MATERIAL STANDARDS

FOR

MISCELLANEOUS ITEMS

0. INTRODUCTION

This Standard title is divided into different parts to cover the instrumentation material standards which are not in common application or not conventional.

Standards included under "Miscellaneous" title (IPS-M-IN-280) are:

Part 1 : Packaged Equipment Instrumentation"
Part 2 : Miscellaneous Valve Actuators"
Part 3 : Rotating Machinery Instrumentation"
Part 4 : Flare System Instrumentation"

Part 1 of this Standards, "Packaged Equipment Instrumentation" covers the instrumentation system which will be purchased in conjunction with packaged equipment and as their scope of supply, such as; Water-tube and Fire-tube boilers, rotating machines, flare system, etc. The "Packaged Equipment Instrumentation" standard may be used in conjunction with the following parts of this standard, as required:

Part 2 of this Standard covers miscellaneous valve actuator system used in pipeline and drilling operations and covers:

- Line-break Valve Actuator for Pipeline Applications
- Wellhead Surface Safety Valve (SSV) Control System
- Wellhead Sub-surface Safety Valve (SSSV) Control System

Part 3 specifies the amendments and supplements to the following standards:

API (AMERICAN PETROLEUM STANDARD)

API Sandard 670 (1986)

"Vibration, Axial-Position, and Bearing-Temperature Monitoring Systems"

API Standard 678 (1981)

"Accelerometer-Based Vibration Monitoring System"

The above standards and part 3 alterations shall be used in conjunction with "Monitoring System Data Sheets".

For ease of reference, the clause or section numbering of API standard 670 and 678 has been used throughout Part 3 Standard Specification.

PART 1

PACKAGED EQUIPMENT INSTRUMENTATION

CONTENTS :

PAGE No.

APPENDICES:

1. SCOPE

This Standard covers general requirements for instrumentation supplied with packaged equipment to be used in oil refineries, chemical plants, gas plants and, where applicable, in exploration and production facilities. The Standard has been prepared to meet the following objectives:

- To enable purchasing of a fully instrumented, manufacturer's standard packaged units.

- To define the administrative procedures and technical requirements, especially at the interface of engineering activities to ensure that instrumentation from various sources will fit properly together and fulfill the functions specified in the requisition.

This Standard shall be applied in conjunction with one or all of the following standards as may be applicable:

IPS-M-IN-280/ Part 3- "Rotating Machinery Instrumentation"
IPS-M-IN-280/ Part 4- "Flare System Instrumentation"

This Standard may also be applied for any other packaged equipment even if they have not been specifically mentioned herein (i.e. Water tube, and Fire-tube boilers).

No deviation or exception from this Standard shall be permitted without written approval of the Company. Vendor shall separately list his intended deviations in his bid proposal in conjunction with supported documents and back-up reasoning under "exception to specification".

2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The editions of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor/Consultant.

API (AMERICAN PETROLEUM INSTITUTE)

RP 500 A/B/C	"Classification of Areas for Electrical Installation in Refineries/Pipeline/Offshore Platforms" (latest edition)
RP 550	"Manual on Installation of Refinery Instrument and Control Systems" (latest edition)
Std. 670	"Vibration, Axial Position, and Bearing-Temperature Monitoring Systems" (1986)
Std. 678	"Accelerometer-Based Vibration Monitoring Systems" (1981)

ISA (INSTRUMENT SOCIETY OF AMERICA)

S 5.1	"Instrumentation Symbols and Identification"
S 5.3	"Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems"
S 5.4	"Instrument Loop Diagrams"

CENELEC (EUROPEAN COMMITTEE FOR STANDARDIZATION OF ELECTROTECHNIQUE)

EN-50.014	"General Requirements"
EN-50.016	"Pressurized Apparatus 'p'"
EN-50.018	"Flame-Proof Enclosure 'd'"

EN-50.020 "Intrinsic Safety 'i'"
EN-50.039 "Systems"

IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSION)

529 "Ingress Protection for Electrical Equipment"

NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)

496 "Purged and Pressurized Enclosures for Electrical Equipment in Hazardous Locations" (1982)

497 A "Classification of Class I Hazardous (Classified) Locations for Electrical Installations in Chemical Process Area" (1986)

ANSI/UL (AMERICAN NATIONAL STANDARDS INSTITUTE/UNDERWRITER LABORATORY)

913 "Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations" (1988)

IPS (IRANIAN PETROLEUM STANDARDS)

E-IN-190 "Instrument Engineering for Transmission System"
M-IN-190 "Instrument Material for Transmission System"
E-IN-180 "Instrument Engineering for Power Supplies and Distribution System"
M-IN-180 "Instrument Material for Power Supplies and Distribution System"
M-IN-220 "Material Standard for Control Centers"

3. DEFINITIONS AND TERMINOLOGY

3.1 Packaged Unit

Is a prefabricated process or utility unit which could operate in isolation.

3.2 Instrument or Instrument Systems for Packaged Units

- Are all those instruments or instrument systems necessary to build the package unit-as provided by the manufacturer of the unit;

- may also include Company's provided instruments, which are those instruments or instrument systems necessary to build the packaged unit supplied free of charge to the equipment package manufacturer by, or on behalf of, the Company.

3.3 Functional Tests

Are tests carried out by simulating a process condition on the input side of the instrument to check the corresponding output 'function'. The conditions should be such that the required accuracy can be obtained.

Note:

All test equipment for this purpose shall be made available by the manufacturer/supplier.

3.4 "Loops" in the Packaged Equipment

- Local control loops including local control panels or local receivers;

- remote control loops, are control loops linked to the main control room through junction boxes installed inside the packaged equipment. The primary element, final control element (control valve) and the transmitter are mounted inside the package, only the receiver/controller is located in the main control room.

3.5 Installation Materials for Packaged Equipment Instrumentation

Are miscellaneous items of material required for the installation of instruments in the packaged equipment such as tubing, fittings and cables etc.

4. UNITS

This Standard is based on International System of Units (SI), except where otherwise specified.

5. GENERAL REQUIREMENTS

5.1 Extent of Supply

5.1.1 The Company shall approve the instrumentation for those packaged equipment where full instrumentation is provided by the manufacturer/suppliers standard packaged equipment. The type of instruments at the interfaces of such a package shall be clearly defined and agreed by the Company prior to order placement according to the pertinent sections of this Standard specification and the contract documents.

5.1.2 In some contracts, as applicable the Company or another contractor may supply the instrumentation required for measurement and control except for those instruments which are considered to be an integral part of a packaged equipment. The manufacturer/supplier then shall provide only those instruments which:

- mechanically, form an integral part of the equipment, e.g., speed governors, overspeed trips, proximitors, vibration pick-ups and convertors, etc.

- require special provisions on the equipment depending on the specific instrument to be used, such as (electronic) detectors for speed, vibration and axial displacement on rotating equipment.

- have been specially requested to be supplied as part of the packaged equipment by the Company.

5.1.3 Close co-operation between the manufacturer/supplier of the packaged equipment and the Company/Contractor are necessary to ensure that the design concept of the packaged equipment is consistent with the rest of the project or plant.

5.2 Documentation Required

The following documents and drawings shall be provided by the packaged equipment Vendor/Supplier at the time requested there-to.

5.2.1 Information with the quotation

The following information shall be provided by the manufacturer/supplier at the quotation stage:

1) Instrumentation diagrams for the control and operation of the equipment, showing all instrumentation together with the connections required, and the demarcation points for the scope of supply.

2) Functional logic diagrams and function descriptions for start-up, sequence control, safeguarding and emergency shutdown procedures.

3) Detailed information for all instruments provided by the supplier, including make and type, range and dimensional drawings.

4) List of all sub-suppliers.

5) Area classification inside the equipment package. This information drawing shall be based on the general area classification lay-out, as supplied by the Company or engineering contractor.

6) Inspection and testing procedures, including the preliminary issue of an inspection plan.

5.2.2 Documentation in the engineering and design phase

The following documentation should be provided by vendor/supplier within six weeks after placement of the order (in 11 copies and one reproducible).

1) Updated versions of the information provided in the quotation, using the ISA S 5.1 instrument symbols and tag numbering system as required by the Company.

2) A list of all instruments, giving the make and type, vendor recommended spare parts list, detailed operating data (especially for flow meters and control valves), length of thermowells, indicating which of these are provided by the supplier. The Company's standard data sheets shall be used for the lists.

3) Instrument data sheets.

4) Equipment lay-out drawings, showing the location of the instruments, junction boxes, (local) instrument panels, the cable routing between the individual instruments, junction boxes and panels, etc.

5) If cable junction boxes are included in the supply of the equipment, the documentation shall include terminal arrangement, signal wire allocation, the make, type and size of the cable glands.

6) If (local) panels are included in the supply of the equipment, the documentation shall include drawings showing the construction panel lay-out and terminal arrangements with signal allocation.

7) Instrument impulse line drawings.

8) Instrument air line drawings.

9) Calculation sheets for control valves and flow measuring devices, etc.

10) Amended inspection/testing procedures and the final inspection plan.

11) A list of the trip/alarm settings.

12) A list of the certificates which shall be submitted.

13) Any other documents which may be requested by the Company.

14) The wiring diagrams (including schematic, connection, and elementary diagrams) required for installation and maintenance.

15) Completed "As-built" data sheets.

5.2.3 Documentation with delivery

The Vendor/Supplier shall provide final documents for all instruments, including installation and maintenance instructions, illustrative spare parts lists, applicable circuit diagrams etc., in good time for incorporation in the 'Plant Instrumentation Manuals' for the entire project.

5.3 The Division of Responsibilities Between the Instrument and Electrical Engineering Disciplines

The division of responsibilities between the two disciplines should generally be in accordance with the list of typical activities included in Appendix A (page 18).

5.4 Electrical Safety

Electrical instrumentation supplied with the packaged equipment for application in hazardous areas shall be selected in accordance with the requirements of CENELEC, NFPA, FM or UL as may be appropriate.

5.5 Electricity Supply

The electricity supply requirements shall be as specified in the Requisition, or Purchase Order.

Note:

Typical, input supplies will be defined in Appendix B (page 22).

For relay based logic circuits, the input supply should be 24 V dc. The output to the field instruments should be based on 24 V dc and 4-20 mA as may be applicable.

5.6 Analog Signal Transmission Systems

These systems shall be in accordance with IPS-E-IN-190 and IPS-M-IN-190.

Note:

Analog signals shall be two wired system.

5.7 Binary Logic Systems

Binary logic systems shall be designed on the "Fail Safe" principle, i.e. "Normally Energised".

Note:

Solenoid valves shall be suitable for continuous energising.

5.8 Environmental Conditions

5.8.1 Environment

The environmental conditions which apply in the intended location for the packaged equipment, will be specified in the Requisition, or Purchase Order.

5.8.2 Instrument protection

The instruments of the packaged equipment, shall be suitable for the particular area and adequately protected against environmental conditions such as salt laden, sulpherous and moist atmospheres, sandy conditions, adverse weather and extreme temperature.

The protection should consist typically of:

- suitable material selection;
- suitable protective paint or other coatings;
- sun shades;
- shelters;
- enclosures (according to IEC 529);
- electric or steam tracing;
- insulation.

5.9 Instrument Air Supply

Instrument air to pneumatic instruments shall be supplied in accordance with the requirements of IPS-M-IN-200 "Instrument Air Systems".

5.10 Guarantee and Warranty Requirements

The packaged equipment Supplier/Vendor shall provide the following guarantee and warranties:

5.10.1 All equipment and component parts in the packaged equipment instrumentation shall be warranted by the packaged equipment Supplier/Vendor against defective materials, faulty design, and poor workmanship for 1 year after being placed in service, or provisional take-over whichever is the latest.

5.10.2 If any malperformance or defects occur during the guarantee and warranty period, the Vendor shall make all necessary alterations, repairs, and replacements free of charge and freight costs to the job site. Field labor charges, if any, shall be subject to negotiation between the Vendor, construction agency and the Company.

6. THE INSTALLATION OF INSTRUMENTATION IN THE PACKAGED EQUIPMENT

6.1 General

The installation of the instruments or instrumentation systems of the packaged equipment shall be carried out in accordance with the requirements for plant instruments as given in the pertinent IPS construction standards together with the following sub-sections, unless otherwise specified.

The scope of work and supply by the Manufacturer/Supplier/Vendor shall be limited to the packaged equipment boundary, including all interconnecting wiring, tubing and installation materials for all packaged instruments and Company's provided instruments.

The plant engineering contractor will be responsible for the interface between the 'packaged equipment' and the rest of the plant.

6.2 Installation

6.2.1 Instruments

All instruments to be installed in accordance with the requirements of the pertinent IPS Construction Standards.

6.2.2 Instrument impulse lines

All impulse lines shall be fabricated and installed in accordance with the requirements of the IPS Standard drawings outlined in impulse line standard.

6.2.3 Signal and supply tubing

All signal and supply tubing shall be fabricated and installed in accordance with the requirements of IPS-C-IN-200, "Instrument air system" and IPS-C-IN-190, "Transmission System".

Note:

Compression fittings and tubings for impulse and signal lines shall be made up by skilled technicians.

6.2.4 Instrument signal cabling

Instrument cabling shall be performed with the following considerations:

- cabling shall follow the shortest possible route;

- adequate spare length shall be provided at the instrument termination points, formed into at least 1 coil of wire of a diameter to suit the cable thickness. At the terminal connection of instruments and junction boxes, etc., the above procedure shall also be considered.

- stranded cables for normal current or voltage signals shall be terminated with crimp-on type connectors;

- cables shall be supported by cable tray to a point not more than 1 metre apart from the instrument;

- cable trays shall be properly supported from the packaged unit structure and not from process lines;

- all junction boxes shall be accessible and properly supported.

Notes:

1) Crimped connections shall not be applied for solid conductors or wires.
2) Intrinsically safe circuit cables shall have a blue colored insulation cover for identification purpose.

6.2.5 Earthing

Provision shall be made for:

1) Plant earth (safety)

Metal parts of equipment such as supporting arrangements and junction boxes, etc. shall be connected to the plant earth when they are not electrically connected to the structure.

2) Instrument earth

Instruments shall be connected through junction boxes via isolated earth bars and cable screens, to the instrument earth system.

7. CONTROL PANELS AND SYSTEM CABINETS FOR THE PACKAGED EQUIPMENT

7.1 Control Panels

Where local control panels included in the manufacturer's standard package, the Company's or the engineering contractor's approval shall be obtained in writing for the detail drawings, materials of construction and the protective finish of the control panels before work commences.

7.2 System Cabinets

System cabinets should be in accordance with the requirements of IPS-M-IN-220 (Control Centers), unless otherwise specified by the Company.

8. FACTORY INSPECTION AND TESTS

8.1 General

The procedures for factory inspection and testing shall be generally in accordance with pertinent IPS material standards.

The inspection should be carried out by using the documents described in the IPS-M-IN-100/2 (Factory Inspection of Instruments & Instrument Systems), which are:

- The inspection plan.
- Release notes.
- Non-conformance notes.
- The inspection report.

Inspection and testing shall be based on the final approved inspection plan and the latest revision of "approved for construction drawings", any deviation from these drawings shall have written confirmation. Company's representative shall have the rights to reject any part of the work which does not meet the specified requirements.

8.2 Inspection Requirements

8.2.1 General

Particular attention shall be paid to:

- Accessibility;
- impulse lines 'Hook-up';
- straight length requirements for orifice plate and control valve installations;
- supporting arrangements;
- general aspects such as the color scheme for control panels, etc.;
- color-coding of the cables and wires;
- quality of wiring/cabling material and work-manship;
- control cabinets;
- in-line instruments;
- earthing connections;
- painting.

8.2.2 Manufacturer's resources provision

The Manufacturer/Supplier shall provide the required manpower and test equipment from his own resources and/or with the assistance of specialist sub-suppliers, to implement test procedures that are necessary during instrument precommissioning procedures.

Note:

The Manufacturer/Supplier shall provide valid calibration certificates for primary test equipment used, approved by the local authorities or a recognised testing laboratory.

8.3 Company's Provided Items

Company's provided instruments or instrument system will be delivered to the packaged equipment manufacturer complete with calibration certificates, electrical protection conformance certificates, functional test reports and material certificates as applicable.

Unless otherwise specified in the contract these items shall not be recalibrated but they will be function tested during "loop checking".

8.4 Instruments Supplied by the Packaged Equipment Manufacturer

All instruments supplied by the manufacturer shall have calibration certificates signed by the QA/QC engineer of the manufacturer or his sub-supplier. These documents shall be available during inspection, for checking by the Company's assigned inspector.

Note:

A typical calibration certificate shall be submitted to the Company for approval. The approved certificate forms shall be used in the final manufacturing report.

If calibration certificates are not available, the Company's assigned inspector shall witness the calibration of not less than 20% of each type of instrument. This shall be increased to 100%, if discrepancies are found, during 20% inspection.

Note:

Where materials of construction and/or hydrostatic/leakage test certificates are required (e.g. for control valves or in-line instruments), the Company's assigned mechanical inspector is responsible for checking these certificates.

8.5 Test Procedures

8.5.1 General guidance

While applying the general procedure of paragraph 8.1, special attention shall be paid to obvious calibration errors and hysteresis problems, etc., which may occur during function testing.

Where signal lines are terminated in junction boxes or bulkhead fittings, i.e., at packaged equipment (skid) limits, these shall constitute the final measuring point for test procedures.

Pressure switches, pressure transmitters and differential pressure transmitters should be function checked by applying a signal of 0 to 100% into the process connections of the switches/transmitters.

Resistance thermometers and thermocouple loops should be function checked by applying the appropriate signal into the thermometer/ thermocouple head, whether the controller/indicator is part of the packaged equipment or connected to the main control room.

Capillary temperature transmitters should be function checked using hot water or an oil bath in conjunction with a standard measuring device.

Controllers (local) should be checked by applying a signal (0 to 100%) at the controller input.

Where control, logic and interface panels etc., are included in the package, they can be inspected as separate or complete units at the Manufacturer's or Sub-supplier's premises, prior to a total system test. The Manufacturer shall supply all relevant information to the Company's assigned inspectors, including that of the sub-supplier's equipment.

8.5.2 Orifice plates

Orifice plates shall be checked for orifice diameter, plate thickness, flatness and flow direction etc., in accordance with the requirements indicated in IPS-M-IN-100.

8.5.3 Orifice flange assemblies

Orifice flange assemblies shall be checked for:

- straight lengths;
- smoothness of the internal welds;
- internal diameter (which shall also be recorded);
- in accordance with IPS-M-IN-130.

8.5.4 Electrical tests

The following tests shall be carried out:

- earth resistance;
- insulation and continuity;
- earthing protection or monitoring.

8.5.5 Pressure and leak tests

8.5.5.1 Pneumatic signal and supply lines

Signal and supply lines shall be leak tested with air or nitrogen at 1.1 times the maximum operating pressure, up to a maximum of 10 bar(g).

For operating pressures over 10 bar(g) the lines shall be hydraulically leak tested at 1.5 times the maximum operating pressure, drained and then blown dry with air or nitrogen.

Signal lines, and supply lines down-stream of the filter/reducer shall be leak tested with air or nitrogen at a minimum pressure of 1.5 bar(g).

8.5.5.2 Instrument impulse lines

Impulse lines shall be leak tested at 1.5 times the maximum process design pressure or at the maximum allowable working pressure of the instruments whichever is the lower. The test shall be made with demineralised water as the medium, except for testing impulse lines on oxygen service, which dry compressed air may be employed.

If any of the instruments are of the differential pressure type, they shall be equalized during the test.

All lines shall be drained and dried with clean air or nitrogen after the test. The lines will be considered dry after air blowing for 30 minutes, minimally.

Note:

The application of solvents for cleaning, e.g. for analyser sampling systems, shall be submitted to the Company for approval.

It shall be ensured that the instruments are not overranged or otherwise damaged during the test.

Notes:

1) During the test, process isolating valves shall be closed.

2) For details of leak testing of pneumatic tubing by the bubbler method, refer to IPS-C-IN-100, 'Field Inspection and Testing of Instruments and Instrument Systems'.

8.5.6 Loop-checking

8.5.6.1 Local control loops

The loop check shall start at the transmitter and terminate at the final element and include local control panels, ancillary equipment (such as limit switches) and Company's provided items, if included.

8.5.6.2 Remote control loops

The loop check shall range from the transmitter to the junction box and from the junction box to the final element.

Notes:

1) Local control loops, i.e. displacer level controllers with direct output to control valves and/or local gages, should be function checked by filling the displacer with liquid and observing operation of the control valves.

2) The controller output should be observed at the control valve, if a control valve is not included in the package then the output of bulkhead connection at the equipment package limit, shall be observed.

8.6 Functional Testing

The Manufacturer/Supplier shall demonstrate by functional test, that; the instruments or instrument systems included in the packaged equipment meet the specifications.

The functional test shall take place after loop checking. The Company's instrument inspector shall control and inspect the calibration or setting of instruments.

The functional test record shall include all the presetting values.

9. SPARE PARTS

9.1 General

The Contractor/Vendor is responsible for ensuring that the Company receives the Manufacturer/Supplier's spare parts for packaged equipment for:

- initial operation, including commissioning;
- normal operation (minimum ten years);

9.2 On Site 'Construction' Spare Parts

Construction spare parts, such as fittings, couplings and consumables (i.e. joint rings, bolts and nuts, etc.) shall be included in the Manufacturer's supply.

10. SPECIAL TOOLS AND CALIBRATION EQUIPMENT

During the engineering phase, the Manufacturer/Supplier shall advise the Company of any special tools and calibration equipment that may be necessary for commissioning and maintenance purposes.

If they are to be provided by the Manufacturer/Supplier of the packaged equipment, then these tools and/or equipment shall be quoted separately in the packaged equipment vendor proposal.

Notes:

1) Before ordering, it shall be ensured that such tools and equipment are not already available on site.

2) The tools and calibration equipment purchased shall be incorporated in the inventory of the plant instrument workshop.

11. PACKING AND MARKING FOR TRANSPORTATION

11.1 General

The packaged equipment shall be adequately protected to prevent damage during transportation to the site.

In general, instruments should remain as part of the packaged equipment during shipping and shall be removed only if they are outside the confines of the packaged equipment skid, or when the Manufacturer requests special packing and shipping facilities.

However, fragile instruments or parts of instrument systems, such as; analyzers, computers, logic cabinets and control panels shall be packed and shipped as separate items. Miscellaneous equipment such as chart recorders, pens and ink supplies shall also be packed separately and clearly identified.

If necessary, 'shipping stops' and additional supporting arrangements shall be provided and checked prior to packing. When shipping stops are fitted, they shall be indicated by a label or marking on the package.

The Supplier/Manufacturer shall provide the complete packing list, installed on the outside wall of the package.

Note:

Before packing, the instrument inspector shall check that all instruments and instrument systems have been drained and dried (if required).

11.2 Marking

Each part of the packaged equipment instrument shall be marked in accordance with the requirements of the Purchase Order, including when applicable, additional marking for customs purposes.

12. FIELD INSPECTION AND TESTING

12.1 General

The engineering contractor shall be responsible for the field inspection and testing of packaged equipment at the site location.

12.2 Calibration

Only those items indicated in the requisition or requested by the Company shall be calibrated or re-calibrated.

12.3 Functional or Performance Test

The Contractor shall provide all necessary tools and equipment and, when required, provide the services of the appropriate specialist from the Manufacturer/Supplier, for the execution of the tests.

A field test report shall be signed by all parties concerned, i.e. the Manufacturer/Supplier and the Contractor and/or the Company.

12.4 Documentation

The type of 'standard forms' used for inspection, testing and recording shall be approved by the Company or the Company's authorized inspection engineer.

APPENDICES

APPENDIX A
TYPICAL ACTIVITIES OF INSTRUMENT AND ELECTRICAL ENGINEERING

A.1 Instrument Engineering Activities

Covers all activities necessary for the specification, design, construction, testing, inspection, quality control, installation and maintenance of equipment and systems for the measurement and control of operating variables in processing units, related utilities and facilities.

The equipment involved in instrument engineering activities comprises, but is not limited to the following:

- Measurement and control systems including analog, digital, sequential and supervisory controls.
- Machine monitoring systems (vibration, displacement, torque, speed) and associated actuation of protection systems.
- Alarm annunciation and safeguarding systems.
- Detection systems and associated alarms for flammable and toxic gases, including those for buildings.
- Pollution detection systems and associated control systems including those for buildings.
- Earthing systems in electronic instrumentation and process control/monitoring computer system.
- Instrument electricity supply and distribution systems, as far as not forming part of electrical engineering.
- Instrument electricity supply system incorporated in instrument system.
- The selection of the type of actuator for control valves and remote-operated on/off valves.
- Remote control and status signaling for pneumatically or hydraulically-operated valve actuators.
- Overvoltage protection systems for instrument circuits.
- Plant-mounted instruments and instrument impulse lines.
- Instrument air supply system as far as not forming part of mechanical engineering.

A.2 Electrical Engineering Activities

Electrical engineering activities consist of specification, design, construction, installation, maintenance, measuring, protection and safeguarding, testing, inspection and quality control of electric power systems and rotating equipment systems.

Operation of electric power system form part of electrical engineering.

The equipment involved in electrical engineering activities comprises, but is not limited to the following:

- Generation, transmission and distribution of electric power.
- Conversion of electric energy (e.g. transformers, frequency-converters, rectifiers, inverters).
- Electric drives (e.g. motors, variable-speed drives, constant-torque drives).
- Electric heating (e.g. process heating, compensation heating).

- Lighting, including dimmer equipment.

- Electrostatic filters, desalters, etc.

- Equipment for electrolysis.

- Electric-motor-operated valve actuators, Electrical feeder.

- Instrument electricity supply system, up to the point where instrument engineering takes over.

- Safety circuits for personnel protection (e.g. emergency stops, pull chains, work safety switches).

- Earthing and bonding systems for electrical system earthing, protection against electrostatic charges, personnel protection.

- Clean earth provisions for instrument system.

- Lightning protection system.

- Equipment for direct manual operation of above mentioned items (e.g. remote control units, limit switches).

- Measurement and control system, including inherent alarm annunciation and safeguarding systems for protection of electrical equipment, analog, digital, sequential and supervisory control for the above mentioned items.

APPENDIX B
INSTRUMENT ELECTRICITY SUPPLY

B.1 Types of Supply

The following types of supply are defined:

B.1.1 AC uninterruptible supply (maintained)

An uninterruptible two feeder AC supply of a higher quality suitable for the feeding of microprocessor based and computer systems.

This supply shall be maintained minimally for 30 minutes for process units and one hour for emergency utilities control system unless otherwise specified. This type of supply should be applied for systems such as fire and gas detection, control and telecommunication, with backing-up times as specified.

B.1.2 AC interruptible supply (maintained)

An AC supply with a two feeder arrangement backed up with an emergency supply, which may have an interrupt time of up to 10 seconds.

Note:

Unless additional measures are taken, the electrical characteristics of this supply shall be as for the mains supply. Additional measures could involve line conditioners and special transformers to stabilize voltage and reduce interference.

B.1.3 AC interruptible supply (not maintained)

As 1.2, but without back-up from an emergency power source.

B.1.4 DC uninterruptible supply (maintained)

"DC supply unit", maintained for a prolonged period such as for B.1.1 above.

B.2 TYPICAL SPECIFICATION FOR THE TYPES OF ELECTRICITY SUPPLY

DESCRIPTION	TYPE OF SUPPLY			
	(B.1.1)*	(B.1.2)*	(B.1.3)*	(B.1.4)*
Voltage 1 ph (Note 1)	110	110	110	24
Voltage tolerance (±% Max.)	5	5 (Note 2)	5 (Note 2)	10
Frequency (Hz)	50	50	50	
Frequency tolerance (% Max.)	2	5	5	—
Harmonic content (% Max.)	5 Total 2 each component	—	—	
Ripple (% Max.) (Note 3)				2
Interrupt time (less than)	10 ms	10 s		
Crest factor (Max.) (Note 4)	3 %			10 ms
In-Rush current (Note 5)				

*** See page 1 of this Appendix.**

Notes:

1) Voltage and frequency to suit local conditions, will be confirmed together with phase required, for each particular case (by Electrical Engineering).

2) As mains supply (statistical information shall be provided by Electrical Engineering).

3) Defined as root mean square value of AC components/nominal DC voltage.

4) Defined as I (peak)/I (root mean square), additional harmonics may be generated by non-linear load. The total shall not exceed 5% with 2% for each component.

5) Defined as the number of times the current will be drawn on during a defined time, typically 20 I (nominal)/10 msecs. This figure will be confirmed in the requisition for each particular case.

PART 2

MISCELLANEOUS VALVE ACTUATORS

CONTENTS :

PAGE No.

APPENDICES:

1. SCOPE

The scope of this Standard specification covers the material and equipment requirements of actuating system for; Surface Safety Valves (SSV), Sub-Surface Safety Valves (SSSV), used in wellhead operations.

In addition to the above mentioned actuators, hydraulic valve actuator control system is also specified in this standard. The hydraulic valve actuators covered herein, are classified in the following types:

Type A : Line-Break Control system with emergency local actuation for gas pipe-lines
Type B : Line-Break Control System with Remote Control System for gas pipe-lines
Type C : Oil pipe-line Manual/Remote operation actuators

2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The editions of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard, The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor.

API (AMERICAN PETROLEUM INSTITUTE)

SPEC 14 D	"Specification for Well-head Surface Safety Valves and Underwater Safety Valves for Offshore Service" (1988)
SPEC 14 A	"Specification for Sub-Surface Safety Valve Equipment" (1988)
RP 14 B	"Recommended Practice for Design, Installation, and Operation of Sub-Surface Safety Valve Systems" (1981)
RP 14 H	"Recommended Practice for Use of Surface Safety Valves and Underwater Safety Valves-Offshore" (1984)
RP 16 E	"Recommended Practice for Design of Control Systems for Drilling Well Control Equipment" (1990)

NACE (NATIONAL ASSOCIATION OF CORROSION ENGINEERS)

MR-0175	"Sulfide Stress Cracking Resistant Metallic Material for Oil Field Equipment"

IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSION)

# 529	"Ingress Protection for Electric Apparatus Enclosures"

NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)

NFC # 70	"National Electrical Code (NEC)"

3. UNITS

This Standard is based on International System of Units (SI), except where otherwise specified.

4. HYDRAULIC ACTUATORS FOR PIPE-LINE APPLICATIONS

4.1 General Requirements on Actuators

4.1.1 The actuator system, including all accessory equipment required for each specific application, shall be provided to meet the stated conditions for each specific project. Vendor shall attach detail technical literature with detail technical specification for each component used (either standard or additional accessory) in his bid proposal/quotation.

4.1.2 All electrical components shall be certified for NEC Class 1, Group C/D, Division 2 applications.

4.1.3 The pipeline sour gas, used for pressurizing the hydraulic fluid shall be scrubbed with activated charcoal bed prior to entering the actuator control system or pressurizing system to decrease/remove the H_2S content of the gas. The H_2S level of the gas entering the actuator system shall be conditioned to contain less than 200 PPM of H_2S.

4.1.4 All actuator parts shall have suitable surface treatment to protect them against corrosion. All pneumatic and hydraulic components of the control system shall be made of corrosion resistant materials, such as; stainless steel and PTFE.

4.1.5 The actuator control circuits shall be equipped with suitable control device for operating speed adjustment.

4.1.6 The actuator shall be equipped with suitable travel/torque protective hydraulic circuit to prevent any damage to the valve or actuator due to the excess torque, in case of valve travel blockage.

4.1.7 Actuator component installation design shall provide good accessibility for all components, parts, and accessories installed in the actuator system enclosure.

4.1.8 All moving parts shall have suitable lubricating facilities. All pneumatic and hydraulic components of the control system shall be made of corrosion resistant materials.

4.1.9 All outgoing or incoming electrical connections of the actuator shall be made by means of high quality terminals installed in a separate junction box mounted on the actuator assembly. The junction box shall have two cable entries suitable for M20 × 15 mm glands blocked with removable plastic cap with two pertinent glands provided inside the junction box. The junction box ingress protection shall comply with IEC-529/IP-65.

Terminals shall be clearly numbered with markers on the terminal side and on the pertinent wires connected.

4.2 Line-Break Valve Actuators with Emergency Local Actuation (Type A)

4.2.1 General

4.2.1.1 The Line-Break valve actuator shall be suitable for automatic line-break detection and shall also be equipped with provision for local emergency actuation of the valve for application in gas pipe-lines.

4.2.1.2 The line-break detection circuit shall basically consist of; shuttle valve, metering valve, sensing tank, control cylinder, etc. to sense the rate of pressure drop. The system shall have provision to prevent erroneous actuation functioning, caused by either; a sudden pressure fluctuation within a range smaller than the designated pressure value or a graduate pressure fluctuation within a larger range by means of a suitable mechanism around the control cylinder.

4.2.1.3 The actuator system shall include provision for remote monitoring of the valve position with voltage free contact limit switches. These limit switches shall indicate extreme open or close position of the valve and shall be of explosion-proof type, unless otherwise specified.

4.2.1.4 Safe and proper operation of the valve shall not be deteriorated by power failure to the valve actuator.

4.2.2 Technical requirements for gas-over-oil actuator

4.2.2.1 The gas-over-oil actuator shall basically comprise of the following components;

Actuating control valve, Control cylinders, Gas-over-oil tank, hand pump with pertinent change-over valve, metering valve, sensing tank and double check valves (see Appendix A1, page 36).

4.2.2.2 The actuators hall have modular design and shall employ scotch yoke mechanism preferably with 90° rotation with a tolerance of ±3°.

4.2.2.3 The actuator design shall be of cylinder type suitable for direct mounting on the valve as specified in Requisition. The actuator shall be capable of withstanding all envisaged line vibrations and movements.

4.2.2.4 All accessory equipment, such as; hydraulic accumulators, line-break detection system, regulators and limit switches shall be mounted, fully piped, connected and supplied with the actuator.

4.2.2.5 The actuator shall be equipped with suitable valve position mechanical indicator.

4.2.2.6 When actuator closes the valve due to a line-break detection, it shall be latched in the close position and shall be only opened locally.

4.2.2.7 The actuator should be provided with a suitable hand-operated control valve for local operation of the valve. The actuator shall also have a hydraulic pump to enable local manual operation of the valve; when there is no gas pressure available in the line.

4.2.2.8 he actuator shall have two gas-over-oil pressure tanks filled with different hydraulic oil levels. The difference between two oil level surfaces must be at least equal to the amount of oil required for a complete valve travel.

4.3 Line-Break Valve Actuator with Remote Control (Type B)

4.3.1 General

4.3.1.1 The actuator system shall be generally, gas-over-oil type to be used for line-break detection and protection and for remote control application in gas pipe-lines. The actuator shall be powered by pipeline gas to operate the valve either to close or open position (see Appendix A2, page 37). The vendor shall consider provision for an additional pneumatic storage power tank suitably sized for a complete "close/open/close" cycles in case of blockage of the gas in pipeline or for start-up of the pipeline.

4.3.1.2 The actuator shall be powered by pipeline gas, pneumatically powered hydraulic pump and a hand hydraulic pump. The actuator shall be provided with pneumatic power storage tank to operate pneumatic/hydraulic pump unit.

4.3.1.3 The actuator shall be equipped with suitable line-break detection system to sense the rate of drop of pressure in a manner not to close the valve at normal operating pressure changes.

4.3.2 Technical requirements

4.3.2.1 The actuator shall be totally self-contained unit and shall be provided with suitable hermetically sealed solenoid operated valves for remote open/close operation. The solenoid valve shall be equipped with mechanical manual reset device, if specified.

4.3.2.2 The actuator system shall include the following features:

- Remote open/close actuation with remote extreme open/close indication.

- Line-break detection and automatic operation consequently, by means of pipe-line gas pressurizing the hydraulic oil actuating system.

- Provision for local manual open/close operation by means of hydraulic hand pump.

4.3.2.3 The actuator shall be provided with suitable limit switches for remote indication of the valve extreme positions.

4.3.2.4 When the actuator closes the valve due to a line-break detection, it shall be latched in the close position and shall be only opened locally.

4.3.2.5 The actuator shall have two gas-over-oil accumulator tanks (one for open and one for close actuation) complying with pertinent ASME Code.

4.3.2.6 The actuator shall employ scotch yoke actuating mechanism preferably, suitable for direct mounting on the valve as specified in Requisition. The actuator shall be capable to withstand all envisaged line vibrations and movements.

4.3.2.7 The actuator shall employ modular design and shall be equipped with all standard fundamental and accessory equipment, such as; hydraulic accumulators, line-break detection system, regulators, pneumatic and hydraulic controls, hand-pump, pneumatic power storage tank, etc., fully piped, connected and supplied with actuator.

4.3.2.8 The actuator control circuit shall be provided with a suitable hand-operated control valve for local/automatic operation.

4.3.2.9 Vendor shall specify the following, in his bid proposal, with full technical literature back-up:

- Control circuit
- Hydraulic circuit
- Pneumatic circuit
- Valve closing and opening operation description.

4.4 Oil Pipeline Manual/Remote Operation Actuators (Type C)

4.4.1 General

4.4.1.1 The actuator shall be hydraulic type to be used for close/open operation of the oil pipeline valves. The actuator shall be powered by hydraulic fluid pressurized in a hydraulic accumulator with nitrogen bladder. The hydraulic pressure shall be provided through a hydraulic hand pump and a pneumatic powered hydraulic pump.

4.4.1.2 The pneumatic supply may be provided through local or portable compressor, as required in Purchase Order.

4.4.1.3 Suitable hand pump shall be provided for each individual actuator. The actuator shall have a hydraulic accumulator equipped with nitrogen bladder as power storage tank. Vendor shall provide full detail technical literature with description of each component function in his bid proposal.

4.4.2 Technical requirements

4.4.2.1 The actuator shall be self-contained unit and shall be capable to be tripped remotely, by an electrical signal to a solenoid operated valve.

The actuator shall also be capable to be tripped locally by manually switching a "mode control" valve at the actuator control panel.

4.4.2.2 The actuator shall have suitably sized hydraulic pressure accumulator tank to maintain hydraulic pressure required for one open and one close operation of the valve, minimally.

4.4.3.3 The actuator shall have suitable mechanical valve position indicator. The actuator shall be equipped with two limit switches (one for extreme open and one for extreme close actuation) for remote valve position indication. The limit switches shall be certified for NEC, Class 1, Group C/D, Division 2 application.

4.4.3.4 The control circuit shall basically comprise of; mode control valve, remote closure solenoid valve, open push-button valve, close and open relay valves, valve close limit valve.

4.4.3.5 The actuator control circuit shall be capable to accept a pressure pilot operated valve for automatic closure of the valve in response to pipeline pressure deviations outside a pre-determined set point (rate of pressure fall).

4.5 Information Requirements

4.5.1 The following information shall be provided by vendor with his proposal:

- Size and primary service pressure rating of the valve.
- The fluid controlled by the valve.
- Maximum differential pressure across the valve.
- Position of valve stem, vertical, horizontal or inclined.
- Valve stem diameter.
- Valve actuator top mounting detail drawings
- Maximum thrust required on the valve stem.
- Wiring/tubing diagram.
- Type of thread.
- Inspection and test, as well as manufacturing and quality test procedures.
- General valve actuator data/drawings.
- Complete catalog and operational details.
- Specification of all materials.
- Guarantee and assurance of suitability and compliance with all reference codes, standards and application in wet H_2S service.
- Fail safe features.
- Recommended spare parts for commissioning and 2 year operation.

4.5.2 The following information/documents shall be provided by the vendor in quantity specified in the contract purchase order:

- Wiring/tubing diagram
- Complete catalog and operational details
- Detail maintenance manual and illustrative parts list

4.6 Inspection

4.6.1 All tests shall be witnessed by inspector representing the Company. Manufacturer shall give the inspector reasonable notice of the time and the place where the test is to be conducted. The inspector representing the Company shall have free access at all times to all parts of the Manufacturer's works and shall be afforded without charge with all reasonable facilities to satisfy him that the actuators are being manufactured and tested in accordance with this standard. All inspections will be made at the Manufacturer's works prior to shipment.

4.6.2 The valve manufacturer shall be responsible for the complete power operated valve and control system when valve and actuator are ordered together. The valve manufacturer shall test the actuator and valve as a unit in the valve manufacturer's plant.

4.7 Shipment

The preferred shipment method is, not removing the actuator from the valve for shipment. If removal is required for safe shipment and protection of material against damage, then valve-actuator shall be boxed, crated, securely bolted to skids or otherwise properly protected in such a manner as to avoid damage during shipment. Particular attention shall be paid to protection of flange face, threads and machined surfaces.

A spare set of necessary gaskets shall be supplied if the actuator and valve are packed separately.

5. WELLHEAD SURFACE SAFETY VALVE (SSV) CONTROL SYSTEM

5.1 General

5.1.1 The actuator shall be of piston-type. The control pressure applied to the piston shall push the valve to the "Open" position (fail-safe operation).

5.1.2 The actuator shall be large ratio pneumatic/hydraulic type to permit the use of lower control pressure. The actuator power supply shall be of pneumatic over hydraulic pump, using compressed air or produced gas for pressurizing. The control gas pressure available is less than 250 psi.

5.1.3 Low-ratio hydraulic actuators shall be provided when the SSV is to be controlled by the same system that controls the sub-surface safety valve, or where limited space is available on the christmas-tree location.

5.1.4 The valve actuator shall meet all requirements specified in API Specification 14 D (Spec. 14 D) and API-RP-14 H.

5.2 Technical Requirements

5.2.1 The actuator shall have a stem position visual indicator.

5.2.2 The actuator shall be equipped with stem position limit switches to provide telemetry feedback information, if specified.

5.2.3 A manually operated mechanical or hydraulic jack shall be attached to the actuator to open a closed safety valve where the control pressure source is downstream of the safety valve or where system failure makes control pressure unavailable.

5.2.4 Materials for the actuator parts in contact with flow line fluid shall be consistent with the service and valve body.

5.2.5 The actuator closing force must be sufficient to close the surface safety valve when the valve is at the most severe design closing condition.

5.2.6 In pneumatically operated SSV actuators, a relief device shall be provided to relieve at a pressure not higher than the rated working pressure of the SSV actuator.

5.2.7 SSV actuators must be designed to prevent pressure build-up in the SSV actuator case due to leakage from the SSV valve.

5.2.8 The actuator shall be equipped with suitably sized automatic actuating system comprising of:

- Trip control valves-3 way NC hydraulic pilot and 3 way NC solenoid, if specified. The actuator shall be tripped to close the valve on application of signal to solenoid valve.

- Latching trip valve

- Hydraulic hand pump; pneumatic/hydraulic pump

- Pressure relief valve (adjustable)

- Oil accumulator (Gas over Oil Tank)

- Pneumatic power storage tank

5.2.9 The actuator system shall be suitable for Class 1, Division 2, Groups C and D according to NFPA-70.

5.2.10 The actuator shall suit the valve as indicated on relevant data sheets, concerning; valve size, working pressure rating, maximum shut-in differential pressure.

6. WELLHEAD SUB-SURFACE SAFETY VALVE (SSSV) CONTROL SYSTEM

6.1 General

6.1.1 SSSV are used because they are located in the wellbore and isolated from possible damage by fire, collision, or sabotage. The SSSV's are either subsurface or surface-controlled. Preference will be given to surface-controlled type.

6.1.2 The wireline-retrievable valves, usually employed, are located in special landing nipples that are part of the tubing string, and they can be retrieved for maintenance with lower cost wireline methods.

6.1.3 Sub-surface-Controlled Sub-surface Safety Valves (SCSSV) shall sense flow conditions in the well at the valve and close when the flow exceeds a preset limit. These valves are in two main types;

- Excess flow valves which sense the pressure drop across an orifice in the valve and close the valve when the increased flow rate causes the pressure drop to increase to a preset limit.

- Low-pressure valves which have a stored reference pressure in the valve. The valve closes when tubing pressure at the valve draws down below the reference pressure due to a flow rate substantially in excess of normal maximum.

6.1.4 Surface-Controlled Sub-surface Safety Valves (SCSSV) shall be controlled by pressure maintained by a unit at the surface in response to a pilot system. Pressure is transmitted to the safety valve through a small-diameter parallel-tube control line in the annulus or through the tubing/casing annulus in conjunction with a packer below the safety valve. Volumetric compression and expansion of the control fluid makes the small tubing system preferable to the annulus conduits even though it is not as rugged.

6.2 Technical Requirements of the Control System

6.2.1 The Surface Controlled Sub-surface Safety Valve (SCSSV) actuator shall use the same power source applied for (SSV) of the well. The preferred type of power source is ratio-piston pneumatic/hydraulic pump.

6.2.2 The control system for actuator shall be provided to interface the power source, the sensors, and the safety valve actuator.

6.2.3 The control system proposed shall fulfill the following requirements in it's design;

- pressure and volume requirements of the safety valves;
- number and type of sensors as indicated in Purchase Order;
- power requirements and limitations of the pilots;
- telemetry interface, if specified;
- logic requirements as specified hereunder, unless otherwise specified in Purchase Order.

6.2.4 In operating the (SCSSV) and (SSV) actuators the logic to be incorporated shall close the SSV before the SSSV's closure and shall open the SSSV's first.

6.2.5 The actuator system including the control system shall meet all requirements of API RP-14 B and Spec. 14 A.

6.3 Sensors Requirements for Offshore Applications

6.3.1 Sensors shall be provided to monitor production system hazards or malfunctions. These sensors shall actuate a pilot valve or switch in the control system to activate the valve. The pilot valve and/or control valve shall be either bleed (two-way) or block-and-bleed (three-way) as required by a specific system.

6.3.2 Conditions that are usually monitored include:

1) pressure-high or low because of flow line or pressure vessel blockage or rupture;

2) level-high or low in separator or storage tank and high level in knock-out drum resulting from system control valve malfunction;

3) fire-heat is sensed by fusible plugs or fusible control line, flames are sensed by ultraviolet detectors, and temperature is detected by infra-red detectors;

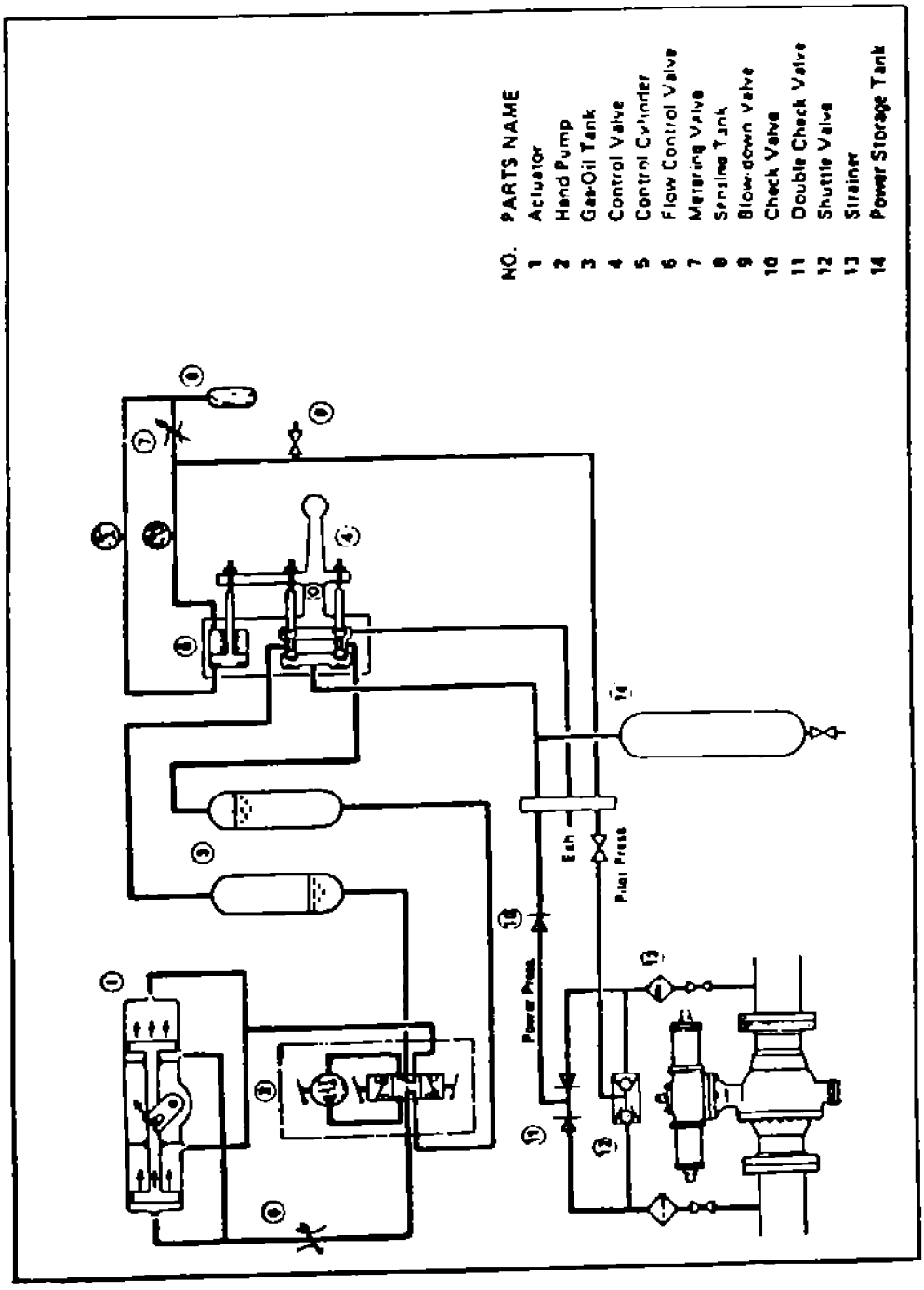
4) toxic or flammable gas mixture-detectors;

5) manual control ESD system valves at boat landings, living quarters, and other critical locations of the offshore platforms.

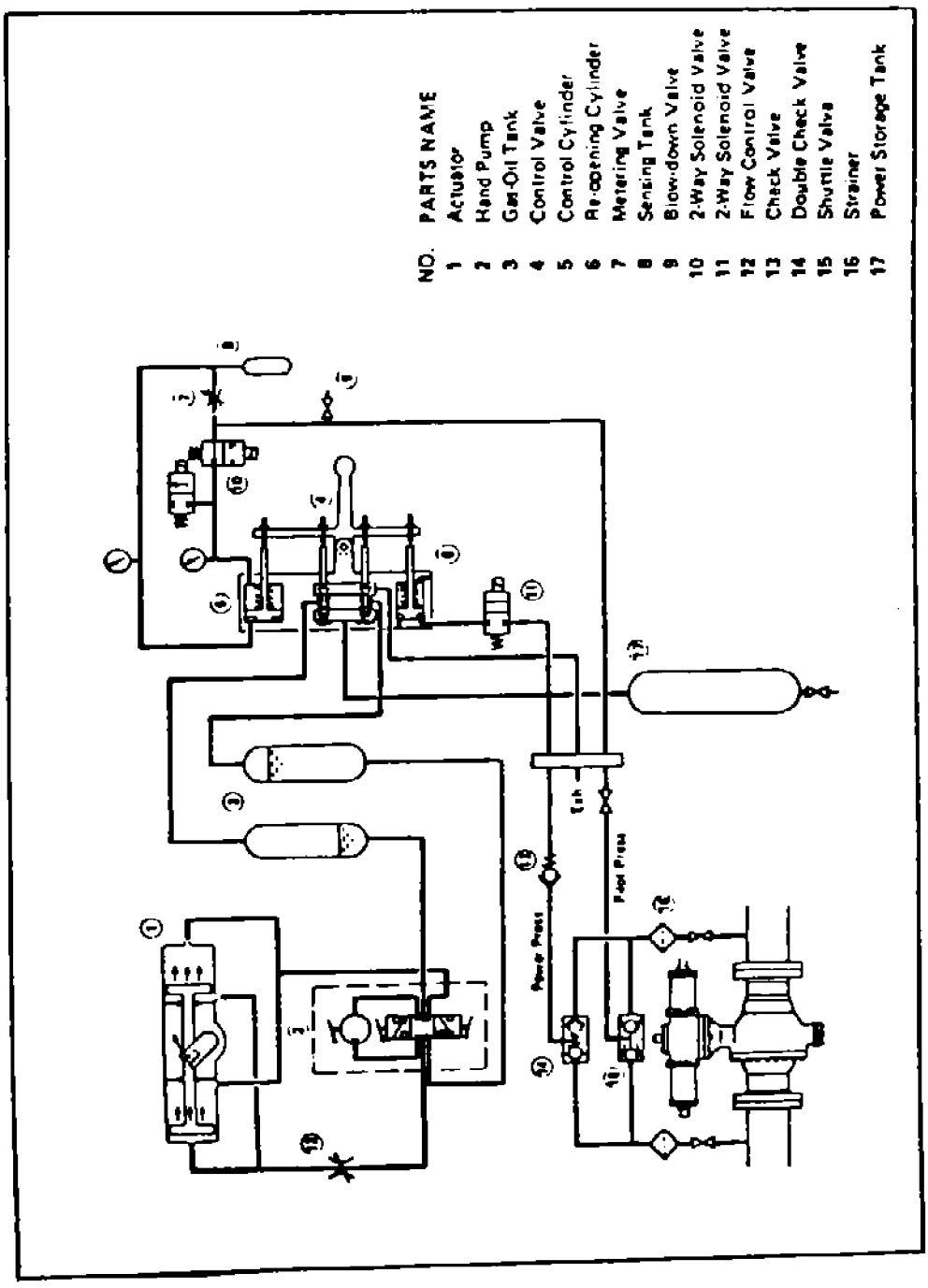
6.3.3 Pressure sensors should be located at any point in the production system where sections of the system can be isolated by a check valve or block valve, or where there is a change in pressure due to a choke or pressure reducing valve. Pressure sensors may have a moving-seal sensing element or an elastic element such as a Bourdon tube.

APPENDICES

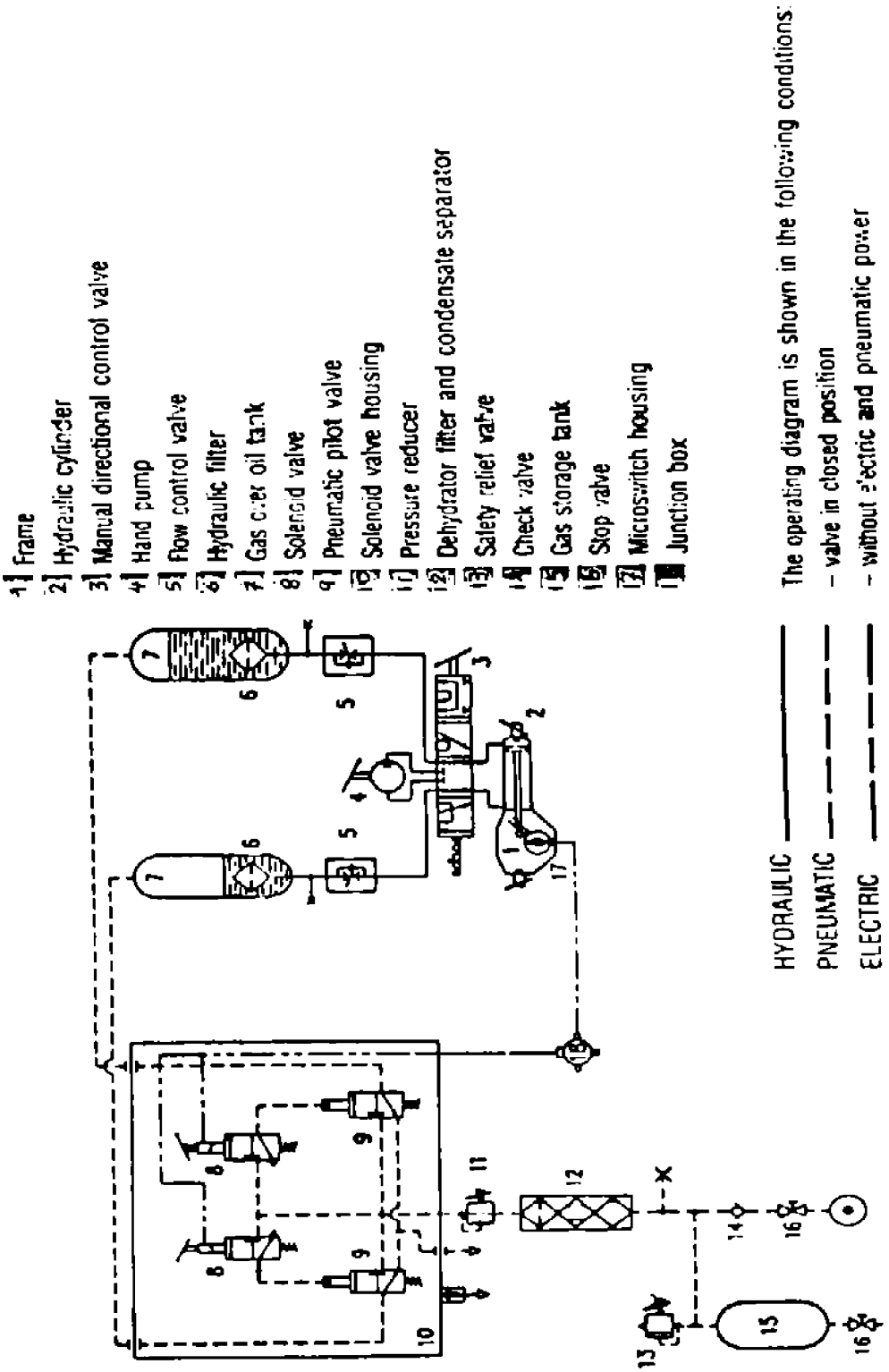
APPENDIX A1
LINE BREAK CONTROL SYSTEM (TYPE A)



APPENDIX A2
LINE BREAK AND REMOTE CONTROL SYSTEM (TYPE B)



APPENDIX A3
OIL PIPE-LINE MANUAL/REMOTE OPERATION CONTROL SYSTEM (TYPE C)



PART 3

ROTATING MACHINERY INSTRUMENTATION

CONTENTS :

PAGE No.

1. SCOPE

The scope of this Standard covers the general requirements for rotating machinery instrumentation, provided on "packaged equipment" basis. This standard specification shall be applied in conjunction with; IPS-M-IN-280/Part 1 here-to-fore (packaged equipment instrumentation) and the following standards as may be applicable:

IPS-M-PM-105	"Centrifugal Pumps for Process Services"
IPS-M-PM-115	"Centrifugal Pumps for General Services"
IPS-M-PM-125	"Centrifugal Fire Water Pumps"
IPS-M-PM-130	"Positive Displacement Pumps, Reciprocating"
IPS-M-PM-140	"Positive Displacement Pumps, Rotary"
IPS-M-PM-150	"Positive Displacement Pumps, Controlled Volume"
IPS-M-PM-170	"Centrifugal Compressors for Process Services"
IPS-M-PM-180	"Packaged Integrally Geared Centrifugal Compressors for Utility & Instrument Air Services"
IPS-M-PM-190	"Axial Flow Centrifugal Compressors"
IPS-M-PM-200	"Reciprocating Compressors for Process Services"
IPS-M-PM-210	"Reciprocating Compressors for Utility & Instrument Air Services"
IPS-M-PM-220	"Positive Displacement Compressors-Rotary"
IPS-M-PM-230	"Forced Draft Fans for Boilers & Process Services"
IPS-M-PM-240	"General Purpose Steam Turbines"
IPS-M-PM-250	"Special Purpose Steam Turbines"
IPS-M-PM-260	"Combustion Gas Turbines"
IPS-M-PM-270	"Expansion Turbines (Turbo-Expanders)"
IPS-M-PM-280	"Internal Combustion Diesel Engines"
IPS-M-PM-290	"Internal Combustion Gas Engines"
IPS-M-PM-300	"Special Purpose Gear Units"
IPS-M-PM-310	"Special Purpose Couplings"
IPS-M-PM-320	"Lubrication Shaft Sealing & Control Oil Systems for Special Purpose Application"
IPS-M-PM-330	"Mixers"

The following definitions has been used throughout this part of standard:

SUB. : The pertinent API paragraph is deleted and substituted by the new clause, as indicated.
DEL. : The pertinent API paragraph is deleted without any replacement.
ADD. : A new paragraph with a new number is added to the pertinent API standard.
MOD. : The pertinent API standard is modified and/or a new description or condition is added to that paragraph.

2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The editions of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor.

API (AMERICAN PETROLEUM INSTITUTE)

Std. 670	"Vibration, Axial-position, and Bearing-Temperature Monitoring Systems" (1986)
Std. 678	"Accelerometer-Based Vibration Monitoring System" (1981)
RP 550	"Manual on Installation of Refinery Instrument and Control System" (latest edition)
RP 500 A	"Classification of Areas for Electrical Installations in Petroleum Refineries" (1982)
RP 500 B	"Recommended Practice for Classification of Areas for Electrical Installation at Drilling Rigs and Production Facilities on Land and on Marine Fixed and Mobile Platforms" (1987)
RP 500 C	"Classification of Areas for Electrical Installation at Petroleum and Gas Pipeline Transportation Facilities" (1984)

CENELEC (EUROPEAN COMMITTEE FOR STANDARDIZATION OF ELECTROTECHNIQUE)

EN 50.014	"General Requirements"
EN 50.016	"Pressurized Apparatus 'p'"
EN 50.018	"Flame-Proof Enclosure 'd'"
EN 50.020	"Intrinsic Safety 'i'"
EN 50.039	"Systems"

ISA (INSTRUMENT SOCIETY OF AMERICA)

S 7.3	"Quality Standard for Instrument Air"
S 12.4	"Instrument Purging for Reduction of Hazardous Area Classification"
RP 12.6	"Installation of Intrinsically Safe Instrument Systems in Class 1 Hazardous Locations"

NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)

NFC # 496	"Purged and Pressurized Enclosures for Electrical Equipment in Hazardous Locations" (1982)
NFC # 497 A	"Classification of Class 1 Hazardous (Classified) Locations for Electrical Installation Area" (1986)
NFC # 70	"National Electrical Code (NEC)"

BSI (BRITISH STANDARDS INSTITUTION)

BS 5345	"Code of Practice for Selection, Installation and Maintenance of Electrical Apparatus for Use in Potentially Explosive Atmosphere (Other than Mining Applications or Explosive Processing and Manufacturing)" (latest edition)

BS 4683 Part 1	"Specification for Electrical Apparatus for Explosive Atmosphere" (1971)
BS 4683 Part 2	"The Construction and Testing of Flame-Proof Enclosures of Electrical Apparatus" (1971)

UL (UNDERWRITER LABORATORY)

UL-913	"Intrinsically Safe Apparatus and Associated Apparatus, for Use in Class 1, 2 and 3, Division 1, Hazardous (Classified) Locations" (1988)

3. API STANDARD 670

Under this title the options indicated in the above Standard by bullet (0) marks will be specified. Clauses in API RP-670 not mentioned, remain unaltered.

Item 1.4 System of Units (Add.)

Equivalent SI Unit System shall be used except for pipe threads which shall be according to API (NPT).

Item 3.1.1.2 * The probe tip shall be from 7.6 to 7.9 millimeters in diameter, with a body diameter of 3/8 - 24 - UNF - 2A threaded (see Fig. 3). (Sub.)

Item 3.1.1.4 The integral probe cable shall be coaxial, with tetra fluoroethylene (TFE) insulation. The electrical length of the probe- and-integral-cable assembly shall be 1 meter. The overall physical length shall be approximately 1 meter, measured from the probe tip to the end of the connector.

*** Note:**

Figures are included in API 670.

The minimum overall physical length shall be 838 millimeters; the maximum overall physical length shall be 1143 millimeters. The probe shall have flexible stainless steel armoring attached to the probe body and extending to within 102 millimeters of the conductor. (Mod.)

Item 3.2.1.1 The standard temperature sensor shall be a grounded, type J iron-copper-nickel (for example, constantan) thermo-couple manufactured in accordance with ANSI MC 96.1. (Mod.)

Item 3.4.1.2/e For each vibration and position monitor and each temperature channel, preshutdown-alarm (alert) set-points that are adjustable over the entire display range. (Mod.)

Item 3.4.2.1 The vibration monitor's read-out range shall be from 0 to 10 mils (0 to 250 micrometers) peak-to-peak displacement, with 0.2 mil (5-micrometer) graduations. (Mod.)

Item 3.4.4.1 The bearing-temperature monitor's standard read-out shall be a digital display with a range from 0 to 150°C and a resolution of 1°C. (Mod.)

Item 3.4.4.3 Bearing-temperature monitors shall have standard configuration of monitoring three pairs of sensors, unless more points are required by specific application. This configuration shall have the capability of automatically displaying the highest reading and of mutually displaying the reading of any individual sensor by the use of a contact switch or push-button. If rotary switches are used, they shall meet or exceed the reliability requirements of MIL-S-3786-13. (Mod.)

Item 4.2.1 * Two axially oriented transducers shall be supplied for the thrust-bearing end of each casing. Both transducers shall be retractable and shall sense the shaft itself or an integral axial surface installed within an axial distance of 305 millimeters from the thrust bearing or bearings (see Figs. 11 and 12). The standard arrangement shall be one probe sensing the shaft end and one probe sensing the thrust collar (see Fig. 13). (Mod.)

*** Note:**

Figures are included in API 670.

Item 5.1.1 One month before Factory Acceptance Test (FAT), at most, the machinery vendor shall furnish the specified number of copies of documentation of the monitoring system's installation and calibration details, rotor runouts, and limits, as listed in 5.1.2 through 5.1.5 herein and IPS-M-IN-280, Part 1,"Packaged Equipment Instrumentation", Paragraph 5.2.2. The appropriate construction agency shall perform the calibration and functional check-out of the entire monitoring system before start up and furnish twelve (12) copies of "As-Built" documentation as specified in IPS-M-IN-280, Part 1, Paragraph 5.2.2, items 7, 8, 11, 13, and 14 to the Company. (Mod.)

Item 5.1.3 At least 6 months before the scheduled shipping date or 6 weeks after placing the order (whichever applicable), the machinery vendor shall supply the following items to the Company.

"items a to e shall be used without any change". (Mod.)

Item 5.2.1 The number of prints and reproducibles required and the times within which they are to be submitted by the vendor shall be in accordance with IPS-M-IN-280, Part 1, Paragraph 5.2.2. (Mod.)

4. API STANDARD 678

Under this title the options indicated in the above standard by bullet (0) marks are specified. Clauses in API-678 not mentioned, remain unaltered.

Item 2.2.1.5 When applications requiring operation of the charge amplifier outside the above temperature range, then military specification components suitable for -55°C to +125°C shall be furnished. (Mod.)

Item 2.4.1 All monitoring equipment purchased under this standard and installed for a single machinery train shall be purchased from the same instrument manufacturer as the plant instrumentation system. The machinery vendor shall assume responsibility for the design and installation of the monitoring system and instrumentation for the train. (Mod.)

Item 3.2.1 * Extension cables of shielded twisted triad type in accordance with Appendix A or coaxial, as required (see Figs. 3 and 4). The conductors shall be tinned. (Mod.)

Note:

Figures are included in API 678.

Item 3.12 Location of Monitor

Monitors shall be located outdoors (it should be recognized that outdoor installations must be designed and located to avoid adverse vibrational and environmental effects.) (Mod.)

Item 3.13.2 Air purging shall be used to avoid moisture problems even when weatherproof and watertight housing are used (see 3.13.1) purge air shall be clean and dry as in type X or Y of NFPA # 496 or CENELEC EN 50.016, as required. (Mod.)

*** Note:**

Figures are included in API 678.

PART 4

FLARE SYSTEM INSTRUMENTATION

CONTENTS :

PAGE No.

1. SCOPE

This Standard covers the general control and instrumentation requirements for flare system application.

Provision of flare system instrumentation shall be according to "Packaged Equipment Instrumentation" Part here-to-fore.

It shall be noted that; the arrangement of the flare system will vary with the performance required. Correspondingly, the selection of instrumentation, as well as their application, must match the needs of the particular plant and it's specification.

2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The editions of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor.

API (AMERICAN PETROLEUM INSTITUTE)

RP-521 "Guide for Pressure Relieving and Depressuring System"

3. CONTROL AND INSTRUMENT REQUIREMENTS FOR FLARE SYSTEM

3.1 Pilot Ignition System

3.1.1 The following instrumentation shall be provided on the fuel gas line to the pilot, as a minimum:

- Pressure indicator;
- low pressure switch (to be connected to control room annunciator).

3.1.2 The Air supply line of pilot shall be minimally equipped with; pressure indicator and flame front generator with the pertinent power supply for spark ignitor.

3.2 Steam Injection

3.2.1 Steam injection lines used in flares for smokeless burning of low-pressure waste gases from industrial plants (refineries, petrochemical, chemical plants) shall be equipped minimally with instrumentation specified hereunder.

3.2.2 The steam injection line shall be provided with a flow control loop, ratio controlled by flow of gas to the flare system.

3.2.3 The controller shall be suitable for local panel mounting.

3.2.4 The steam line shall be equipped with suitable steam traps as required by API-RP-521.

3.3 Flame Detection System

3.3.1 For each pilot of the flare system, a thermocouple shall be provided to detect the pilot flame. The thermocouple shall command the pilot ignition system in case of pilot extinguishment.

3.3.2 The thermocouple extension cable shall be of Mineral Insulated Cable (MIC) type to be capable to withstand the radiation heat of the flare.

3.4 Flare Control Panel

3.4.1 All flare instrumentation and control system shall be installed on a local control panel suitable for Class 1, Group C/D, Division 2 area.

3.4.2 Vendor shall specify the safe distance of the flare control panel to the flare installation for operation of the instruments and safety of the personnel considering the radiation heat of the flame front.