

OGP

Instrument & automation standards and committees for the international oil & gas industry

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International Association of Oil & Gas Producers



Publications

Global experience

The International Association of Oil & Gas Producers has access to a wealth of technical knowledge and experience with its members operating around the world in many different terrains. We collate and distil this valuable knowledge for the industry to use as guidelines for good practice by individual members.

Consistent high quality database and guidelines

Our overall aim is to ensure a consistent approach to training, management and best practice throughout the world.

The oil and gas exploration and production industry recognises the need to develop consistent databases and records in certain fields. The OGP's members are encouraged to use the guidelines as a starting point for their operations or to supplement their own policies and regulations which may apply locally.

Internationally recognised source of industry information

Many of our guidelines have been recognised and used by international authorities and safety and environmental bodies. Requests come from governments and non-government organisations around the world as well as from non-member companies.

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Instrument & automation standards and committees for the international oil & gas industry

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Acknowledgements

This report was compiled by the OGP Instrumentation & Automation Task Force

Abbreviations (origin)

AGA	American Gas Association	LAN	Local area network
ASME	American Society of Mechanical Engineers	MOA	Memorandum of Agreement
ANSI	American National Standards Institute	MODU	Mobile Offshore Drilling Units Code (IMO)
API	American Petroleum Institute	NACE	National Association of Corrosion Engineers (US)
ASCI	Automation Standards Compliance Institute	NAMUR	Automation Systems Interest Group of the Process Industry (Germany)
ASM	Abnormal Situation Management Consortium	NAS	National Aerospace Standard (US)
BCS	British Computer Society	NEK	Norwegian Electrotechnical Committee
BS	British Standards	NEMA	National Electrical Manufacturers Association (US)
BSC	British Computer Society	NESC	National Electrical Safety Code
CEN	European Committee for Standardization	NFC	National Fire Code
CENELEC	European Committee for Electrotechnical Standardization	NFPA	National Fire Protection Association (US)
CFR	Code of Federal Regulations (US)	NORSOK	Norwegian Competitive Position on the Continental Shelf
CRE	API Committee for Refining Equipment	NPD	Norwegian Petroleum Directorate
CSA	Canadian Standards Association	NS	Norwegian Standard
DNV	Det Norske Veritas (Norway)	OGP	International Association of Oil & Gas Producers
DIN	German Institute for Standardization	OLF	Norwegian Oil Industry Association
EC	European Commission	OSHA	Occupational Safety and Health Administration (US)
EEMUA	Engineering Equipment & Materials Users' Association	PAS	Publicly Available Specification (ISO)
EIA	Electronics Industries Association	PIP	Process Industry Practices (US)
EMC	Electromagnetic compatibility	PD	Private Document (BSI)
EN	European Norm	PSA	Petroleum Safety Authority (Norway)
FCI	Fluid Controls Institute (US)	SAC	Standardisation Administration of China
FDT	Field Device Type	SCD	System Control Diagram
HCF	HART Communication Foundation	SDO	Standards Developing Organization
IAS	IEEE Industry Applications Society	SIL	Safety Integrity Levels
IEC	International Electrotechnical Commission	SOICS	API Subcommittee on Instruments & Control Systems
IEE	Institution of Electrical Engineers (UK)	SOLAS	International Convention for the Safety of Life at Sea (IMO)
IEEE	Institute of Electrical and Electronics Engineers (US)	TIA	Telecommunications Industry Association
IFE	Institute for Energy Technology (Norway)	TF	Task Force
IFEA	The Association for Electrotechnics and Automation in Industry (Norway)	UKOOA	UK Offshore Operator Association (Now UK Oil & Gas)
IMO	International Maritime Organization	UL	Underwriters Laboratories (US)
IMS	IEEE Instrumentation & Measurement Society	VDI	Association of German Engineers
INC	EEMUA Instrumentation and Control Committee	VDE	Association for Electrical, Electronic & Information Technologies
ISA	International Society of Automation (US)	WCT	Wireless Cooperation Team
ISO	International Organization for Standardization		

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1 – Introduction

The International Association of Oil & Gas Producers (OGP) arranged a workshop 21 – 22 November 2006, in London with the objective to facilitate global networking of the instrument and automation (process control) specialists of OGP members and global suppliers and furthermore with the purpose of:

- discussing the existing operators' company and project specifications and available standards related to this discipline; and
- evaluating the needs for new international standards work in this area for the benefit of the OGP members and the global petroleum industry.

The following companies were present at this first workshop meeting:

- ABB, Norway & UK
- BP, UK
- Emerson, UK
- Honeywell, UK
- Hydro, Norway
- Petrobras, Brazil
- Siemens, Germany
- Total, France

The workshop heard presentation and proposals from each participating company and agreed a number of actions. OGP subsequently agreed to establish a permanent Task Force (TF) for Instrument & Automation standardisation for its oil & gas industry members to continue networking and handle the actions agreed at the workshop. The TF will be reporting to the OGP Standards committee with the following terms of references:

- To arrange for global networking of the instrument and automation specialists of OGP members and global suppliers.
- Present the existing company and project specifications and available standards related to the discipline.
- Discuss, propose and evaluate the needs for harmonisation of company specifications in international standards in this area for the benefit of the global petroleum industry.
- Discuss the need and make proposals for new international standards.

This report is a summary of a fact finding mission following from the workshop to identify available international standards used by the Instrument & Automation TF participating companies and a listing of technical committee where work is presently ongoing for this area. Metering (*eg* API MPMS) and subsea instrumentation standards and work have not yet been included.

This report documents the fact finding mission that followed the workshop with the intent to serve as part of the basis for evaluation of further standards work for the OGP members and interested suppliers in this area.

Text in this report is frequently taken from the open websites of the different standards development organisations described herein.

Proposals for supplements or corrections of this report are welcome; please email publications@ogp.org.uk

2 – Available standards

2.1 Instrument & automation specific standards available and used

The primary instrument & automation standards are singled out in this paragraph, as these standards are the responsibility of the instrument & automation community to develop and maintain.

ANSI/IEEE Std 1008	Software Unit Testing
ANSI/IEEE Std 610.12	Software Requirements
ANSI PTC 19.3	Thermowells (chapter 1, section 8-19)
ANSI/FCI 70-2	Control valve seat leakage.
API RP 520	Sizing, Selection, and Installation Of Pressure-Relieving Devices in Refineries, Part I and II.
API RP 551	Process Measurement Instrumentation
API RP 552	Transmission Systems
API RP 553	Refinery Control Valves
API RP 554	Process Control Systems
API RP 555	Process Analyzers
API RP 557	Guide to Advanced Control Systems
ASM	Effective Operator Display Design Practices
ASM	Effective Alarm Management Practices
BS 5839	Fire detection and alarm systems for buildings – Part 1: Code of practice for system design, installation, commissioning and maintenance
BS 6266	Code of practice for fire protection of electronic equipment
BS 6739	Instrumentation in Process design and Practice
DNV OS-D202	Instrument, control and safety systems
EEMUA 178	A Design Guide for the Electrical Safety of Instruments, Instrument/Control Panels and Control Systems
EEMUA 189	A guide to Fieldbus application to the process industry
EEMUA 191	Alarm systems - a guide to design, management and procurement
EEMUA 201	Process plant control desks using human-computer interfaces –a guide to design, operational and human interface issues
EEMUA 222	Guide to the Application of IEC 61511 to safety instrumented systems in the UK process industries
EN 54-1	Fire detection and fire alarm systems. Part 1: Introduction
EN 837-1	Pressure Gauges. Part 1: Bourdon Tube Pressure Gauges
EN 964-1	Safety of machinery. Safety related part of control system. General principles for design.
EN 50073	Guide for selection, installation, use and maintenance of apparatus for the detection and measurement of combustible gases or oxygen
EN 50104	Electrical apparatus for the detection and measurement of oxygen. Performance requirements and test methods
EN 50170	Fieldbus - General Purpose Field Communication System-Amendment 3, Ratified European Text; Partially superseded by EN 61784-1:2004; Partially superseded by EN 61158-2:2004; Partially superseded by EN 61158-3:2004; Partially superseded by EN 61158-5:2004; Partially superseded by EN 61158-4:2004; Partially superseded by EN 61158-6:2004
EN 50241-1	Specification for open path apparatus for the detection of combustible or toxic gases and vapours. General requirements and test methods

EN 50241-2	Specification for open path apparatus for the detection of combustible or toxic gases and vapours - Part 2: Performance requirements for apparatus for the detection of combustible gases
EN 50402	Functional Safety of Fixed Gas Detection Systems
IEC 60079	Electrical apparatus for explosive gas atmospheres Part 10-1: Classification of areas – explosive gas atmospheres Part 10-2: Classification of areas – combustible dust atmospheres. Part 11: Equipment – Protection by intrinsic safety “i” Part 13: Construction and use of rooms or buildings protected by pressurization/Artificial ventilation (CDV) Part 25: Intrinsically safe systems Part 29-1: Equipment for the detection and measurement of flammable gases – Performance requirement Part 29-2: Equipment for the detection and measurement of flammable gases – Guide for selection, installation, use and maintenance Part 29-3: Equipment for the detection and measurement of flammable gases - Requirements on the functional safety of fixed gas detection systems. Part 29-4: Gas Detectors – open path requirements and test methods. (CDV issued)
IEC 60381-1	Analogue signals for process control systems. Part 1: Direct current signals
IEC 60381-2	Analogue signals for process control systems. Part 2: Direct voltage signals
IEC 60534-1	Industrial-process control valves – Part 1: Control valve terminology and general considerations
IEC 60534-2-1	Industrial-process control valves – Part 2-1: Flow-capacity – Sizing equations for fluid flow under installed conditions
IEC 60534-2-3	Industrial-process control valves – Part 2-3: Flow capacity – Test procedures
IEC 60534-2-4	Industrial-process control valves – Part 2: Flow capacity – Section four: Inherent flow characteristics and rangeability
IEC 60534-2-5	Industrial-process control valves – Part 2-5: Flow capacity – Sizing equations for fluid flow through multistage control valves with interstage recovery
IEC 60534-3-1	Industrial-process control valves – Part 3-1: Dimensions – Face-to-face dimensions for flanged, two-way, globe-type, straight pattern and centre-to-face dimensions for flanged, two-way, globe-type, angle pattern control valves
IEC 60534-3-2	Industrial-process control valves – Part 3-2: Dimensions – Face-to-face dimensions for rotary control valves except butterfly valves
IEC 60534-3-2	Industrial-process control valves – Part 4: Inspection and routine testing
IEC 60534-4	Industrial-process control valves – Part 4: Inspection and routine testing
IEC 60534-5	Industrial-process control valves – Part 5: Marking
IEC 60534-7	Industrial process control valves - Part 7: Control Valve Data Sheet
IEC 60534-8-1	Industrial-process control valves – Part 8: Noise considerations – Section One: Laboratory measurement of noise generated by aerodynamic flow through control valves
IEC 60534-8-2	Industrial-process control valves – Part 8: Noise considerations – Section 2: Laboratory measurement of noise generated by hydrodynamic flow through control valves
IEC 60534-8-3	Industrial-process control valves – Part 8-3: Noise considerations – Control valve aerodynamic noise prediction method

IEC 60534-8-4	Industrial-process control valves – Part 8: Noise considerations – Section 4: Prediction of noise generated by hydrodynamic flow
IEC 60584-1	Thermocouples – Part 1: Reference tables
IEC 60584-2	Thermocouples – Part 2: Tolerances
IEC 60584-3	Thermocouples – Part 3: Extension and compensating cables – Tolerances and identification system
IEC 60654-1	Industrial-process measurement and control equipment – operating conditions – Part 1: climatic conditions
IEC 60654-2	Operating conditions for industrial-process measurement and control equipment – Part 2: Power
IEC 60654-3	Operating conditions for industrial-process measurement and control equipment – Part 3: Mechanical influences
IEC 60654-4	Operating conditions for industrial-process measurement and control equipment – Part 4: Corrosive and erosive influences
IEC 60751	Industrial platinum resistance thermometer sensors
IEC 60770-1	Transmitters for use in industrial-process control systems – Part 1: Methods for performance evaluation
IEC 60770-2	Transmitters for use in industrial-process control systems – Part 2: Methods for inspection and routine testing
IEC 60770-3	Transmitters for use in industrial-process control systems - Part 3: Methods for performance evaluation of intelligent transmitters
IEC 60801-1	Electromagnetic compatibility for industrial-process measurement and control equipment
IEC 61000	Electromagnetic compatibility (EMC)
IEC 61131-1	Programmable controllers - Part 1: General information
IEC 61131-2	Programmable controllers - Part 2: Equipment and test requirements
IEC 61131-3	Programmable controllers - Part 3: PLC programming languages
IEC 61131-4	Programmable controllers - Part 4: User guidelines
IEC 61131-5	Programmable controllers - Part 5: Communications
IEC 61158	Digital data communications for measurement and control – Fieldbus for use in industrial control systems
IEC TR 61158-1	Digital data communications for measurement and control - Fieldbus for use in industrial control systems - Part 1: Overview and guidance for the IEC 61158 series.
IEC 61285	Industrial-process control – Safety of analyser houses
IEC 61300-3-31	Fibre optic interconnecting devices and passive components
IEC 61326	EMC for Programmable Systems
IEC 61499	Function Blocks
IEC 61508-1	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements
IEC 61508-2	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems
IEC 61508-3	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 3: Software requirements
IEC 61508-4	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 4: Definitions and abbreviations
IEC 61508-5	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 5: Examples of methods for the determination of safety integrity levels
IEC 61508-6	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3
IEC 61508-7	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 7: Overview of techniques and measures

IEC 61511-1	Functional safety – Safety instrumented systems for the process industry sector – Part 1: Framework, definitions, system, hardware and software requirements
IEC 61511-2	Functional safety – Safety instrumented systems for the process industry sector – Part 2: Guidelines for the application of
IEC 61511-3	Functional safety – Safety instrumented systems for the process industry sector – Part 3: Guidance for the determination of the required safety integrity levels.
IEC 61512	Batch Control Systems
IEC 61518	Mating dimensions between differential pressure (type) measuring instruments and flanged-on shut-off devices up to 413 BAR (41,3 MPa).
IEC 61804	Function Blocks for Process Control
IEC 61850	Commutation networks and systems in substations
IEC 61987	Measuring Equipment/Electronic Catalogue
IEC 61784	Fieldbus Profile Sets
IEC 62061	Safety of Machinery – Functional Safety of Safety-related Electrical, Electronic and Programmable Electronic Control Systems
IEC 62424	Representation of process control engineering requests in P&I diagrams and data exchange between P&ID tools and PCE-CAE tools
IEC 62453	Field device tool (FDT) interface specification
IEE/BCS	Safety, Competency and Commitment - Competency Guidelines for Safety-Related System Practitioners
IEEE 488.1	Standard for Higher Performance Protocol for the Standard Digital Interface for Programmable Instrumentation.
IEEE 488.2	Standard Codes, Formats, Protocols, and Common Commands for use with IEEE-488.1.
IEEE 518	Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources
IEEE 730	Software Quality Assurance Plans
IEEE 802.3	Carrier Sense Multiple Access With Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications
IEEE 802.4	Token Bus Access Method
IEEE 802.5	Token Ring Access Method
IEEE 829	Software Test Documentation
IEEE 830	Recommended Practice for Software Requirements Specifications.
IEEE 1174	Standard Serial Interface for Programmable Instrumentation.
ISA Guide	Control Valves: Practical Guides for Measurement and Control
ISA 5.1	Instrumentation Symbols and Identification.
ISA S51.1	Process Instrumentation Technology
ISA 5.2	Binary Logic Diagrams for Process Operations.
ISA 5.3	Graphic Symbols for Distributed Control/Shares Display Instrumentation, Computer Systems
ISA S5.4	Instrument Loop Diagrams.
ISA S5.5	Graphic Symbols for Process Displays
ISA 5.06.01	Functional Requirements Documentation for Control Software Applications
ISA 7.0.01	Quality Standard for Instrument Air
ISA 12.01.01	Definitions and Information Pertaining to Electrical Apparatus in Hazardous (Classified) Locations
ISA RP 12.2.02	Recommendations for the Preparation, Content, and Organization of Intrinsic Safety Control Drawings
ISA 12.13.01	Performance Requirements for Combustible Gas Detectors

ISA 12.13.02	Explosive atmospheres - Part 29-2: Gas detectors - Selection, installation, use and maintenance of detectors for flammable gases and oxygen (ISA-60079-29-2)
ISA 12.21.01	Use of Fiber Optic Systems in Class I Hazardous (Classified) Locations
ISA 18.1	Annunciator Sequences and Specifications
ISA 18.2	Management of Alarm Systems for the Process Industries
ISA 20	Specifications Forms For Process Measurement And Control Instruments, Primary Elements and Control Valves.
ISA TR20.00.01	Specification Forms for Process Measurement and Control Instruments
ISA S 26	Dynamic Response Testing of Process Control Instruments
ISA RP 42.00.01	Nomenclature for Instrument Tube Fittings
ISA 50.00.01	Compatibility of Analog Signals for Electronic Industrial Process Instruments
ISA 50.02-2	Fieldbus Standard for Use in Industrial Control Systems, Part 2: Physical Layer Specification and Service Definition
ISA S71.01	Environmental Conditions for Process Measurement and Control Systems, Temperature and Humidity
ISA 75.01	Flow equations for sizing control valves.
ISA 75.02	Control Valve Capacity Test Procedures
ISA 75.05.01	Control Valve Terminology
ISA 75.07	Laboratory Measurement of Aerodynamic Noise Generated by Control Valves
ISA 75.08.01	Face-to-Face Dimensions for Integral Flanged Globe-Style Control Valve Bodies (Classes 125, 150, 250, 300, and 600)
ISA 75.08.02	Face-to-Face Dimensions for Flangeless Control Valves (Classes 150, 300, and 600)
ISA 75.08.03	Face-to-Face Dimensions for Socket Weld-End and Screwed-End Globe-Style Control Valves (Classes 150, 300, 600, 900, 1500, and 2500)
ISA 75.08.04	Face-to-Face Dimensions for Butt-weld-End Globe-Style Control Valves (Class 4500)
ISA 75.08.05	Face-to-Face Dimensions for Butt-weld-End Globe-Style Control Valves (Classes 150, 300, 600, 900, 1500, and 2500)
ISA 75.08.06	Face-to-Face Dimensions for Flanged Globe-Style Control Valve Bodies (Classes 900, 1500, and 2500)
ISA 75.08.07	Face-to-Face Dimensions for Separable Flanged Globe-Style Control Valves (Classes 150, 300, and 600)
ISA 75.08.09	Face-to-Face Dimensions for Sliding Stem Flangeless Control Valves (Classes 150, 300, and 600)
ISA 75.11.01	Inherent Flow Characteristic and Rangeability of Control Valves
ISA 75.17	Control Valve Aerodynamic Noise Prediction
ISA 75.19.01	Hydrostatic Testing of Control Valves ISA RP 75.21 Process Data Presentation for Control Valves
ISA RP 75.23	Considerations for Evaluating Control Valves Cavitation
ISA TR75.25.02	Control Valve Response Measurement from Step Inputs
ISA 75.26.01	Control Valve Diagnostic Data Acquisition and Reporting
ISA RP 76.0.01	Analyzer System Inspection and Acceptance
ISA 84.00.01	Functional safety: Safety Instrumented Systems for the Process Industry Sector (IEC 61511 Mod)
ISA TR84.00.02-1	Safety Instrumented Systems – Safety Integrity Level (SIL) Evaluation Techniques – Part 1: Introduction
ISA TR84.00.02-2	Safety Instrumented Systems – Safety Integrity Level (SIL) Evaluation Techniques – Part 2: Determining the SIL of a SIS via Simplified Equations

ISA TR84.00.02-3	Safety Instrumented Systems – Safety Integrity Level (SIL) Evaluation Techniques – Part 3: Determining the SIL of a SIS via Fault Tree Analysis
ISA TR84.00.02-4	Safety Instrumented Systems – Safety Integrity Level (SIL) Evaluation Techniques – Part 4: Determining the SIL of a SIS via Markov Analysis
ISA TR84.00.04-1	Guideline on the Implementation of ANSI/ISA-84.00.01-2004 (IEC 61511 Mod)
ISA TR84.00.03	Guidance for Testing of Process Sector Safety Instrumented Functions (SIF) Implemented as or Within Safety Instrumented Systems (SIS)
ISA TR84.00.04-1	Guideline on the Implementation of ANSI/ISA-84.00.01-2004 (IEC 61511 Mod)
ISA TR84.00.04-2	Example Implementation of ANSI/ISA-84.00.01-2004 (IEC 61511 Mod)
ISA TR84.00.05	Application of ISA 84.00.01-2004 for Safety Instrumented Functions (SIFs) in Burner Management Systems
ISA dTR84.00.01	Safety Fieldbus Design Considerations for Process Industry Sector Applications
ISA 91.00.01	Identification of Emergency Shutdown Systems and Controls that are Critical to Maintaining Safety in Process Industries
ISA TR91.00.02	Criticality Classification Guideline for Instrumentation
ISA 92.0.01	Performance Requirements for Toxic Gas Detection Instruments: Hydrogen Sulfide
ISA 92.0.02	Installation, Operation, and Maintenance of Toxic Gas-Detection Instruments: Hydrogen Sulfide
ISA 93.00.01	Standard Method for the Evaluation of External Leakage of Manual and Automated On-Off Valves
ISA TR99.00.01	Security Technologies for Manufacturing and Control System
ISA TR99.00.02	Integrating Electronic Security into the Manufacturing and Control System Environment
ISA 99.02.01	Security for Industrial Automation and Control Systems: Establishing an Industrial Automation and Control Systems Security Program
Note:	Many of the ISA standards are adopted by ANSI and issued as ANSI/ISA standards
ISO 3511-3	Process Measurement Control Functions and Instrumentation-Symbolic Representation - Part 3: Detailed Symbols for instrument interconnection diagrams
ISO 5167	Measurement of fluid flow by means of pressure differential devices - Part 1 General principles and requirements
ISO 7240-15	Fire detection and alarm systems -- Part 15: Point type fire detectors using scattered light, transmitted light or ionization sensors in combination with a heat sensor.
NAMUR NA 054	Examples of successful Applications involving Advanced Process Control Strategies
NAMUR NA 075	Special Requirements of Display Screen Workplaces in Control Rooms
NAMUR NA 076	NAMUR Checklist for Control Rooms and Control Stations
NAMUR NA 078	Process Control System Migration from the Users Point of View
NAMUR NA 103	Usage of Internet Technologies in Process Automation
NAMUR NA 113	Online Process Control Analysis
NAMUR NA 114	Best Practice Fieldbus Applications
NAMUR NA 115	IT-Security for Industrial Automation Systems: Constraints for measures applied in process industries
NAMUR NA 120	Operator Workplace from the Human-Process Communication Point of View
NAMUR NA 102	Alarm ManagementNAMUR NE 074 NAMUR-Fieldbus Requirements

NAMUR NE 053	Software of Field Devices and Signal Processing Devices with Digital Electronics
NAMUR NE 072	Validation of Process Control Systems
NAMUR NE 100	Use of Lists of Properties in Process Control Engineering Workflows
NAMUR NE 105	Specifications for Integrating Fieldbus Devices in Engineering Tools for Field Devices
NAMUR NE 106	Test Intervals of Safety Instrumented Systems
NAMUR NE 107	Self Monitoring and Diagnosis of Field Devices
NAMUR NE 121	Quality Assurance of Control Systems
NAMUR NE 122	PROFIBUS Interface for Drives with Frequency Converters in Process Technology
NAMUR NE 123	Service and Maintenance of the Physical Layer of Fieldbuses
NAMUR NE 124	Wireless Automation Requirements
NEMA ICS.6	Enclosure for Industrial Control system
NORSOK I-001	Field Instrumentation
NORSOK I-002	Safety and automation system (SAS)
NORSOK I-005	System Control Diagram (SCD)
OLF 070	Recommended guidelines for the application of IEC 61508 and IEC 61511 in the petroleum activities on the Norwegian continental shelf
OLF 104	Information Security Baseline Requirements for Process Control, Safety, and Support ICT Systems
PSA YA-711	Principles for design of alarm systems (Norwegian Petroleum Safety Authority)
TIA/EIA RS-232-F	Interface between data terminal equipment and data communication equipment employing serial data interchange
TIA/EIA TIA-422-B	Electrical Characteristics of Balanced Voltage Differential Interface Circuits
TIA/EIA TIA-485-A	Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems
UKOOA	Guidelines for Instrument-Based Protective Systems, Issue 2, 1999
UL 268	Safety Smoke Detectors for Fire Alarm Signaling Systems
UL 521	Safety Heat Detectors for Fire Protective Signaling Systems
VDI/VDE GL 3699	Process control using monitors

Observation: Few of the standards above are made specifically for the oil & gas industry, except for the EEMUA, NORSOK, OLF, PSA and a few other documents, but they are all process industry documents equally relevant to the oil and gas industry.

2.2 Non specific standards used by instrument & automation discipline

Many of the references below are generally applicable standards not specifically made for instrument and automation purposes, but they are listed here as they are frequently used by the instrument and automation discipline in the global oil & gas industry.

AGA Report No 3	Orifice calculations
AGA Report No 8	Compressibility Factor of Natural Gas and Related Hydrocarbon Gas
AGA Report No 9	Measurement of gas by Multipath Ultrasonic Meters
ANSI B1.20.1	Pipe threads general purpose (imperial units)
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B16.10	Face-to-face and end-to-end dimensions of valves.
ANSI B16.34	Valves-flanged, threaded and
ANSI B16.36	Steel orifice flanges
API Publ 2501A	Fire-Protection Considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities
API RP 14B	Recommended Practice for Design, Installation, Repair and Operation of Subsurface Safety Valves Systems
API RP 14C	Analysis, Design, Installation and Testing of Basic Surface Safety Systems on Offshore Production Platforms (basis for ISO 10418).
API RP 14E	Design and Installation of Offshore Production Platform Piping System (basis for ISO 13703).
API RP 14FZ	Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class 1, Zone 0, Zone 1 and Zone 2 Locations
API RP 14G	Fire Prevention and Control on Open Type Offshore Production Platforms
API RP 14H	Installation, Maintenance, and Repair of Surface Safety Valves and Underwater Safety Valves Offshore
API RP 14J	Design and Hazards Analysis for Offshore Production Facilities
API RP 520	Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries
API RP 526	Flanged steel safety relief valves.
API RP 527	Seat Tightness of Pressure Relief Valves.
API RP 537	Flare Details for General Refinery and Petrochemical Services
API RP 574	Inspection Practices for Piping System Components
API RP 576	Inspection of Pressure-Relieving Devices
API RP 678	Accelerometer-based Vibration Monitoring System.
API RP 2001	Fire protection in refineries
API Spec 6A	Wellhead and Christmas Tree Equipment
API Std 598	Valve Inspection and Testing
API Std 670	Vibration, axial position and bearing temperature system.
API Std 521	Guide for Pressure-Relieving and Depressuring Systems (identical to ISO 23251)
API Std 2000	Venting Atmospheric and Low Pressure Storage Tanks Nonrefrigerated and Refrigerated.
ASME I	Power boilers
ASME VIII, Div 1	Boiler and pressure vessel code
ASME PTC 25	Pressure Relief Devices

BS 2915	Bursting Discs and Bursting Disc Devices
BS 6121-5	Mechanical cable glands. Code of practice for selection, installation and inspection of cable glands and armour glands
BS 6656	Assessment of inadvertent ignition of flammable atmospheres by radio-frequency radiation. Guide
BS 6755-1	Testing of valves. Part 1. Specification for production pressure testing requirements
BS 6883	Elastomer Insulated cables mobile and fixed offshore units.
BSI PD 5500	Specification for Unfired Fusion Welded Pressure Vessels
DIN 3381	Safety devices for gas supply installations operating at working pressures up to 100 bar; pressure relief governors and safety shut-off devices.
DNV OS-A101	Safety principles and arrangements
DNV OS-D101	Marine & Machinery systems
DNV OS-D201	Electrical systems & equipment
DNV OS-D301	Fire protection
EN 1127-1	Explosive atmospheres. Explosion prevention and protection. Basic concepts and methodology
EN 1834-1	Reciprocating internal combustion engines. Safety requirements for design and construction of engines for use in potentially explosive atmospheres. Group II engines for use in flammable gas and vapour atmospheres.
EN 10204	Metallic products. Types of inspection documents
EN 13445	General rules for pressure vessels
EN 13463	Non-electrical equipment for use in potentially explosive atmospheres
EN 50014	Electrical Apparatus for potentially explosive atmospheres – General Requirements
EN 50016	Electrical Apparatus for potentially explosive atmospheres – Pressurized Apparatus ‘p’
EN 50018	Electrical Apparatus for potentially explosive atmospheres – Flameproof Enclosure ‘d’
EN 50019	Electrical Apparatus for potentially explosive atmospheres – Increased Safety ‘e’
EN 50020	Electrical Apparatus for potentially explosive atmospheres – Intrinsic Safety ‘i’
EN 50081	Electro Magnetic Compatibility –general emission standard
EN 50082	Electro Magnetic Compatibility –generic immunity standard
EN 50173	Information technology – Generic cabling system
EN 60534-2-1/2	Industrial process control valves P2, sect. 1 and 2
EN 60584-1/2	Thermocouples
EN 60751	Resistance Temperature Detectors (RTD)
EN 61000-5-7	Electromagnetic Compatibility (EMC)

IEC 17799	Information Technology- Security techniques- Code of practice for information security management (ISO/IEC 17799)
IEC 60034	Rotating Electrical Machines
IEC 60068	Environmental test
IEC 60079	Electrical apparatus for explosive gas atmospheres
IEC 60092	Electrical Installations in Ships (All Parts)
IEC 60204	Safety of Machinery
IEC 60331	Tests for electrical cables under fire conditions –Circuit integrity
IEC 60332-3	Tests on electrical cables under fire conditions –Part 3: tests on bunched wires and cables
IEC 60364	Electrical installations of buildings
IEC 60446	Identification of cables
IEC 60529	Degrees of protection provided by enclosures (IP code)
IEC 60533	Electrical and electronic installations in ships – Electromagnetic compatibility
IEC 60584-1	Thermocouples (adopted as EN 60584-1)
IEC 60664	LV Insulation
IEC 60669	Household switches
IEC 60721	Environmental conditions
IEC 60751	Resistance Temperature Detectors (adopted as EN 60751)
IEC 60793	Optical fibers
IEC 60794	Optical fiber cables
IEC 60898	Circuit-breakers (overcurrent protection)
IEC 60947	Low voltage switch gears – general rules
IEC 61000	Electromagnetic compatibility (EMC)
IEC 61008	Circuit-breakers (current operated)
IEC 61010	Electrical Safety
IEC 61073	Splices for optical fibers and cables
IEC 61280	Fiber optic communication subsystem basic test procedures
IEC 61281	Fiber optic communication subsystems
IEC 61282	Fiber optic communication system design guides
IEC 61757	Fiber optic sensors
IEC 61892-1	Mobile and Fixed Offshore Units - Electrical installations – Part 1: General Requirements and Conditions
IEC 61892-3	Mobile and Fixed Offshore Units - Electrical installations – Part 3: Equipment
IEC 61892-5	Mobile and Fixed Offshore Units - Electrical installations – Part 5: Mobile Units
IEC 61892-6	Mobile and Fixed Offshore Units - Electrical installations - Part 6: Installation
IEC 61892-7	Mobile and Fixed Offshore Units - Electrical installations - Part 7: Hazardous Area
IEC 62026	Actuator/Sensor-Interface
IEC 62091	Controllers for drivers of stationary fire pumps (electrically and engine driven)
IEC 62264	Enterprise Control
IEC 62305	Protection against lightning
IEC 62561-7	Requirements for Lightning Protection System Components (LPSC) - Part 7: Requirements for earthing enhancing compounds
IFEA	Guidelines for heat tracing installation in industry and offshore. (Norwegian text only)

IFE/HR/F-1158	Alarm System Requirements
IMO MODU Code	Construction and Equipment of Mobile Offshore Drilling Units
IMO SOLAS	International Convention for the Safety of Life at Sea
ISO 31	Quantities and Units
ISO 1000	SI Units and recommendation for the use of their multiples and of certain other units.
ISO 1998-6	Petroleum Industry - Terminology - Part 6: Measurement
ISO 3511	Process measurement control functions and instrumentation – Symbolic representation – All parts
ISO 4402	Hydraulic fluid power - Calibration of automatic count instruments for particles suspended in liquids - Method using classified AC Fine Test Dust
ISO 4406	Cleanliness Requirements of Parts Used in Hydraulic Systems.
ISO 5210	Industrial valves - Multi-turn valve actuator attachments.
ISO 5211	Industrial valves - Part-turn valve actuator attachment - Part 1, 2 & 3.
ISO 5660	Fire Tests –Reaction to fire – Rate of heat release from building products
ISO 9001	Quality Management System Requirements
ISO 10303	Product Data Exchange (STEP)
ISO 10418	Recommended practice for Analysis, Design, Installation and Testing of Basic surface Safety Systems for Offshore Production Platforms
ISO 10423	Petroleum and Natural Gas Industries - Drilling and Production Equipment - Wellhead and Christmas Tree Equipment
ISO 11064-1	Ergonomic design of control centres -- Part 1: Principles for the design of control centres
ISO 11064-2	Ergonomic Design of Control Centres - Part 2: Principles for the Arrangement of Control Suites
ISO 11064-3	Ergonomic Design of Control Centres - Part 3: Control Room Layout
ISO 11171	Hydraulic fluid power - Calibration of automatic particle counters for liquids
ISO 13702	Petroleum and Natural Gas Industries - Offshore production installations Control and mitigation of fires and explosions - Requirements and Guidelines
ISO 15663	Life Cycle Costing
ISO TR 16386	Hydraulic fluid power - Impact of changes in ISO fluid power particle counter, contamination control and filter test standards
ISO 17776	Petroleum and Natural Gas Industries - Offshore production installations – Guidelines on Tools and Techniques for Hazard Evaluation and Risk Assessment
ISO 23251	Petroleum, Petrochemical and Natural Gas Industries – Pressure Relieving and Depressuring Systems
ISO 61499-1	Function Blocks.- Part 1: Architecture
ISO 61499-2	Function Blocks.- Part 2: Software Tool Requirements
ISO 61499-3	Function Blocks.- Part 3: Tutorial Information
NACE MR0175	Materials for use in H ₂ S-containing environments in oil and gas production (now adopted and published as ISO 15156)
NAS 1638	Cleanliness Requirements of Parts used in Hydraulic Systems
NEC	National Electric Code

NEK 606	Cables for offshore installations Halogen-free, or mud resistant (Norwegian Electrotechnical Committee).
NESC	National Electrical Safety Code
NFC	National Fire Code
NFPA 12	Standard on CO ₂ extinguishing systems
NFPA 13	Standard for the installation of sprinkler systems
NFPA 15	Standard for water spray systems for fire protection
NFPA 16	Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
NFPA 20	Standard for the Installation of Stationary Pumps for Fire Protection
NFPA 25	Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
NFPA 30	Flammable and Combustible Liquids Code
NFPA 72E 3-3	National Fire Alarm and Signaling Code: Temperature Classification
NFPA 85	Boiler and combustion systems hazards code
NFPA 307	Standard for the Construction and Fire Protection of Marine Terminals, Piers, and Wharves
NFPA 750	Standard on Water Mist Fire Protection Systems
NFPA 496	Purged and Pressurized Enclosures for Electrical Equipment
NORSOK E-001	Electrical systems
NORSOK L-002	Piping Design, Layout
NORSOK L-003	Piping Details
NORSOK M-501	Surface Preparation
NORSOK P-001	Process design
NORSOK S-001	Technical safety
NORSOK Z-002	Code Manual
NORSOK Z-004	CAD Symbol Libraries
NORSOK Z-013	Risk and emergency preparedness analysis
NORSOK Z-016	Regularity management and reliability technology
NS 1710	Technical drawings – Drawing symbols for piping systems
NS 1438	Process measurement control functions and instrumentation – Symbolic representation – Part 1: Basic requirements
NS 5820	Supplier Documentation of Equipment

3 – OGP catalogue of standards

OGP Standards committee has developed a Catalogue of International – IEC and ISO – Standards used in the petroleum and natural gas industries. This report lists about 1300 ISO standards and 700 IEC standards used by the OGP Standards committee member companies. Relevant standards from IEC/TC 65 have been included in 2.1 above. For full catalogue ref. OGP report No. 362, January 2005 available at www.ogp.org.uk.

4 – Active IEC standards committees

4.1 IEC TC 65: Industrial-process measurement and control

TC 65 was established in 1968 to prepare basic standards for industrial automation (*eg* programmable controllers, functional safety, fieldbus) as well as process industry specific standards (*eg* actuators and sensors, batch control, analysing equipment). Scopes of TC 65 and its SCs are as follows :

To prepare international standards for systems and elements used for industrial process measurement, control and automation. To coordinate standardization activities which affect integration of components and functions into such systems including safety and security aspects. This work of standardization is to be carried out in the international fields for equipment and systems operating with electrical, pneumatic, hydraulic, mechanical or other systems of measurement and/or control.

TC 65 web link: http://www.iec.ch/dyn/www/f?p=102:17:0:::FSP_SEARCH_TC:65

IEC TC 65 Membership (<http://www.iec.ch/dyn/www/f?p=102:5:0:::>)

Australia	O-Member	Mexico	P-Member
Austria	P-Member	Netherlands	P-Member
Belgium	P-Member	New Zealand	O-Member
Bulgaria	O-Member	Norway	P-Member
Canada	P-Member	Pakistan	P-Member
China	P-Member	Poland	P-Member
Czech Republic	O-Member	Portugal	O-Member
Denmark	P-Member	Romania	P-Member
Finland	P-Member	Russian Federation	P-Member
France	P-Member	Serbia	O-Member
Germany	P-Member	Singapore	O-Member
Greece	O-Member	Slovakia	P-Member
Hungary	P-Member	Slovenia	O-Member
India	O-Member	Spain	P-Member
Indonesia	O-Member	Sweden	P-Member
Ireland	O-Member	Switzerland	P-Member
Italy	P-Member	Turkey	O-Member
Japan	P-Member	Ukraine	O-Member
Kazakhstan	P-Member	United Kingdom	P-Member
Korea, Republic of	P-Member	United States of America	P-Member

Strategic Policy Statement (<http://www.iec.ch/cgi-bin/getspis.pl/65.pdf?file=65.pdf>) has been prepared and is available from IEC web (<http://www.iec.ch>).

Chairman: (Term of office January 2013)

Mr. Roland HEIDEL

Siemens AG A&D, ATS SR

Oestliche Rheinbrueckenstrasse 50

DE – 76187 KARLSRUHE, GERMANY

Tel: +49 721 595 4632

Secretary:

Monsieur Bernard DUMORTIER
28 chemin des Hauts Doigts
Schneider Electric
Information Technology Standardization Manager
FR - 78750 MAREIL MARLY, FRANCE
Tel: +33 1 72 55 80 62
Fax: +33 1 39 16 99 60

Working Groups:

- WG 1 Terms and definitions (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2612)
- WG 10 Security for industrial process measurement and control – Network and system security (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2612)
- WG 12 P&I diagrams, P&ID tools and PCE-CAE tools (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2563)
- JWG 13 Safety requirements for industrial-process measurement, control and automation equipment, excluding functional safety (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2562)
- JWG 14 Energy Efficiency in Industrial Automation (EEIA)

Subcommittees

- SC65A: System Aspects
- SC65B: Measurement and control devices
- SC65C: Industrial networks
- SC65E: Devices and integration in enterprise systems

TC 65 web: http://www.iec.ch/dyn/www/f?p=102:7:0:::FSP_ORG_ID:1250

4.2 Subcommittee 65A: System aspects

Scope:

To prepare standards regarding the generic aspects of systems used in industrial-process measurement and control: operational conditions (including EMC), methodology for the assessment of systems, functional safety, etc.

Horizontal Safety Function

Functional safety or electrical/electronic/programmable electronic systems (which would encompass safety-related software).

Working Group :

- WG 4 – EMC Requirements (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2581)
- WG 14 – Functional Safety Guide: IEC 61508-0 (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2592)
- WG 15 – Management of Alarm Systems for the Process Indicators

Maintenance Team :

- MT 61508-3 – Maintenance of IEC 61508-3, -4, -6 and -7 (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2591)
- MT 61508-1/2 – Maintenance of IEC 61508-1, -2, -4, -5, -6 and 7 (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2586)
- MT 61508-1/2-TG1 – Digital communication systems with reference to IEC 61508 (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2580)
- MT 61511 – Functional safety – Safety instrumented systems for the process industry (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2580)
- MT 61512 – Batch control systems (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2604)

SC 65A web: http://www.iec.ch/dyn/www/f?p=102:7:0:::FSP_ORG_ID:1369

One of the standards is IEC 61508, Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems, Parts 1-7, 1998. It is an umbrella standard applicable to all industries. IEC has developed a process-industry-specific version of IEC 61508 i.e. IEC 61511, Functional SIS for the Process Industry Sector in three parts:

- Part 1 Framework, definitions, systems, hardware and software requirements
- Part 2 Guidelines in the application of Part 1
- Part 3 Guidance for the determination of safety integrity levels.

4.3 Subcommittee 65B: Management and control devices

Scope:

Standardization in the field of specific aspects of devices (hardware and software) used in industrial process measurement and control, such as measurement devices, analyzing equipment, actuators, and programmable logic controllers, and covering such aspects as interchangeability, performance evaluation, and functionality definition.

Working Groups:

- WG 5: Temperature sensors (<http://www.iec.ch/cgi-bin/procgi.pl/www/iecwww.p?wwwlang=E&wwwprog=dirwg.p&ctnum=463>)
- WG 6: Methods of testing and evaluation of performance of system elements (<http://www.iec.ch/cgi-bin/procgi.pl/www/iecwww.p?wwwlang=E&wwwprog=dirwg.p&ctnum=437>)
- WG 7: Programmable control systems for discontinuous industrial-processes (<http://www.iec.ch/cgi-bin/procgi.pl/www/iecwww.p?wwwlang=E&wwwprog=dirwg.p&ctnum=436>)
- WG 9: Final control elements (<http://www.iec.ch/cgi-bin/procgi.pl/www/iecwww.p?wwwlang=E&wwwprog=dirwg.p&ctnum=3092>)
- WG 14: Analyzing equipment (<http://www.iec.ch/cgi-bin/procgi.pl/www/iecwww.p?wwwlang=E&wwwprog=dirwg.p&ctnum=3092>)
- WG 15: Function block (<http://www.iec.ch/cgi-bin/procgi.pl/www/iecwww.p?wwwlang=E&wwwprog=dirwg.p&ctnum=3095>)
- PT 61207: Gas Analyzer

SC 65B web: http://www.iec.ch/dyn/www/f?p=102:7:0:::FSP_ORG_ID:1375

4.4 Subcommittee 65C: Digital Communications

To prepare international standards on Digital Data Communications sub-systems for industrial process measurement and control as well as on instrumentation systems used for research, development and testing purposes.

Working Groups:

- WG 12 – Functional Safety for Fieldbus (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2583)
- WG 13 – Cyber Security (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2566)
- WG 15 – High Availability Networks (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2566)
- WG 16 – Wireless (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:4192)
- WG 17 – Wireless Coexistence (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:6106)

Maintenance Team:

- MT 9 – Maintenance Team for IEC 61158 and IEC 61784-1 and 2 (Fieldbus) (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2589)

Joint Working Group:

- JWG 10 – Industrial Cabling (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2579)

SC 65C web: http://www.iec.ch/dyn/www/f?p=102:7:0:::FSP_ORG_ID:1376

4.5 Subcommittee 65E: Devices and integration in enterprise systems

To prepare international standards to specify digital representation of device properties and functions, methodologies and applications supporting automation of engineering processes, including diagnostic and maintenance techniques.

Working Groups:

- WG 2 – Product properties & classification (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2561)
- WG3 – Commissioning (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2588)
- WG 4 – Field device tool interface specification (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2570)
- WG 7 – Function blocks for process control and EDDL (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2611)
- WG 8 – OPC unified architecture (http://www.iec.ch/dyn/www/f?p=102:14:0:::FSP_ORG_ID:2559)

Joint Working Groups:

- JWG 5 – Enterprise-control
- JWG 6 – Device profiles

SC 65E web: http://www.iec.ch/dyn/www/f?p=102:7:0:::FSP_ORG_ID:1452

4.6 Observations

The oil & gas industry participation and influence in IEC/TC 65 appears to be limited. This is demonstrated e.g. by the need for EEMUA, UKOOA and OLF to develop their own industry specific guidelines for the application of IEC 61508 and 61511. It is also interesting to observe that other industry sectors have developed their sector specific interpretations or application guides:

- Nuclear industry has developed IEC 61513 for this purpose.
- Railway industry has developed EN 50126, EN 50128 and EN 50129.
- Machinery industry has developed IEC 62061.

IEC 61511 is the sector specific application of IEC 61508 for the process industry, but this is a very wide industry with lots of independent sectors within it. Therefore it may be relevant to develop an oil & gas sector specific IEC standards to cover the oil & gas industry. This is currently looked into by OGP Instrument & Automation Standards TF.

4.7 IEC TC 79 Alarm systems

The work of TC 79 is to prepare international standards for detection, alarm and monitoring systems for protection of persons and property, and for elements used in these systems. The scope includes, but is not limited to:

- intruder and hold-up alarm systems,
- fire alarm systems,
- hazard alarm systems,
- social/emergency alarm systems,
- other monitoring and surveillance systems (for example, personal or baggage screening, and access control systems),
- associated transmission and communication systems.

The standards to be prepared shall cover terminology and technical characteristics regarding electrical safety, safe operation, testing, and performance criteria of the detection, alarm, monitoring and associated transmission systems. The work of TC 79 shall be conducted so as to ensure that liaison is maintained with other specialized IEC Technical Committees, ISO/TC 21 and ISO/TC 43, and the TSB and BR, so as to avoid duplication.

5 – ANSI/ISA

5.1 Background

ISA is an ANSI accredited organization. Founded in 1945, ISA (<http://www.isa.org>) is a leading, global, non-profit organization that is setting the standard for automation by helping over 30,000 worldwide members and other professionals solve difficult technical problems, while enhancing their leadership and personal career capabilities. Based in Research Triangle Park, North Carolina, ISA develops standards; certifies industry professionals; provides education and training; publishes books and technical articles; and hosts the largest conference and exhibition for automation professionals in the Western Hemisphere. ISA is the founding sponsor of The Automation Federation (<http://www.automationfederation.org>).

ISA is globally recognized as a standards writing organization, developing consensus standards for automation, security, safety, batch control, control valves, fieldbus, environmental conditions, measurement, and symbols.

Accredited by the American National Standards Institute (ANSI), ISA has published more than 150 standards, recommended practices, and technical reports, through the dedicated efforts of a network of industry experts.

5.2 ISA-SP84 Programmable Electronic System (PES) for use in safety applications

In the United States, many companies must adhere to OSHA 1910.119, Process Safety Management for Highly Hazardous Chemicals. The intent of the ISA SP84 committee was to write a standard that would supplement the requirements of OSHA 1910 related to the implementation of instrumentation and controls necessary for safe operation. In the development of ISA 84.01-1996, the committee did not want to repeat requirements that were already part of 29 CFR Part 1910 "Process Safety Management of Highly Hazardous Chemicals; Explosives and Blasting Agents", OSHA. In fact, there are several specific references in ISA 84.01-1996 to the requirements of OSHA 1910. Consequently, when ISA 84.01-1996 was released in February 1996, it did not cover safety management, hazard analysis, pre-start-up safety review, or training.

The ISA-SP84 committee achieved a major milestone in publishing ANSI/ISA-84.00.01-2004 Parts 1-3 (IEC 61511 Mod), *Functional Safety: Safety Instrumented Systems for the Process Industry Sector*. This three-part series gives requirements for the specification, design, installation, operation, and maintenance of a safety instrumented system so that it can be confidently entrusted to place and/or maintain a process in a safe state. Through its working groups, ISA-SP84 has and is currently developing several key technical reports to provide guidance on the implementation and use of the three-part series of standards.

5.3 ISA-99 Industrial automation control systems security

5.3.1 ISA99 Scope

The ISA99 Committee addresses manufacturing and control systems whose compromise could result in any or all of the following situations:

- endangerment of public or employee safety
- loss of public confidence
- violation of regulatory requirements
- loss of proprietary or confidential information
- economic loss
- impact on national security

The concept of manufacturing and control systems electronic security is applied in the broadest possible sense, encompassing all types of plants, facilities, and systems in all industries. Manufacturing and control systems include, but are not limited to:

- hardware and software systems such as DCS, PLC, SCADA, networked electronic sensing, and monitoring and diagnostic systems
- associated internal, human, network, or machine interfaces used to provide control, safety, and manufacturing operations functionality to continuous, batch, discrete, and other processes.

Physical security is an important component in the overall integrity of any control system environment, but it is not specifically addressed in this series of documents.

<http://www.isa.org/MSTemplate.cfm?MicrositeID=988&CommitteeID=6821>

5.3.2 ISA99 Purpose

The ISA99 Committee will establish standards, recommended practices, technical reports, and related information that will define procedures for implementing electronically secure manufacturing and control systems and security practices and assessing electronic security performance. Guidance is directed towards those responsible for designing, implementing, or managing manufacturing and control systems and shall also apply to users, system integrators, security practitioners, and control systems manufacturers and vendors.

The Committee's focus is to improve the confidentiality, integrity, and availability of components or systems used for manufacturing or control and provide criteria for procuring and implementing secure control systems. Compliance with the Committee's guidance will improve manufacturing and control system electronic security, and will help identify vulnerabilities and address them, thereby reducing the risk of compromising confidential information or causing Manufacturing Control Systems degradation or failure.

5.3.3 Standards

ISA-99 recently completed its Part 2 standard, ANSI/ISA-99.02.01-2009 (<http://www.isa.org/Template.cfm?Section=Standards&Template=/Ecommerce/ProductDisplay.cfm&ProductID=10243>), *Security for Industrial Automation and Control Systems: Establishing an Industrial Automation and Control Systems Security Program*. This standard was approved by ANSI on 13 January 2009.

ISA99 published its Part 1 standard, ANSI/ISA-99.00.01-2007 (<http://www.isa.org/isa9900012007>), *Security for Industrial Automation and Control Systems: Concepts, Terminology and Models*, in late 2007. This Part 1 standard serves as the foundation for all subsequent standards in the ISA99 series.

Also in late 2007, ISA99 published an updated version of its technical report, ANSI/ISA-TR99.00.01-2007 (<http://www.isa.org/isatr9900012007>), *Security Technologies for Manufacturing and Control Systems*. This technical report provides an assessment of cyber security tools, mitigation countermeasures, and technologies that may be applied to industrial automation and control systems regulating and monitoring numerous industries and critical infrastructures.

The major focus of ISA99 is now on another standard in the series, *Technical Requirements for Industrial Automation and Control Systems*, which is being developed by WG 4.

ISA-99 Plans a WG 7 on Cyber Security and Safety in Industrial Processes. The chairpersons of the ISA-99 Industrial Automation and Control Systems Security committee have announced plans to establish ISA-99 WG7: Safety and Security of Industrial Automation and Control Systems. This is a joint working group between the ISA-99 committee and the ISA-84 functional safety standards committee, as well as other international standards programs and related interest groups, to promote greater awareness of the impact of cyber security issues on the safe operation of industrial processes.

The next logical step for the ISA-99 standards committee is to investigate how to protect industrial processes against systematic and intentional threats. These cyber security threats against industrial automation and control systems can result in dangerous failures, making the challenge of protect-

ing these systems unique from traditional IT security. As technologies such as wireless, Ethernet, and computer information systems gain increased acceptance in industrial automation, the need for design strategies and methodologies to identify and mitigate risk is clear.

ISA99 Working Group 7 initial tasks include:

- Completing a Security Assurance Level methodology for cyber security, similar to that of the current Safety Integrity Levels (SIL) defined in ISA-84, and
- Defining and developing processes for identifying intentional and systematic threats that can expose process hazards.

5.4 ISA100 Wireless systems for automation

The ISA100 Committee addresses wireless manufacturing and control systems in the areas of the:

- Environment in which the wireless technology is deployed
- Technology and life cycle for wireless equipment and systems
- Application of wireless technology

The wireless environment includes; the definition of wireless, radio frequencies (starting point), vibration, temperature, humidity, EMC, interoperability, coexistence with existing systems, and physical equipment location.

Global short-, medium-, and long-term technology needs and solutions will be incorporated on a non-exclusive technology basis with no bias towards or against a particular wireless technology. The standards themselves may influence the allocation and use of resources and spectrum.

Application of the technology will include:

- Field sensors used for monitoring, control, alarm, and shutdown that can be vertically integrated from field to business systems.
- Wireless technology whose uses include real time field-to-business systems (*eg* wireless equipment interfacing work order systems, control LAN, business LAN, voice)
- Across all industries – fluid processing, material processing, and discrete parts manufacturing environments

ISA100 web: <http://www.isa.org//MSTemplate.cfm?MicrositeID=1134&CommitteeID=6891>

5.5 ISA100 Wireless Compliance Institute

The ISA100 Wireless Compliance Institute facilitates the effective implementation and understanding of the planned ISA100 universal family of industrial wireless standards through:

- compliance testing programs,
- associated market awareness, and
- technical support to users and developers.

The mission of the ISA100 Wireless Compliance Institute is to assure that the consensus industry standards arising from the work of ISA100 Standards Committee on Wireless Systems for Automation are applied effectively and consistently. The ISA100 Wireless Compliance Institute fulfils its functions as a natural complement to the ISA100 standards development activity, and ISA marketing and training activities for the ISA100 standards.

The ISA100 Wireless Compliance Institute is constituted as an industry group within the Automation Standards Compliance Institute (ASCI), an organization created to facilitate the proper use and application of automation standards through development and implementation of conformance assessment programs and related activities. It is open to participation from end users, technology suppliers, research and development, academia, and other industry consortia and standards bodies.

Among the members of the ISA100 Wireless Compliance Institute we find:

- BP
- Chevron
- ExxonMobil Research & Engineering
- Honeywell
- Shell Global Solutions
- Yokogawa

Read more at: <http://www.isa100wci.org/>

5.6 ISA Subcommittee for convergence of ISA100 and WirelessHART standards

The ISA100 standards committee on wireless systems for automation has created a new subcommittee to address options for convergence of the ISA100.11a and WirelessHART standards. This initiative is a key step in the mission of the ISA100 committee to develop a family of universal industrial wireless standards designed to satisfy the needs of end users across a variety of applications.

The subcommittee will contrast and compare the technology within the ISA100.11a and WirelessHART standards, building on the experiences gained with industrial applications of both standards, with an ultimate goal of merging the best of both standards into a single converged subsequent release of the ISA standard.

'On behalf of end users, I believe I can safely state that our ultimate goal is to have a single industry standard for process applications. We are pleased that a path is developing to achieve that goal and that interim steps for achieving interoperable practical experience with both standards have been identified', said ISA100 End User Working Group co-chair Jim Reizner of Procter and Gamble who led a team of end users, including Pat Schweitzer of ExxonMobil, Herman Storey of Shell Global Solutions, and others, which stimulated the formation of the subcommittee.

Read more at: <http://www.isa.org/MSTemplate.cfm?MicrositeID=1409&CommitteeID=7163>

6 – API Subcommittee on Instruments & Control Systems

6.1 General

Website: <http://mycommittees.api.org/standards/cre/soics/default.aspx>

This information is derived from the home page for the CRE (Committee for Refining Equipment) Subcommittee on Instruments and Controls and its chairman. The website provides information on upcoming meetings, minutes and presentations from recent meetings and information on the status and balloting of standards maintained by SOICS.

The mission of SOICS is to develop standards and recommended practices specific to the refining industry, analyze technical issues, provide training and advice on relevant technical issues and share information which is useful to the industry as a group. The SOICS also works closely with other standards organizations such as ISA and PIP.

SOICS have representation from BP, Chevron, Marathon, ConocoPhillips, ExxonMobil and Aramco. Most major instrument manufacturers and contractors are also represented, though attendance varies with current activities. General goals are to provide recommended practices that capture refining practices and experiences rather than standards for equipment. Unlike many of the other subcommittees, there are other bodies that already cover much of this material such as ISA, ISO and PIP. Most of the SOICS documents therefore are more tutorials than specifications.

SOICS's activities are divided between information exchange and work on published documents. SOICS hold an all day business meeting at each API meeting where there is usually some type of technical presentations on a subject requested by the membership (for example Asset Management Systems).

6.2 Recommended practices prepared by this API CRE subcommittee

RP 551 Process Measurement Instrumentation

Provides procedures for the installation of the more generally used measuring and control instruments and related accessories. This standard addresses a number of common measurement technologies and installation recommendations for basic field instrumentation. This is representative of general practice and does not attempt to be prescriptive. The RP is due for a refresh and SOICS are discussing timing. May reaffirm it if little to update is found. 1st Edition/May 1993

RP 552 Transmission Systems

Reviews the recommended practices for the installation of electronic and pneumatic measurement and control-signal transmission systems. Transmission systems permit operation of one or more large or small process units from a remote control center. An update is currently going through a re-ballot. Earlier ballot did get a positive ballot from those who did respond. 1st Edition/October 1994

RP 553 Refinery Control Valves

This document provides recommended criteria for the selection, specification and application of piston and diaphragm actuated control valves. It also outlines control valve design considerations, discusses control valve sizing, noise, fugitive emissions, and defines types of commonly used control valves and their actuators. 1st Edition/September 1998

This RP is due for update, mainly to include greater usage of smart positioners and diagnostics. The control valve manufacturers are also saying that they would like to include more information on severe service applications. Work on identifying the needed updates was likely started at the Spring 2007 meeting. It will probably take 2 years to get this to press.

RP 554 Process Instrumentation and Control – 3 parts

Covers performance requirements and considerations for the section, specification, installation and testing of process instrumentation and control systems. Control centers as used in the petroleum industry are also covered. This practice is not intended to be used as a purchase specification, but makes recommendations from minimum requirements and can be used to provide guidance for the development of detailed designs and specifications. 1st Edition/September 1995

This document has been rewritten and being split into 3 parts:

- Part 1 – Process Control System – Functions and Functional Specification Development, first edition published July 2007.
- Part 2 – Process Control System – Process Control System Design, first edition published October 2008.
- Part 3 – Process Control System – Project Execution and Process Control System Ownership, first edition published October 2008.

RP 555 Process Analyzers

This document is not being actively worked and will likely remain as it stands for the foreseeable future, Second edition, November 2001.

RP 556 Instrumentation, Control, and Protective Systems for Fired Heaters and Steam Generators

This document, published in May 1997, is being re-written and is actively being edited by SOICS and the Subcommittee on Heat Transfer Equipment. This document is the subject of a number of conflicting opinions and practices among the various operating companies that are represented so it has been slow in reaching a complete draft.

RP 557 Guide to Advanced Control Systems

Address the implementation and ownership of advanced control systems for refinery purposes. RP 557 describes commonly used practices for the opportunity identification, justification, project management, implementation and maintenance of advanced control system applications in refinery service. First edition published December 2000.

Obsevation: The focus of this US-based committee is refineries and downstream activities, but their Recommended Practices are also used in the upstream industry. API RP 554 is a relevant standard.

7 – CENELEC CLC/TC 65CX Fieldbus (mirror to IEC/TC 65)

Scope

To elaborate a generic fieldbus standard and its applications to industrial-process measurement and control, inclusive the mapping of application specific functions on fieldbus protocols. Communications and mapping of application specific functions include in particular those between local and/or remote system functional modules such as, but not limited to, input and output subsystems, control subsystems and process computers

Work programme (2006)

prEN 61784-3:2006	Digital data communications for measurement and control – Part 3: Profiles for functional safety communications in industrial networks http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=20788
prEN 61784-5:2006	Digital data communication for measurement and control – Part 5: Installation profiles for communication networks in industrial control systems http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=20789
prEN 61918:2006	Digital data communications for measurement and control - Profiles covering installation practice for fieldbus communications media within and between the Automation Island http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=20790
prEN 61158-400:2006	Digital data communication for measurement and control - Fieldbus for use in industrial control systems – Part 400 : Data Link Layer protocol specification http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=20744
prEN 61158-500:2006	Digital data communication for measurement and control - Fieldbus for use in industrial control systems – Part 500 : Application Layer service definition http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=20745
prEN 61158-600:2006	Digital data communication for measurement and control - Fieldbus for use in industrial control systems – Part 600: Application Layer protocol specification http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=20746
prEN 61784-1:2006	Digital data communications for measurement and control – Part 1: Profile sets for continuous and discrete manufacturing http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=20740
prEN 61158-2:2006	Digital data communication for measurement and control – Fieldbus for use in industrial control systems – Part 2: Physical layer service definition and protocol specification http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=20741
prEN 61158-300:2006	Digital data communication for measurement and control - Fieldbus for use in industrial control systems – Part 300 : Data Link Layer service definition http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=20742
CLC/prTR 61804-4	Function blocks (FB) for process control - Part 4: EDD Interoperability Guideline http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=20723
prEN 61784-2:200X	Digital data communication for measurement and control – Part 2: Additional profiles for ISO/IEC 8802-3 based communication networks

	in real-time applications http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=20644
prEN 50XXX	Safety-relevant and redundant communication based on EN 50325-4 (CANopen-Safety) http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=17047
prEN 61804-2:200X	Function Blocks (FB) for process control – Part 2: Specification of FB concept http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=17029
prEN 61804-3:200X	Function Blocks (FB) for process control – Part 3: Electronic device description language (EDDL) http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=17032
CLC/TR 61158-1:2004	Digital data communications for measurement and control - Fieldbus for use in industrial control systems – Part 1: Overview and guidance for the IEC 61158 series http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=16143
EN 61784-1:2004	Digital data communications for measurement and control – Part 1: Profile sets for continuous and discrete manufacturing relative to fieldbus use in industrial control systems http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=15674
EN 61158-4:2004	Digital data communication for measurement and control - Fieldbus for use in industrial control systems – Part 4: Data link protocol specification http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=15671
EN 61158-5:2004	Digital data communication for measurement and control - Fieldbus for use in industrial control systems – Part 5: Application layer service definition http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=15672
EN 61158-6:2004	Digital data communication for measurement and control - Fieldbus for use in industrial control systems – Part 6: Application layer protocol specification http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=15673
EN 61804-2:2004	Function Blocks (FB) for process control – Part 2: Specification of FB concept and Electronic Device Description Language (EDDL) http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=15668
EN 61158-2:2004	Digital data communications for measurement and control - Fieldbus for use in industrial control systems – Part 2: Physical layer specification and service definition http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=15669
EN 61158-3:2004	Digital data communication for measurement and control - Fieldbus for use in industrial control systems – Part 3: Data link service definition http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=15670
EN 50325-1:2002	Industrial communications subsystem based on ISO 11898 (CAN) for controller-device interfaces – Part 1: General requirements http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=14485

- EN 50325-4:2002** Industrial communications subsystem based on ISO 11898 (CAN) for controller-device interfaces – Part 4: CANopen
http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=14486
- EN 50170:1996/A3:2002** General purpose field communication system
http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=13407
- EN 50325-2:2000** Industrial communications subsystem based on ISO 11898 (CAN) for controller-device interfaces – Part 2: DeviceNet
http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=13078
- EN 50325-3:2001** Industrial communications subsystem based on ISO 11898 (CAN) for controller-device interfaces – Part 3: Smart Distributed System (SDS)
http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=13079
- EN 61158-2:1994/A2:1996** Fieldbus standard for use in industrial control systems – Part 2: Physical layer specification and service definition
http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=7729
- EN 50254:1998** High efficiency communication subsystem for small data packages
http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=7043
- EN 61158-2:1994/A1:1996** Fieldbus standard for use in industrial control systems – Part 2: Physical layer specification and service definition
http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=6915
- EN 50170:1996** General purpose field communication system
http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=5308
- EN 61158-2:1994** Fieldbus standard for use in industrial control systems – Part 2: Physical layer specification and service definition
http://tcelis.cenelec.be/pls/portal30/CELISPROC.RPT_WEB_PROJECT_D.SHOW?p_arg_names=project_number&p_arg_values=4337

8 – EEMUA Instrumentation and Control Committee (INC)

8.1 General introduction to EEMUA

EEMUA's mission is to improve quality and safety, and to reduce the cost of operating industrial facilities by sharing experience and expertise, and by the active, enlightened promotion of the distinct interests of engineering users. This mission is achieved by:

- Providing the organisation within which networking, information sharing and collaboration among users on non-competitive technical matters can take place
- Influencing the way written regulations are interpreted and applied in practice
- Promoting and presenting the users' views, and encouraging the application of good sound engineering practice
- Developing and publishing user standards, specifications, and training materials
- Facilitating members' (generally with home base in the UK) participation in national, European and international standards making
- Influencing relevant national and European legislation and regulations.

8.2 General about EEMUA INC

Instrumentation, control and monitoring systems for process and related industries. Sensors, final control elements and control systems (analogue and digital). On-line computers, microprocessors and communication techniques for control and management information systems. Computer aided engineering as applied to the design of instrumentation and control systems. Co-ordination with the EEMUA Electrical Committee on electrical safety techniques

for instrument and control systems.

8.3 EEMUA INC publications

138 Design and Installation of On-Line Analyser Systems

This specification for on line analysers encourages standardisation within industry, resulting in reduction in design and construction costs and improved safety. Published 2010 (revised, formerly OCMA Spec. INP 3 Part 1).

138S1 Design and Installation of On-Line Analyser Systems: A Guide to Technical Enquiry and Bid Evaluation

This publication sets out those factors which should be included in a tender document and suggests procedures for evaluation of the bids received. Its use will help minimise the possibility of relevant items being overlooked, whether in the preparation of a tender document or in evaluation of the bids received. Published 1993.

155 Standard Test Method for Comparative Performance of Flammable Gas Detectors Against Poisoning

This publication describes a standardised method of checking manufacturers' claims for the performance of their pellistors against poisoning. Published 1988.

175 EEMUA Code of Practice for Calibration and Checking Process Analysers

This Code of Practice is a general guide to the principles and methods used for calibrating and checking process analysers. It covers initial factory or plant calibration and subsequent validation and routine calibration. The publication is based on and supersedes the IP Codes 340/82, 341/82, 347/82, 348/82, 349/82 and 353/82. Published 1995.

178 A Design Guide for the Electrical Safety of Instruments, Instrument/Control Panels and Control System

Incidents of electrical shock, burns and arcing continue to occur during the installation, commissioning, routine maintenance and testing of instruments, instrument/control panels and control systems. This publication gives a description of those electrical safety aspects which should be considered, in a straightforward non-technical language, for use by technicians and engineers alike. Published 2009, 2nd edition.

187 Analyser Systems - A Guide to Maintenance Management

This guideline is designed to define the best practices in the maintenance of on-line analysers. It provides guidance on performance target setting, strategies to improve reliability and methods to measure effective performance. Published 2000.

189 A Guide to Fieldbus Application for the Process Industry

The guidelines included in this document are designed to assist users specify the design, installation and maintenance of Fieldbus based control and instrumentation for process industries. Published 1997.

191 Alarm Systems - A Guide to Design, Management and Procurement

Alarm systems form an essential part of the operator interfaces to large modern industrial facilities. They provide vital support to the operators by warning them of situations that need their attention and have an important role in preventing, controlling and mitigating the effects of abnormal situations. Since it was first published in 1999, EEMUA 191 has become the globally accepted and leading guide to good practice for alarm management. The guide, developed by the users of alarm systems in industry, is published in conjunction with Britain's Health & Safety Executive and ASM, the Abnormal Situation Management Consortium (Arizona, USA). It gives comprehensive guidance on designing, managing and procuring an effective alarm system. Following the guidance in EEMUA 191 should result in better alarm systems that are more usable and that result in safer and more cost-efficient industrial operations. Published 2007, 2nd edition.

201 Process Plant Control Desks Utilising Human-Computer Interfaces - A Guide to Design, Operational and Human Interface Issues

This publication gives design guidance for maximising the effectiveness of the human computer interface, including an introduction to what is a human computer interface, the role of the operator, the design of systems reliant on the human computer interface, guidance on display format design, principles and methodology, together with overall control room design for operator use. The publication was written as a result of issues which arose during the research for EEMUA Publication 191 on alarm systems, and includes material derived from co operation with the US Abnormal Situation Management Consortium (ASM). Published 2010.

222 Guide to the application of IEC 61511 to safety instrumented systems in the UK process industries

This Guide, written by leading experts, including from the UK Health & Safety Executive, provides guidance and recommendations on the application of IEC 61511 for the specification and implementation of safety instrumented systems, systems designed to bring a process plant to a safe state should a hazardous incident occur. It is intended to explain how to use the IEC 61511 standard effectively and addresses the responsibility and deliverables of organisations involved in the specification, supply and maintenance of safety instrumented systems. IEC 61511, 'Functional safety - Safety instrumented systems for the process industry sector' is now widely accepted as the state of the art for such systems. Published 2009.

8.4 National, European & International Standards and other Bodies

- The Committee provides a technical input, where appropriate to the lead Instrumentation Standards Committee IEC/TC 65 and its sub-committees.
- To maintain an input to the Accreditation scheme for Bodies undertaking design and manufacture of programmable control systems. This is embodied in the CASS scheme.

8.5 Networking

- Networking on non-commercial matters enables Members to share common interests and discuss, on an informal basis, matters affecting their daily tasks.
- Discussions with Vendors are arranged when this can result in improved operability and better diagnostic information being introduced.

8.6 Initiatives

- To be proactive in work associated with the economic and safe operation of process plants.
- To be involved with new overall enterprise wide schemes, which are addressing the most appropriate methods to safeguard control systems from unauthorised changes.
- Through advances in Information technology control systems may be adjusted remotely over the internet. This could allow the deliberate introduction of errors by malicious hacking or possibly by incorrect changes to parameters being made. At the same time the possibility is presented for Viruses to be introduced, which could attack the control systems.
- To be involved in conjunction with other EEMUA Technical Committees, with developing an Information Sheet to the DSEAR (Dangerous Substances & Explosive Atmosphere Regulations).
- To develop Codes of Practice where there is a perceived need.
- To maintain a watching brief on European Directives, particularly (i) ATEX Directives which may affect the development and use of instrumentation schemes and related mechanical systems; (ii) the Measuring Instruments Directive which is mainly concerned with instruments used for fiscal measurement.
- To arrange technical meetings from time to time at premises where Members can discuss issues with Manufacturers or witness the functionality of innovative control systems.

9 – Institute of Electrical and Electronics Engineers

9.1 About IEEE

IEEE (Institute of Electrical and Electronics Engineers, Inc.), the world's largest technical professional society, is commemorating its 125th anniversary in 2009 by "Celebrating 125 Years of Engineering the Future" around the globe. Through its more than 375,000 members in 160 countries, IEEE is a leading authority on a wide variety of areas ranging from aerospace systems, computers and telecommunications to biomedical engineering, electric power and consumer electronics. Dedicated to the advancement of technology, IEEE publishes 30 percent of the world's literature in the electrical and electronics engineering and computer science fields, and has developed nearly 900 active industry standards. The organization annually sponsors more than 850 conferences worldwide. Additional information about IEEE can be found at <http://www.ieee.org>.

9.2 About the IEEE Standards Association

The IEEE Standards Association, a globally recognized standards-setting body, develops consensus standards through an open process that engages industry and brings together a broad stakeholder community. IEEE standards set specifications and best practices based on current scientific and technological knowledge. The IEEE-SA has a portfolio of 900 active standards and more than 400 standards under development. For information on the IEEE-SA, see: <http://standards.ieee.org>.

9.3 IEEE Instrumentation & Measurement Society (IMS)

The field of interest of the IEEE Instrumentation & Measurement Society (<http://ewh.ieee.org/soc/im/>) encompasses measurement systems and science. The Society seeks to advance knowledge:

- in the theory, methodology, and practice of measurement, including, but not limited to, primary metrology, measurement uncertainty, and traceability;
- in the design, development and evaluation of measurement systems, or any of their components, involved in generating, acquiring, conditioning and processing signals for the purpose of measuring quantities and phenomena of interest;
- in the analysis, representation, display, and preservation of the information obtained from a set of measurements so as to best meet the needs of the end-user, whether human or machine; and
- through the establishment and maintenance of related technical standards.

9.4 IEEE Industry Applications Society (IAS)

The Industrial Automation & Control Committee is responsible for all matters within the scope of the IAS in which the emphasis or dominant factor specifically relates to the applications of industrial electrical and electronic control devices, systems, and methods to the conversion, regulation and utilization of electricity for the control of industrial processes, machinery and heating.

10 – Process Industry Practices

10.1 Introduction

Process Industry Practices (PIP) is a consortium of process industry owners and engineering construction contractors who serve the industry. PIP was organized in 1993 and is a separately funded initiative of the Construction Industry Institute (CII) (<http://construction-institute.org>), at The University of Texas at Austin (<http://www.utexas.edu/>).

PIP publishes documents called Practices. These Practices reflect a harmonization of company engineering standards in many engineering disciplines. Up to 6% savings on capital projects can be achieved (http://www.pip.org/downloads/Position_Paper.pdf) with the implementation of the Practices. Specific Practices include design, selection and specification, and installation information.

Practices are developed for a number of areas, including the following disciplines:

- Control Panels
- Control Regulators
- Control Valves
- Documentation
- Differential Pressure
- Electrical/Flow/General
- Instrument Air
- Instrument Piping
- Level Instrumentation
- Pressure
- Process Analyzers
- Safety Systems
- Temperature

10.2 PIP mission

To increase the value of the engineering - procurement - construction process for the U.S. process industry in the global marketplace, and enhance compliance with safety, health and environmental objectives. This will be accomplished through ensuring the availability of recommended Practices for the detailed design, procurement, and construction of process facilities, including the perspective of maintenance and operations.

10.3 Scope

Develop voluntary recommended "Practices" for the detailed design, procurement, and construction of process manufacturing facilities, based on a compilation and harmonization of existing member company internal standards, or will develop recommended practices based on new material where harmonization of existing material is not adequate and the need for the Practice is clearly demonstrated. Versions of the US voluntary recommended Practices can be used as the basis to meet international requirements.

10.4 Applicability to other industries

While the emphasis is on the Process Industry, it is clear that many PIP Practices can effectively be used by related industries such as Pharmaceuticals, Pulp & Paper, and Power.

10.5 Value Proposition

Position Paper PDF (http://www.pip.org/downloads/Position_Paper.pdf) "PIP - A Way to Achieve up to 6% Savings on Your Capital Projects." Members Reported Recent Successes:

- More than 30% reduction in costs for maintaining internal company standards.
- Reduced valve inventory by 40% using PIP Practices.
- Piping Practices save up to 1,6% of total installed cost and 2 weeks on schedule.
- PIP davits cost 7% less than others.
- Estimated potential 6,7% savings in total installed cost for project. (See PIP Paper Measuring the Value below)

"PIP Paper - Measuring the Value" PDF (http://www.pip.org/downloads/PIP_White_Paper12.pdf)

This paper was presented at the April 1999 General Meeting and is now available for downloading.

11 – NAMUR

II.1 History and development of NAMUR

NAMUR was founded at Leverkusen on November 3, 1949, as the body to represent the interests of the users of measurement and control technology in the chemical industry by such renowned experts in the field as Dr. Sturm (Bayer), Dr. Hengstenberg (BASF) and Dr. Winkler (Hüls). At the second meeting in December 1949, the founding members of the working group settled the name: Standardization association for measurement and control in chemical industries - abbreviated to NAMUR.

In accordance with the state of the art, NAMUR's subtitle was changed in 1996 to "Interessengemeinschaft Prozessleittechnik der chemischen und pharmazeutischen Industrie" (Process Control Systems Interest Group of the Chemical and Pharmaceutical Industries); and on 9 November 2005, the subtitle was changed again to "Interessengemeinschaft Automatisierungstechnik der Prozessindustrie" (Automation Systems Interest Group of the Process Industry). The NAMUR logo remained unchanged.

In the post-war years, the main activities in process measurement were the improvement of measurement, control loop analysis, standardization, especially of interfaces (4-20 mA signal, NAMUR Initiator [proximity switch]), i.e. the emphasis was on the standardization and exchange of experience relating to measurement and control devices.

II.2 About NAMUR

Today, NAMUR is an international user association of automation technology in process industries. Most of the members are from Germany, with some in German speaking countries in Europe. NAMUR is engaged in the following key activities:

- pooling experiences among its member companies,
- compiling aids and check lists for member companies,
- setting user requirements on new devices, systems and technologies,
- participating in national and international standardization bodies.

NAMUR is active in the fields of:

- measurement systems
- process analytics
- process control systems
- communications systems
- operations management
- operational logistics systems
- electrical engineering

over the entire life-cycle of systems, including their planning, installation and operation as well as their shutdown.

NAMUR represents approx. 15,000 PCS experts, of whom approx. 300 are active in the 33 working groups that cover the fields of measurement & control, automation, communication, process control and electrical engineering over the entire life-cycle of systems, including planning, procurement, installation, operation as well as maintenance and decommissioning.

NAMUR's working language is German.

NAMUR work is organised in four main Work areas:

- 1 deals with project management, quality management and construction
- 2 deals with solutions and systems for the process and plant control level
- 3 deals with measurement ("sensor technology" and "actuator technology").
- 4 deals with maintenance, electrical engineering, training for and safety of process control facilities

Cooperation agreements exist with many organisations and associations with the topics: measurement and control, standardization, chemistry, electrical engineering, automation, informatics, such as DIN, EEMUA, IEC, ISA and ISO.

11.3 NAMUR Recommendations (NE) and Worksheets (NA)

NAMUR Recommendations and NAMUR Worksheets are experience reports and working documents prepared by NAMUR for its members among process control users. These papers should not be viewed as standards or guidelines. However, they can also be purchased by manufacturers, associations, universities and other interested parties from the NAMUR Office.

NAMUR Recommendations explain the state of the art and the regulations, not only for member companies but also for manufacturers, scientists and public authorities.

NAMUR Worksheets provide check lists and instructions that support member companies in their practical work. However, NAMUR Recommendations and Worksheets should not be viewed as standards or guidelines.

The catalogue of NAMUR NE and NA currently include 100 documents, such as:

NE 053	Software of Field Devices and Signal Processing Devices with Digital Electronics
NA 054	Examples of successful Applications involving Advanced Process Control Strategies
NE 072	Validation of Process Control Systems
NE 074	NAMUR-Fieldbus Requirements
NA 075	Special Requirements of Display Screen Workplaces in Control Rooms
NA 076	NAMUR Checklist for Control Rooms and Control Stations
NA 078	Process Control System Migration from the Users Point of View
NA 102	Alarm Management
NA 103	Usage of Internet Technologies in Process Automation
NE 105	Specifications for Integrating Fieldbus Devices in Engineering Tools for Field Devices
NE 106	Test Intervals of Safety Instrumented Systems
NA 113	Online Process Control Analysis
NA 114	Best Practice Fieldbus Applications
NA 115	IT-Security for Industrial Automation Systems: Constraints for measures applied in process industries
NA 120	Operator Workplace from the Human-Process Communication Point of View
NE 121	Quality Assurance of Control Systems
NE 122	PROFIBUS Interface for Drives with Frequency Converters in Process Technology
NE 123	Service and Maintenance of the Physical Layer of Fieldbuses
NE 124	Wireless Automation Requirements

12 – Standards Norway – Norsok

The Norsok standards were initially developed by a consortium of Norwegian petroleum industry companies to ensure adequate safety, value adding and cost effectiveness for petroleum industry developments and operations. Furthermore, Norsok standards were as far as possible intended to replace oil company specifications and serve as references in the authorities' regulations.

The Norsok standards are normally based on recognized international standards, adding the provisions deemed necessary to fill the broad needs of the Norwegian petroleum industry. Where relevant, Norsok standards will be used to provide the Norwegian industry input to the international standardization process. Subject to development and publication of international standards, the relevant Norsok standard will be withdrawn.

The Norsok standards are developed according to the consensus principle, generally applicable standards work and according to established procedures defined in Norsok A-001. The Norsok standards are prepared and published with supported by the Norwegian Oil Industry Association and the Federation of Norwegian Industries. Nowadays, Norsok standards are administered and published by Standards Norway.

Expert Group Instrument (EgI) and SCD are responsible for the following Norsok standards:

- I-001 Field instrumentation (Rev. 4, Jan. 2010)
(<http://www.standard.no/en/Sectors/Petroleum/NORSOK-Standard-Categories/I-Instrumentation/I-001/>)
- I-002 Safety and automation systems (SAS) (Rev. 2, May. 2001)
(<http://www.standard.no/en/Sectors/Petroleum/NORSOK-Standard-Categories/I-Instrumentation/I-002/>)
- I-005 System control diagram (Rev. 2, April 2005)
(http://www.standard.no/en/Sectors/Petroleum/NORSOK-Standard-Categories/I-SCD-Syst-Contr-Diag)

13 – Consortia developing standards

Consortia are private group of members or companies that set their own rules for standards development as the founders or members see fitting to themselves to meet their own needs. Sometimes, consortia are open, nonprofit, industry-driven bodies comprised of research organizations, designers, manufacturers, vendors, etc.

Therefore, a consortium's standards are not publicly, consensus standards like the standards delivered by international or national Standards Developing Organizations, such as IEC, ISO, ANSI, BSI, CSA, GOST, SAC or Standards Norway.

Consortium standards can, however, be useful to the industry at large. But sometimes, consortium standards may impact on competition and market availability.

14 – Fieldbus Foundation

From its inception Fieldbus Foundation, a not-for-profit trade consortium representing the major process automation industry suppliers and end users worldwide, has taken a leadership role in the development of fieldbus digital communications and integrated system architecture based on regional and international standards. The foundation's history is one of growth and achievement, as fieldbus-based control solutions have gained widespread acceptance in the global automation marketplace.

In late 1994, the path of fieldbus took a new direction. Two parallel supplier consortiums—the InterOperable Systems Project (ISP) and WorldFIP North America merged to form the Fieldbus Foundation. The new organization immediately brought critical mass to the effort to achieve an internationally acceptable fieldbus standard. The foundation organized development programs, conducted field trials, and established the industry's most rigorous program for testing and registration of fieldbus devices.

Working arm-in-arm, manufacturers, end users, academic institutions and other interested parties became members of the Fieldbus Foundation and developed open, non-proprietary specifications known as FOUNDATION fieldbus. This advanced digital communication solution was designed from the ground-up to support mission-critical control applications where the proper transfer and handling of data is essential. FOUNDATION technology was created to replace incompatible networks and systems with an open, fully integrated architecture for information integration and distributed, real-time control across the enterprise.

Critical to the industry's acceptance of the technology was its standardization by recognized international governing bodies. These include:

- ANSI/ISA, September 1992
- IEC, December 1999
- CENELEC, March 2000

The IEC voted to include the FOUNDATION H1 and HSE specifications in the IEC 61158 international fieldbus standard. The CENELEC Technical Bureau added the FOUNDATION H1 specifications to the EN 50170 Euronorm. In addition, FOUNDATION H1 is the only implementation of the ANSI/ISA-50.02 standard.

International end user associations such as NAMUR (Germany) and JEMIMA (Japan) have voiced support for FOUNDATION technology, and provided input from the end user community that aided in specification development.

Approval and support by key international industry bodies gave users the confidence that their investments in FOUNDATION control solutions were based on recognized global standards.

In little more than a decade, the Fieldbus Foundation's technology has achieved industry standard status among process end users. Implementation of the FOUNDATION system architecture is growing at a rapid pace in diverse industries across the globe.

The IEC recently approved Phase 1 enhancements to the Electronic Device Description Language (EDDL) standard. The IEC voted unanimously to adopt the technology for the international IEC 61804-3 specification.

The Fieldbus Foundation has also developed FOUNDATION fieldbus Technical Specifications-Safety Instrumented Functions (SIF) supporting the design and end user implementation of safety technology compliant with IEC guidelines.

The FOUNDATION architecture, with its industry-proven distributed function blocks and open communications protocol, is an ideal platform for advancing standards-based safety system technology. Fieldbus Foundation members developed SIF specifications and guidelines in cooperation with the world's leading safety experts.

The FOUNDATION fieldbus Technical Specifications-Safety Instrumented Functions will enable end users to take advantage of open fieldbus technologies to improve integration and interoperability of safety instrumentation, while reducing system and operational costs such as annual shutdowns for test and validation purposes.

Beginning in May 2006, the Fieldbus Foundation and NAMUR, a Germany based user association for automation technology in the process industries, collaborated on enhancements to FOUNDATION technology. Considering the NAMUR NE107 (Self Monitoring and Diagnosis of Field Devices) recommendations for diagnostic profiles support, the Fieldbus Foundation developed a profiles specification enhancing organization and integration of device diagnostics within FOUNDATION fieldbus systems.

The FOUNDATION fieldbus Diagnostic Profiles Specification identifies "role-based diagnostics" for fieldbus equipment and defines a consistent set of parameters for diagnostic alarming. This approach supports categorization of diagnostics according to NE107, thus ensuring the right diagnostic information is available to the right person-at the right time. In addition, it allows diagnostics to be applied, as most appropriate, for a particular plant application (such as process control engineering or asset management maintenance).

Technical guides

FOUNDATION Technical Guides were developed to provide an in-depth analysis of key fieldbus technical issues: wiring & installation, Function Block implementation, system engineering, and more. The technical guides are a valuable resource assisting control industry professionals in their usage of FOUNDATION technology.

Downloadable technical guides include:

- Wiring & Installation Application Guide (31.25 kbit/s Voltage Mode)
- 31.25 kbit/s Intrinsically Safe Systems
- Function Block Capabilities in Hybrid/Batch Applications
- System Engineering Guidelines

These files can be downloaded and viewed with an Adobe Reader, which can be found at the Adobe web site

15 – Profibus and Profinet (PI)

15.1 General

PI is the largest automation organization of its type in the world, according to their website, with a network of regional offices and globally-based member companies. PI also has a network of competence centers, training and test organizations that contribute to and support developers, integrators and end users. PI's mission as expressed on their website: "We are and will remain the world's leading automation organization for communication solutions, serving our users, our members and the press with the best solutions, benefits and information."

The goal of PI is to create and deliver the most powerful, relevant and high quality networking solutions for industrial automation, solutions that are open, standardized, certified and widely supported by vendors and users across the world.

PI operates through the PI Support Center (PISC) based in Karlsruhe, Germany, and coordinates the activities of a network of regional PI associations (RPAs) in major industrialized countries. Currently there are 24 RPAs, and there are over 1400 members worldwide making PI the largest automation organization of its kind.

15.2 Global collaboration

PI collaborates with organizations such as IEC, ISA, NAMUR, etc, many universities and, of course, the end user and vendor communities. Three significant technology collaborations are:

ECT (EDDL Cooperation Team) – EDDL, or Electronic Device Description Language, is used by major manufacturers to describe the information that is accessible in digital devices. Electronic device descriptions are available for over 15 million devices in the process industry. The technology is used by the major process control systems and maintenance tool suppliers to support device diagnostics and calibration. Visit the EDDL web site.

FDI (Future Device Integration) – an initiative to develop a common solution combining FDT (Field Device Type) technology and EDDL (see above) using a single interface. FDT standardizes the communication interface between field devices and systems. It is independent of the communication protocol and the software environment of either the device or host system. FDI will utilize the advanced features of the Unified Architecture (UA) technology of the OPC Foundation, another global automation organization having close links with PI. Visit the FDT web site.

WCT (Wireless Cooperation Team) – a joint initiative to optimize the use of wireless technologies in the process industries using the WirelessHART standard being developed by the HART Communication Foundation.

15.3 Specifications and standards

PI offers a number of documents such as installation guides, technical descriptions etc. on their internet website for downloading, including the following specifications and standards. Much of it is free, although to get some files you will need to join PI to gain access:

- Fieldbus Integration into PROFINET IO
- IO-Link Communication Specification
- MES and PROFINET
- Physical Layer Medium Dependent Sublayer on 650 nm Fibre Optics
- PROFIBUS Standard - DP Specification
- PROFINET CBA - Architecture Description and Specification
- PROFINET IO and CBA Specification
- PROFINET Security Guideline
- Communication Function Blocks for PROFIBUS and PROFINET
- Specification Slave Redundancy
- Time Stamp
- Profiles for decentralized periphery
- Profiles for distributed automation
- Application layer protocol for decentralized periphery and distributed automation
- Application layer services for decentralized periphery and distributed automation
- PROFINET IO - Application Layer Service Definition - Application Layer Protocol Specification

16 – HART Communication Foundation (HCF)

16.1 General

HART Communication Foundation is an international, not-for-profit, membership organization to support and promote the use of the HART Communication Protocol standards and technology.

Their mission is to serve the global process automation industry and their members by providing best-in-class communication technology, standards, specifications, tools, technical expertise and application support services to compliment, enable and support the advanced capabilities and increasing intelligence of modern automation systems.

HCP technology, services and programs provide the infrastructure for an open, stable environment that benefits members and industry users, protects investments, promotes interoperability and assures compliance to HART Communication requirements.

16.2 About the HART Protocol

The HART Protocol was developed in the mid-1980s by Rosemount Inc. for use with a range of smart measuring instruments. Originally proprietary, the protocol was soon published for free use by anyone, and in 1990 the HART User Group was formed. In 1993, the registered trademark and all rights in the protocol were transferred to the HART Communication Foundation (HCF). The protocol remains open and free for all to use without royalties.

This section focuses on providing information that is relevant to the various aspects of the HART Protocol.

16.3 HART Protocol Specifications and Documents

The HART Protocol Specifications are sold as a collection of over 20 documents that specify the different aspects of the protocol and test procedures for slave devices. The specifications are sold as a kit that includes all the documents in the specification set.

Document Title	Doc. Rev.	Doc. Number
HART Communication Protocol Specification	7.2	HCF_SPEC-13
FSK Physical Layer Specification	8.1	HCF_SPEC-54
C8PSK Physical Layer Specification	1.0	HCF_SPEC-60
2.4GHz DSSS O-QPSK Physical Layer Specification	1.0	HCF_SPEC-65
TDMA Data-Link Layer	1.1	HCF_SPEC-75
Token-Passing Data Link Layer Specification	8.2	HCF_SPEC-81
Network Management Specification	1.2	HCF_SPEC-85
Command Summary Specification	9.0	HCF_SPEC-99
Universal Command Specification	7.1	HCF_SPEC-127
Common Practice Command Specification	9.1	HCF_SPEC-151
Wireless Command Specification	1.1	HCF_SPEC-155
Device Families Command Specification	1.0	HCF_SPEC-160
Common Tables Specification	20.0	HCF_SPEC-183
Block Data Transfer Specification	1.0	HCF_SPEC-190
Discrete Applications Specification	1.0	HCF_SPEC-285
Wireless Devices Specification	1.1	HCF_SPEC-290
Command Response Code Specification	6.0	HCF_SPEC-307
Slave Token-Passing Data Link Layer Test Specification	3.0	HCF_TEST-1
FSK Physical Layer Test Specification	2.2	HCF_TEST-2
Slave Universal Command Test Specification	4.0	HCF_TEST-3
Slave Common Practice Command Test Specification	4.0	HCF_TEST-4

16.4 WirelessHART

WirelessHART technology provides a wireless protocol for the full range of process measurement, control, and asset management applications. Based on the proven and familiar HART Communication Protocol, WirelessHART enables users to quickly and easily gain the benefits of wireless technology while maintaining compatibility with existing devices, tools, and systems. The HART Communication Foundation, its member companies and the industry leaders developed WirelessHART technology to meet the unique requirements of wireless networks operating in process plants.

The new WirelessHART standard was developed under the guidance of the HART Communication Foundation (HCF) through the combined, cooperative efforts of HCF member companies, leaders in wireless technology and the input of industry users. Established in 1993, the Foundation is the technology owner and standards setting body for the HART Protocol. It is a not-for-profit, member-funded organization with membership open to anyone interested in the use of HART technology. Membership includes more than 200 users and major instrumentation suppliers from around the world.

IEC approved the WirelessHART Communication Specification (HART 7.1) as a Publicly Available Specification, or PAS, (IEC/PAS 62591Ed. 1) in September 2008. WirelessHART Communication is the first industrial wireless communication technology to gain this type of international recognition. The WirelessHART Communication standard builds on established standards including the HART Protocol (IEC 61158), EDDL (IEC 61804-3), IEEE 802.15.4 radio and frequency hopping, spread spectrum, and mesh networking technologies.

The Fieldbus Foundation (FF) and PROFIBUS Nutzerorganisation (PNO) have signed an agreement with the HCF to develop a specification for a common interface to a wireless gateway. The goal is to ensure complete compatibility with the existing wired versions of each participant's technology.

16.5 WirelessHART and ISA SP100

It's not unusual for multiple standards to address different aspects of a technology, or even for one standard to incorporate another. While WirelessHART was designed specifically for process measurement and control applications, it will be used in plants and other process operations that also employ wireless technology for other functions (e.g., WiFi-based backbones, RF Identification, plant security). It therefore makes sense that the HCF and ISA are collaborating to investigate the incorporation of WirelessHART into the ISA100's family of standards. In fact, the WirelessHART and SP100 teams include many of the same members. It also makes sense that the SP100 team would take advantage of the work already done on WirelessHART by including it in the broader ISA100 wireless standard. Because ISA100 has such broad objectives, the SP100.11a team has narrowed their near-term focus to the wireless process automation networks. To date, their decisions about technical requirements for robust application of wireless in process operations are largely consistent with the technical specification of the approved WirelessHART standard. Including WirelessHART in ISA100's family would give users all the benefits of WirelessHART and accelerate ISA100 development by enabling team members to focus their efforts on tools and best practices for plant-wide applications such as wireless physical-security monitoring, voice communications, and support for mobile workers.

The recent, relatively dramatic surge forward on the ISA100.11a front need not eclipse WirelessHart, especially in light of the ongoing effort to bring the two to convergence as ISA100.12.

17 – FDT Group

17.1 General

The FDT Group is an open, independent, not-for-profit association of international companies dedicated to establishing the FDT Technology as an international standard with broad acceptance in the automation industry. As of October 2009, 71 companies within the Factory and Process Automation industries have pledged their support to FDT Technology and the FDT Group. FDT specification is freely available to all companies that wish to utilize it: <http://www.fdtgroup.org/en/documents/technical-documents.html>

17.2 About FDT/DTM

FDT standardizes the communication and configuration interface between all field devices and host systems. FDT provides a common environment for accessing the devices' most sophisticated features. Any device can be configured, operated, and maintained through the standardized user interface – regardless of supplier, type or communication protocol.

Besides a variety of devices of different manufacturers, in most industrial plants different standardized field busses and protocols are installed, often in parallel operation. These include e.g. HART, PROFIBUS, FOUNDATION Fieldbus, Modbus, IO-Link or DeviceNet. For those plants FDT is an efficient solution that manages the variety of different devices communicating with different protocols. FDT is well suited for those inhomogeneous environments because it is system independent and able to integrate practically all communication methods.

The benefits of FDT Technology for users become evident, if each device vendor uses the latest technological developments for the functionality in their instruments. With an open, standardized and freely accessible integration technology like FDT, device manufacturers can be sure that all device features and their complete mapping in DCS and asset management systems are implemented. This is the only way to make the benefits for the user reality and to avoid filtering them by proprietary integration technologies. Thus, device manufacturers provide even more added value, as users have access to all device and diagnosis possibilities by using an according DTM.

17.3 IEC standard for FDT Technology

Since end of May 2009 an international IEC 62453 standard “Field device tool (FDT) interface specification” for FDT Technology is available. All national committees with voting rights have unanimously approved the IEC FDT Standard. The norm enables quality assurance of FDT products. Certification tools and procedures are built on a stable basis and assure conformity and compatibility of DTMs and FDT Frame Applications. A style guide, which was specified based on NAMUR requirements, is also included in the standard. Thus, the variety which is provided by FDT for device functionality does not lead to different, manufacturer specific operating templates.

18 – Subsea Instrumentation Interface Standardisation (SIIS)

SIIS is a Joint Industry Project with its goal to achieve improvements in subsea reliability. The aim is to standardise the interface between subsea sensors and the subsea control system. SIIS is committed to working towards an open standard for the benefit of industry as a whole.

The ultimate vision which has utility for both the end user operators and for the first tier Subsea Control System suppliers, is one in which ROV-pluggable interfaces are available from subsea control systems, which do not have to be pre-defined in terms of the instrumentation to which they will subsequently be attached.

SIIS is open to all oil companies, Subsea Control System suppliers and subsea sensor vendors. Since its inception SIIS has grown to 33 members, including: BP, Chevron, Petrobras, Shell, Total and Statoil. Membership remains open to any organisation wishing to contribute to this industry standardisation.

Background

The concept of SIIS originated with BP and Shell in 2003. Following an initial meeting with other leading Oil-Field Operators (held in July 2003), and two subsequent meetings with the subsea controls industry, held in October 2004 and late January 2004, a Subsea Control System User Group was formed, involving the operators with representation from: BP, Shell, Total, ENI-AGIP, Norsk Hydro, Statoil, ChevronTexaco and subsea control system vendors: ABB Offshore System Limited, Aker Kvaerner, Cameron, Dril-Quip and FMC/KOS.

The Subsea Control Systems User Group identified a number of issues on which the operators may like to see progress in terms of standardisation of interfaces. This may facilitate greater reliability for subsea field developments and reduce risks to functionality and schedule.

The first topic discussed by the Subsea Control System User Group has been Subsea Instrumentation Interface Standardisation (SIIS).

The scope of the SIIS initiative is distinct from IWIS (standardisation for downhole instrumentation) and it is limited to subsea production system instruments interfacing directly to the Subsea Control Module.

The Group initially discussed a five-level classification system for control system-to-sensor interfaces. This was simplified to three levels in September 2007. The SIIS JIP meeting is focused around a number of member led technical working groups:-

- Application Layer
- Topology & Connector
- Level 3
- EMC

SIIS agreed on a suitable protocol to be taken forward as a basis for standardisation. The CAN-OPEN interface type was selected as the SIIS protocol.

19 – Company specification

All of the international operators have their own in-house technical specifications in order to specify exactly what is considered required for their plants and installations. These specifications (also called company standards, engineering practices, best practices, supplementary technical specifications etc.) also carry their experience and they may be supplemented by individual project specifications to cover specific project needs. These documents are normally based on, but include various degrees of supplements and amendments to international, national and industry standards.

At the workshop the operating companies present agreed to share their specifications in a closed OGP web environment for review by the other participants to see if there was scope for harmonisation, standardisation or improvement.

For further information and publications,
please visit our website at

www.ogp.org.uk



**International
Association
of Oil & Gas
Producers**

209-215 Blackfriars Road
London SE1 8NL
United Kingdom
Telephone: +44 (0)20 7633 0272
Fax: +44 (0)20 7633 2350

165 Bd du Souverain
4th Floor
B-1160 Brussels, Belgium
Telephone: +32 (0)2 566 9150
Fax: +32 (0)2 566 9159

Internet site: www.ogp.org.uk
e-mail: reception@ogp.org.uk