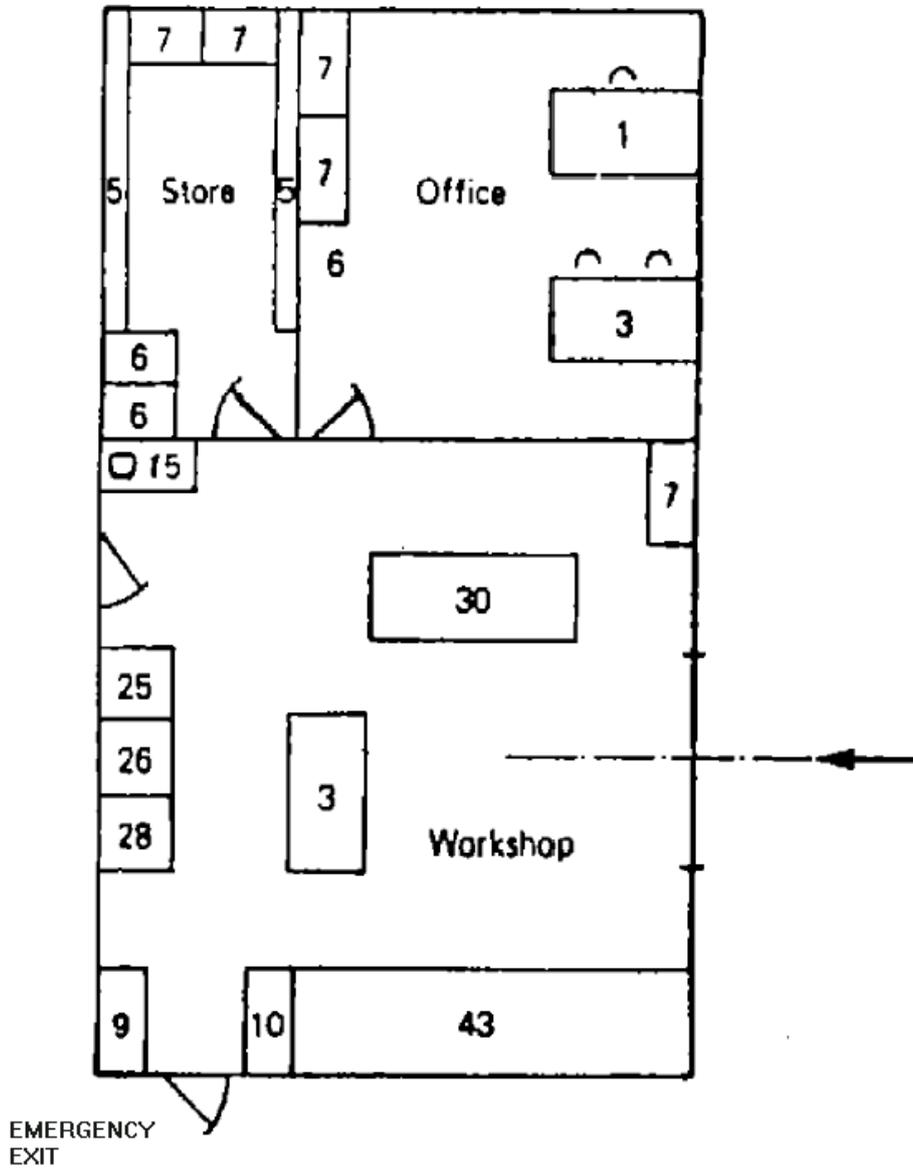
TYPICAL LAYOUT OF A MECHANICAL, ELECTRICAL AND INSTRUMENT WORKSHOP



APPENDIX B  
TYPICAL LAYOUT OF AN INSTRUMENT WORKSHOP



APPENDIX C  
TYPICAL LAYOUT  
FOR A 'SATELLITE' INSTRUMENT WORKSHOP



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**APPENDIX D****TYPICAL WORK-BENCH AND TEST-BENCH REQUIREMENTS****General**

Work-benches and test-benches should be in accordance with this Standard. For those applications where work or test-benches described in the following sub-sections are not suitable, special designs may be developed.

**D.1 Work benches**

Work-bench is an item of equipment with facilities necessary to general repair, testing and calibration of instruments.

**D.1.1 Light duty work bench****1) Bench**

- with a Melamine faced top and an insulated steel frame.

**2) Power supply unit**

- complete with safety devices.

**3) Pneumatic supply unit**

- with regulators and pressure gages.

**4) Socket outlet panel**

- complete with plugs for:

400 V/3Phase 50 Hz (if required)

230 V 50 Hz

110 V 50 Hz

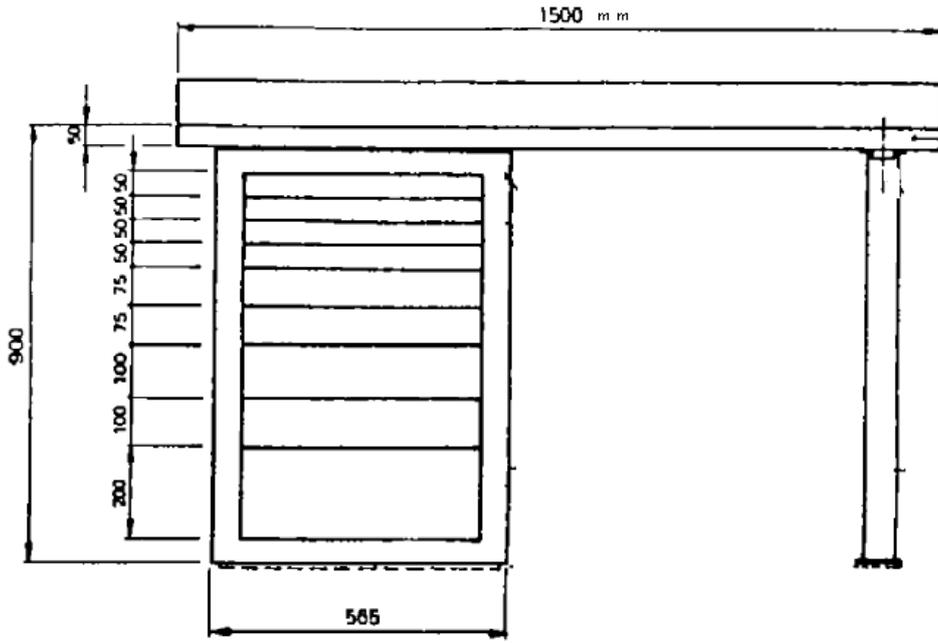
110 V DC (if required)

24 V DC

**Note:**

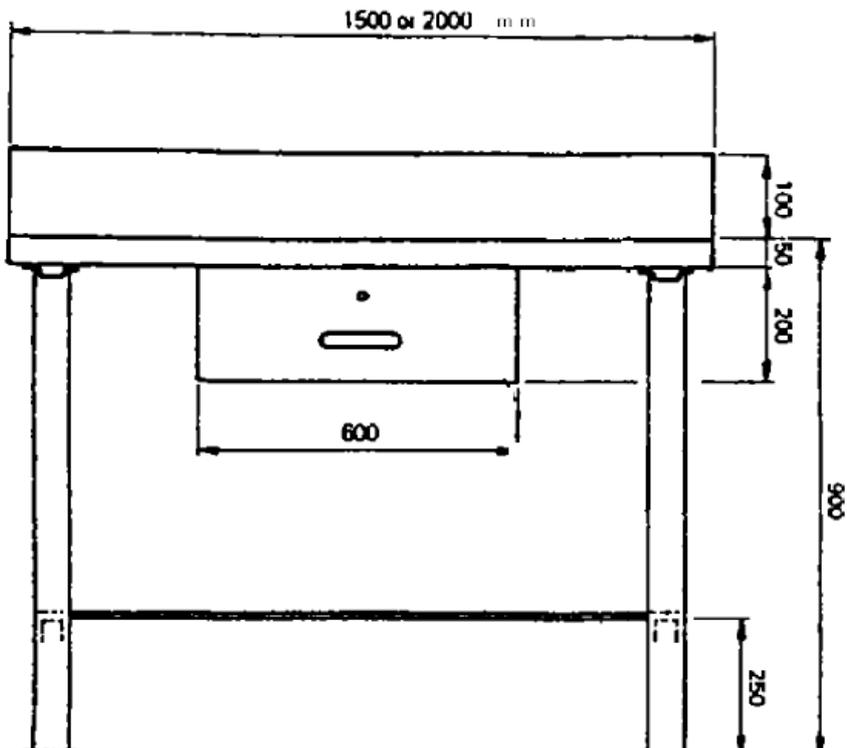
**Each socket should be in a dedicated color.**

**5) Suitable Light source****6) Suitable Magnifying lens**



LIGHT DUTY WORK BENCH

Fig. D.1



LIGHT DUTY WORK BENCH

Fig. D.2

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**APPENDIX D (continued)****D.1.2 Heavy duty work-bench (Mechanical)****1) General**

- Typical size 1750 (or 2000) × 750 mm, overall height 1630 mm.

**2) Work top**

- beech wood, plastic faced with aluminum angle sides,
- 50 mm thick.

**3) Drawer-cabinet/supports**

- each cabinet to have 4 large capacity drawers with a locking system
- 2 drawers to be fitted with compartments
- constructed in heavy gage sheet steel

**4) Shelf**

- fitted between the cabinets complete with back cover constructed in heavy gage sheet steel

**5) Top unit**

- with sliding roller shutter type lockable doors
- fitted with a tool storage system
- constructed in heavy gage sheet steel

**6) Base**

- of hardwood or equivalent

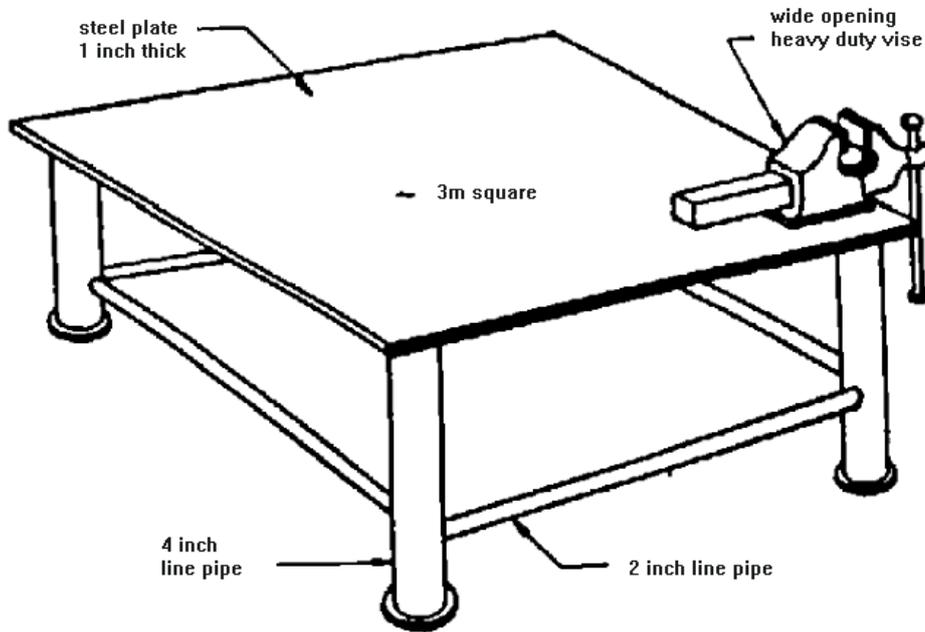
**7) Accessories**

- a light source
- a parallel jaw vice

**D.1.3 Extra heavy duty work-bench**

**Bench:**

- Size 2000 × 1500 × 900 mm, high with 25 mm thick steel top and steel pipe supports Complete with wide opening heavy duty vise.
- To be fabricated in The site workshop, or by local manufacturer



**EXTRA HEAVY DUTY WORK BENCH**

**Fig. D.3**

**D.2 Test-benches**

The Instrument Test-bench is an item of equipment provided with all the facilities necessary to test and calibrate instruments, which are used to measure and control manufacturing processes.

The test-bench generally consists of a lower unit 'The Bench', which supports a selection of test/calibration equipment installed in 'The Top Unit'. The type of test/calibration equipment fitted depends on the duties of the particular test bench.

The test bench (Top and Lower units) may be based on the standard product of recommended manufacturer's.

The length of the bench will depend on local circumstances and expected application, but should not be less than 1500 mm.

The work top which will support the 'Top Unit', should be robustly constructed in wood of at least 50 mm thick and plastic faced, e.g. with Melamine.

Typical details of various top units are illustrated in the following pages of this standard; however some of the larger workshops may require other special arrangements.

**D.2.1 Pneumatic test-bench**

**1) Bench**

- with Melamine faced top and an insulated steel frame

**2) Power supply**

- 230 V 50 Hz complete with miniature circuit breaker having over current protection of 16 A, with a combined or separated earth leakage device of 30 mA

**3) Pneumatic supply unit panel**

- instrument air supply with filter/ nitrogen, precision pressure regulators and gages

**4) Socket outlet panel**

- complete with:

- 2 plugs,           for 230 V       50 Hz
- 1 plug,           for 110 V       50 Hz
- 2 plugs,           for 24 V        DC.

**Note:**

**Socket with different voltages should have different contact arrangements and be in a dedicated color.**

**5) Suitable Light source****6) Suitable Magnifying lens****D.2.2 Electronic test-bench****1) Bench**

- with Melamine faced top (anti static)

**2) Power supply unit**

- 230 V 50 Hz complete with miniature circuit breaker having over current protection of 16 A, with a combined of separate earth leakage device of 30 mA.

**3) Oscilloscope (general purpose)****4) Outlet socket panel**

- complete with plugs for:

- 230 V   50 Hz
- 110 V   50 Hz
- 24 V    DC

- earth connections.

**Note:**

**Sockets for different voltages should have different contact arrangements and be in a dedicated color.**

**5) Variable AC voltage****6) Analog voltmeter****7) Variable DC power stabilizer unit**

- 0 to 24 V and 0 to 120 mA

**8) Earth free variable DC power unit**

- 0 to 30 V.

**9) Digital voltmeter****10) Pneumatic distributor panel**

- complete with pressure gages and regulators.

**11) Transmitter calibration unit**

- 0 to 50 V DC and 0 to 50 mA with an accuracy of 0.1% of full scale

**D.2.3 Analyzer test-bench (If required)****1) Power supply unit**

- 230 V 50 Hz complete with a miniature circuit breaker having overcurrent protection of 16 A, with a combined or separate earth leakage device of 30 mA

**2) Slide unit with:**

- a vacuum pump  
- digital indicator and a start/stop switch

**3) Pneumatic digital indicator****4) Digital multi meter****5) Oscilloscope (general purpose)****6) Variable DC power supply unit**

- 0 to 24 V and 0 to 120 mA

**7) Variable stabilized DC power supply****8) Electronic timer**

- with automatic/manual start/stop

**9) Analog multi meter****10) Analog pressure gage****11) Digital pressure gage****12) Socket outlet unit**

- with a plug for - 230 V 50 Hz

**13) Pneumatic unit**

- regulators, pressure gages and connections

**14) Electrical junction box unit**

- with a safety device for the pumps

**15) Transmitter calibration unit**

- with digital gage 0 to 50 mA

**16) Digital vacuum indicator unit (including connections)****D.2.4 Control valve test-bench (If Required)****1) General**

The control valve test-bench should provide all the facilities necessary for the complete testing and calibration of control valves such as:

**2) The bench**

- of welded steel frame complete with:

- two control desks
- one hydraulic lifting table fitted with safety devices
- special connections for 3-way valves
- complete set of interchangeable flanges in stainless steel

### 3) Capacity

- suitable for the testing of control valves up to 16 in nominal bore and 1200 mm between flanges and for calibrating 3-way valves

### 4) Equipment and facilities

- required to carry out the following tests:

#### a) leak tests - in accordance with:

- ANSI B 16 - 106 up to Class VI (Ref. [IPS-C-IN-160](#), "Construction and Installation Standard of Control Valves")

The equipment shall include:

- a set of leakage rotameters for 6 l/h up to 30 l/h
- a manifold for rotameter selection

#### b) pneumatic tests-requiring:

- air supply variable with variable control
- a complete air manifold with accurate manometers fixed outputs of:
  - 0.2 bar
  - 1.0 bar
- pneumatic connections made with stainless steel tubing and compression fittings
- variable output

#### c) hydraulic tests-requiring:

- mechanical protection for the hydraulic tests

#### d) Electronic tests-requiring:

- electricity supply of 230 V 50 Hz complete with a miniature circuit breaker having over current protection of 16 A, with combined or separate leakage device of 30 mA
- 24 V DC
- fixed output 4 mA
- fixed output 20 mA
- variable output 0-50 mA with digital indication for input measurement
- electronic timer for start/stop

#### e) electronic leak test-requiring:

- electronic leak detection apparatus

#### f) PLC capabilities-requiring

- automatic clamping with safety features
- automatic control of clamping pressure
- automatic sequence procedures
- configuration via the keyboard

**g) micro-computer equipment comprising:**

- bench filing capabilities
- storage for manufacturer's data
- filing all test procedures
- control valve data
- control valve records
- calibration via keyboard

**h) printer:**

- procedures
- calibration
- control valve data and specification
- control valve records by tag number

#### **D.2.5 Hydraulic test bench (portable), If required**

**1) General**

To be suitable for the liquid testing of equipment with hand operated pumps of 300 barg max. capacity (unless otherwise specified)

**2) Hydraulic oil reservoir**

- capacity 20 liters (unless otherwise specified), constructed from heavy gage steel plate

**3) Hand pump**

- built into the reservoir and fitted with a release valve

**4) Strainer plate**

**5) Test stand**

**6) Deflector/safety guard**

- of transparent material.

**7) Pressure gages-for setting and control**

- required ranges, according to [IPS-M-IN-110](#)

**8) Selection valve for each gage**

**9) Control panel for gages etc.**