Designer to End User – The IECEx Verification Dossier

Roger D Jones

National Oilwell Varco (NOV)

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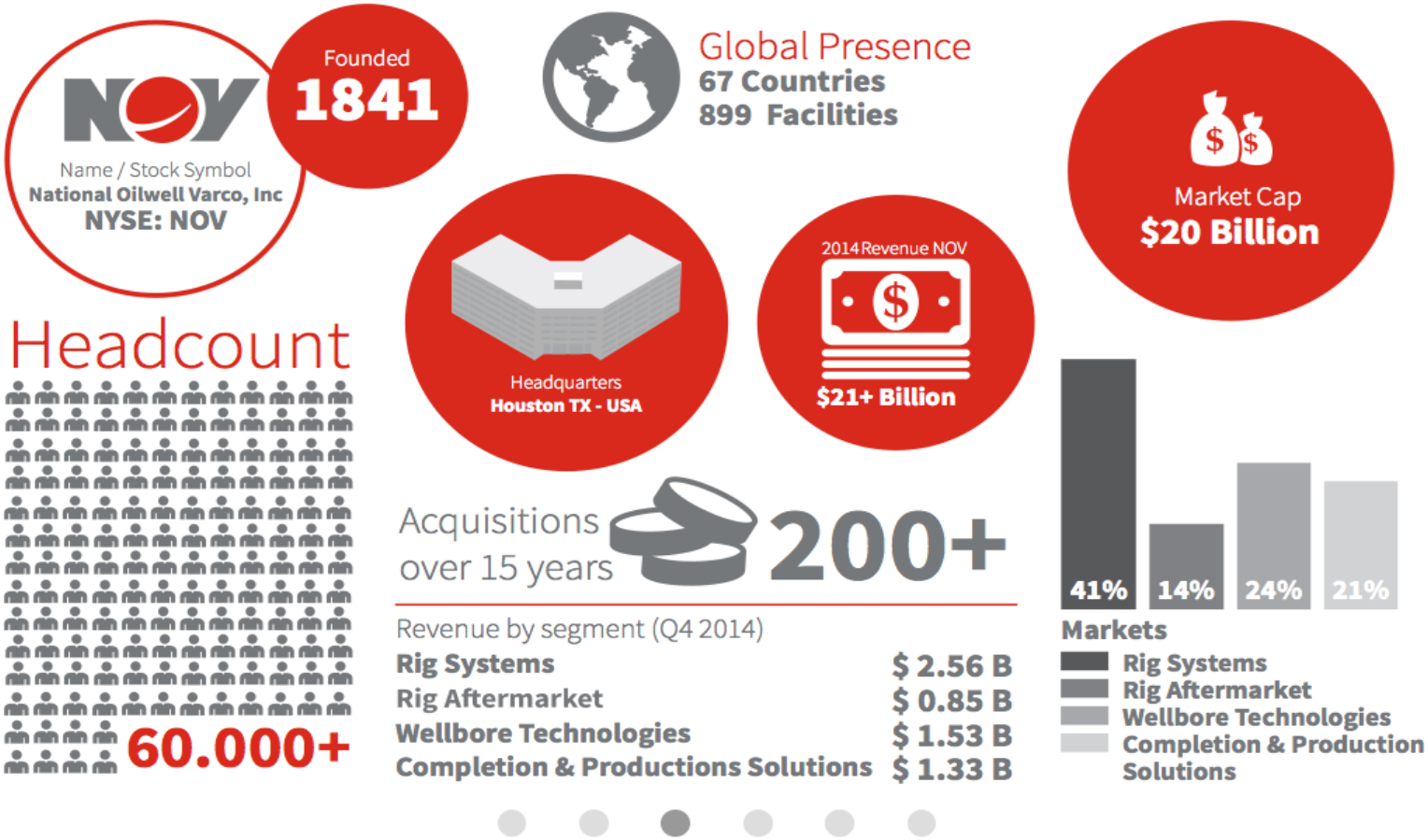
Introduction to the Company – NOV in China

Since 1995, NOV has delivered outstanding equipment and services to China's growing oil and gas market. We currently operate from 32 locations and China.

Our strong local presence, combined with more than 170 years of global industry expertise, enable us to deliver the technical support, superior equipment and integrated services that help you build lasting success.

Introduction to the Company – NOV National Oilwell Varco

ABOUT



Introduction to the Company – NOV National Oilwell Varco

About Videos Investors News Locations Technology Contact NOV Timeline

Introduction to the Presenter – Roger D Jones NOV

- 25 years in International Hazardous Area Approvals and Machinery Risk Assessment
- Member of NOVs Global Compliance Engineering Group based in Houston Texas USA
- TC31 SC31J UK Member of MT60079-14, MT60079-17, MT60079-19
- ExPCC Working Group Member for Personal Competency Certificate WG2 WG3 WG4
- British Standards EXL/31/3 and EXL/31/1 Member for Potentially Explosive Atmospheres
- British Electrotechnical Committee L/6/10 Member for Potentially Explosive Atmospheres
- Previously Department Section Head of a UKAS Notified Body (Machinery Division)
- Presented Technical Papers at the Institute of Mechanical Engineers London
- Speaker and Technical Expert at Offshore Safety Aberdeen & HazardEx Conferences
- Appointed by the FIA as Lead Equipment Inspector for all Formula1 Race Teams

Introduction

What we are going to cover:

- IECEx Verification Dossier
- ISO12100 Risk Assessment
- Ignition Hazard Assessment
- Example of an Ignition Hazard Assessment
- IECEx Electrical and Mechanical Inspections
- Global Engineering Competence and Training
- Future Developments
- Review of End Users Comments

IECEx Verification Dossier

The IECEx Verification Dossier format can be used for:

- International or National Type Approval of Electrical or Mechanical Products
- International or National Type Approval of Assemblies or Machines
- Final Installation Inspections and Audits by NOV or End Users
- Initial Site Inspections and Audits by End Users
- Ongoing Installation or Site Inspections by NOV or End Users
- Developing a Global Market Access Compliance Strategy
- Research and Development of Advanced Machines, Assemblies, and Drilling Rigs
- ISO9001:2015 Documentation and Verification Control (QANs)
- Competence Reviews and Audits

IECEx Verification Dossier

The IECEx Verification Dossier format is used for:

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IECEx Verification Dossier

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IECEx Verification Dossier

The IECEx Verification Dossier format is used for:

- Final Site Inspections and Audits by NOV or End Users

IECEx Verification Dossier

The IECEx Verification Dossier format is used for:

- Developing a Global Market Access Strategy based on ISO/IEC Standards

IECEx Verification Dossier

IECEx Verification Dossier Basic Format

TITLE	MASTER VERIFICATION DOSSIER	**DATE**
GUIDEANCE	ISO12100 GUIDELINES	**CHK**
ASSESSMENT TYPE	PRODUCT/ASSEMBLY/INSTALLATION	**APP**
DESCRIPTION		**ISSUE**
ANNEX A	**DESCRIPTION**	**DOCUMENT**
1	Limits of the Product/Assembly/Installation	
2	Area Classification Drawings	
3	Manufacturing Drawings	
4	Controlled Certification Drawings	
5	Information & Instructions for Safe Use	
6	ISO12100 Risk Assessment	
7	Ignition Hazard Assessment	
8	Applied IEC & ISO Standards (Mitigation)	
9	Certificates & Declarations	
10	ISO9001 & Quality Assurance	
Annex B	Electrical & Mechanical Inspections	
Annex C	Competence Records	

Next subject

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ISO12100 Risk Assessment

The following describes the basic compliance process:

1. Organise Resource, ensure we have the resources and competence
2. Assess Hazards & Risks based on ISO12100
3. Develop a Mitigation Plan based on ISO/IEC Standards
4. Implement Plan and Monitor Progress through Quality (ISO9001)

ISO12100 Risk Assessment

1. Organise Resources; Financial, Engineering, Competence, Legal

ISO12100 Risk Assessment

2. **Assess Hazards and Risks based on ISO12100**

Hazards and Risks in the Oil & Gas Industry (Piper Alpha 1988)

ISO12100 Risk Assessment

2. Assess Hazards and Risks based on ISO12100

Hazards and Risks in the Oil & Gas Industry (Petrobras P36 2001)

ISO12100 Risk Assessment

2. **Assess Hazards and Risks based on ISO12100**

Hazards and Risks in the Oil & Gas Industry (Deepwater Horizon 2010)

ISO12100 Risk Assessment

2. **Assess Hazards and Risks based on ISO12100**

INTERNATIONAL STANDARD

ISO 12100

First edition
2010-11-01

Safety of machinery — General principles for design — Risk assessment and risk reduction

Sécurité des machines — Principes généraux de conception — Appréciation du risque et réduction du risque

ISO

Reference number
ISO 12100:2010(E)

© ISO 2010

ISO12100 Risk Assessment

2. **Assess Hazards and Risks based on ISO12100**

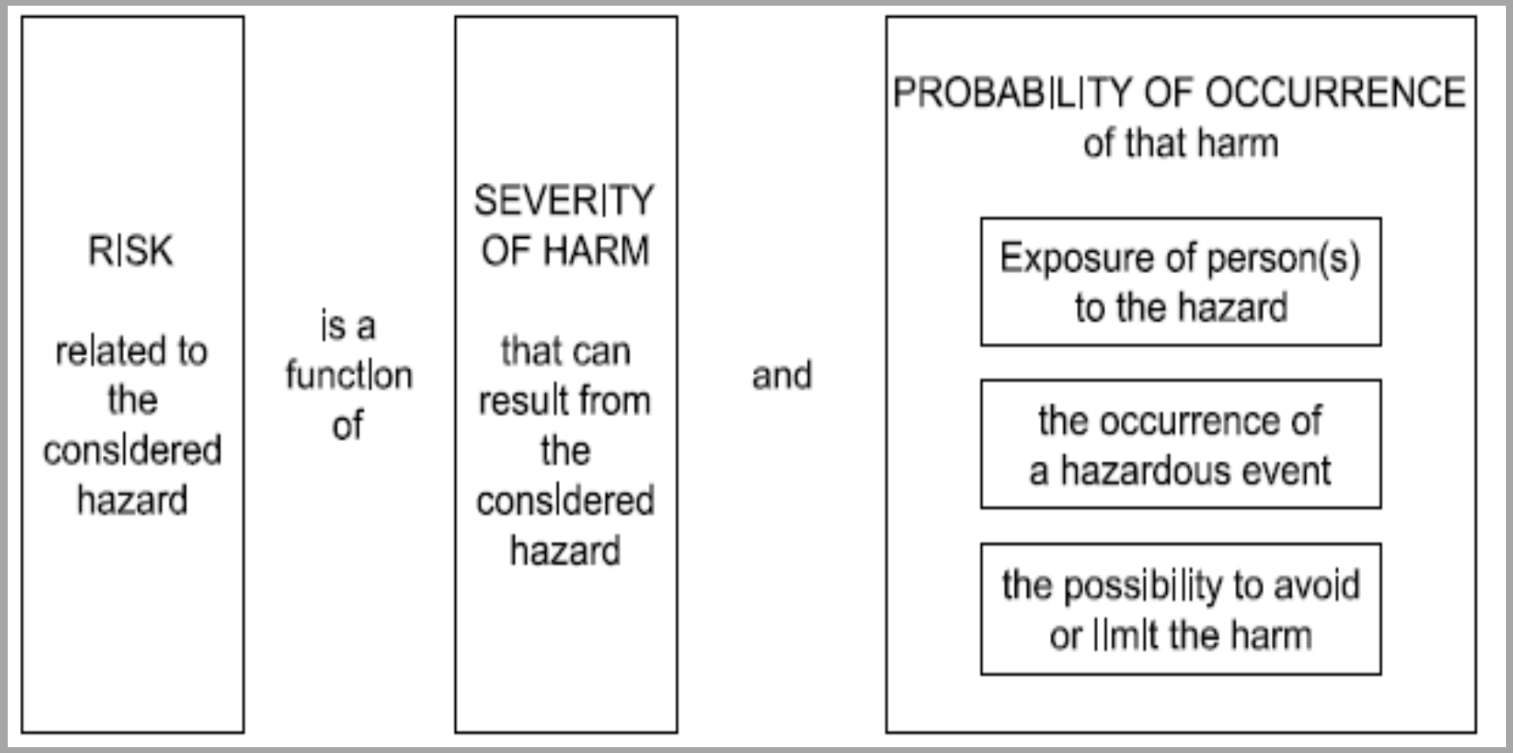
The primary purpose of this International Standard is to provide designers with an overall framework and guidance for decisions during the development of machinery or assemblies to enable them to design machines that are safe for their intended use. **It also provides a strategy for standards developers and will assist in the preparation of consistent and appropriate type-B and type-C standards.**

This International Standard is the basis for a set of standards which has the following structure:

- Type-A standards (basic safety standards) giving basic concepts, principles for design and general aspects that can be applied to machinery or assemblies;
- Type-B standards (generic safety standards) dealing with one safety aspect or one type of safeguard that can be used across a wide range of machinery or assemblies.
- Type-C standards (machine safety standards) dealing with detailed safety requirements for a particular machine or group of machines or assemblies.

ISO12100 Risk Assessment

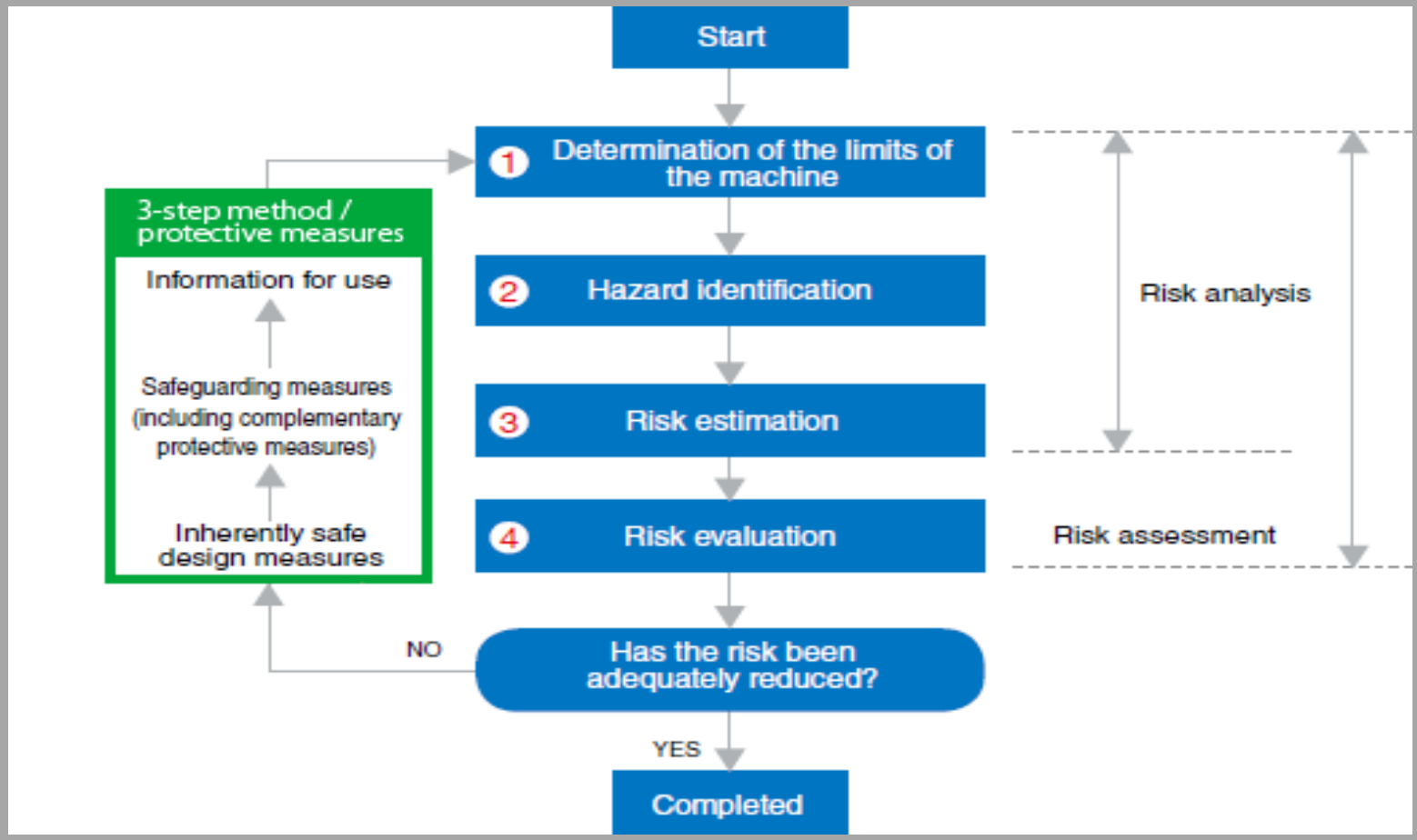
2. **Assess Hazards and Risks based on ISO12100**



Inherently Safe Design (ISO/IEC Standards)-Remove the Hazard Significantly Reduces the Risk

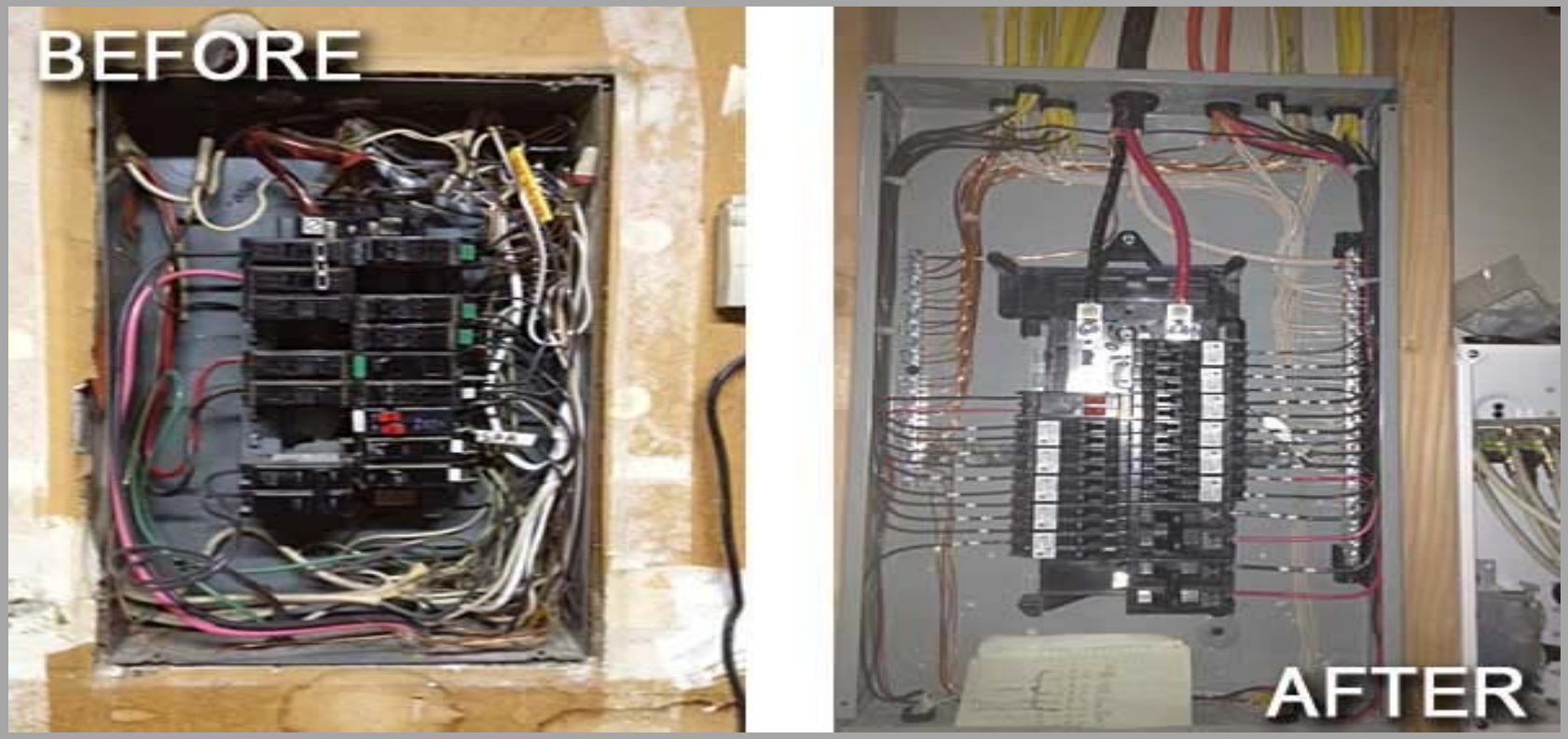
ISO12100 Risk Assessment

2. **Assess Hazards and Risks based on ISO12100**



ISO12100 Risk Assessment

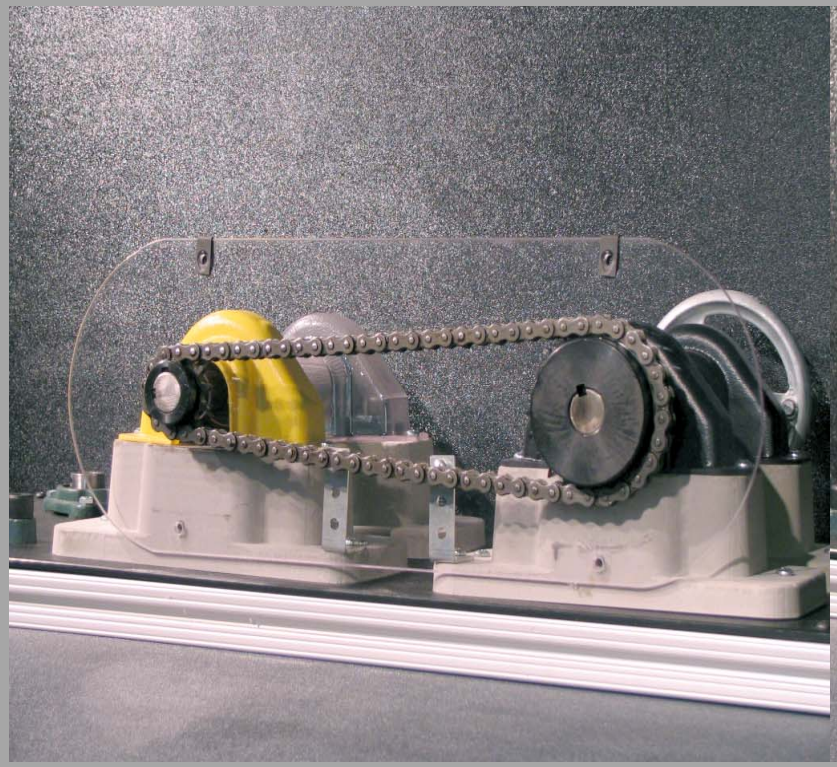
3. **Develop a Mitigation Plan based on ISO/IEC Standards**



Safe Design Measures IEC-ISO Standards (Electrical IEC61010)

ISO12100 Risk Assessment

3. **Develop a Mitigation Plan based on ISO/IEC Standards**



Safeguarding measures IEC-ISO Standards (Guards ISO14120)

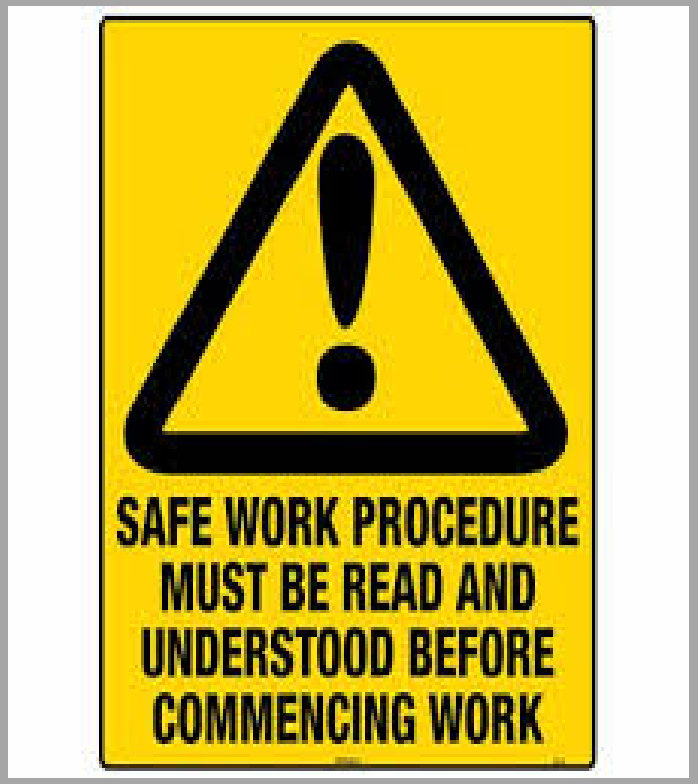
ISO12100 Risk Assessment

3. **Develop a Mitigation Plan based on ISO/IEC Standards**

Information for Use (Instructions IEC 82079-1)

ISO12100 Risk Assessment

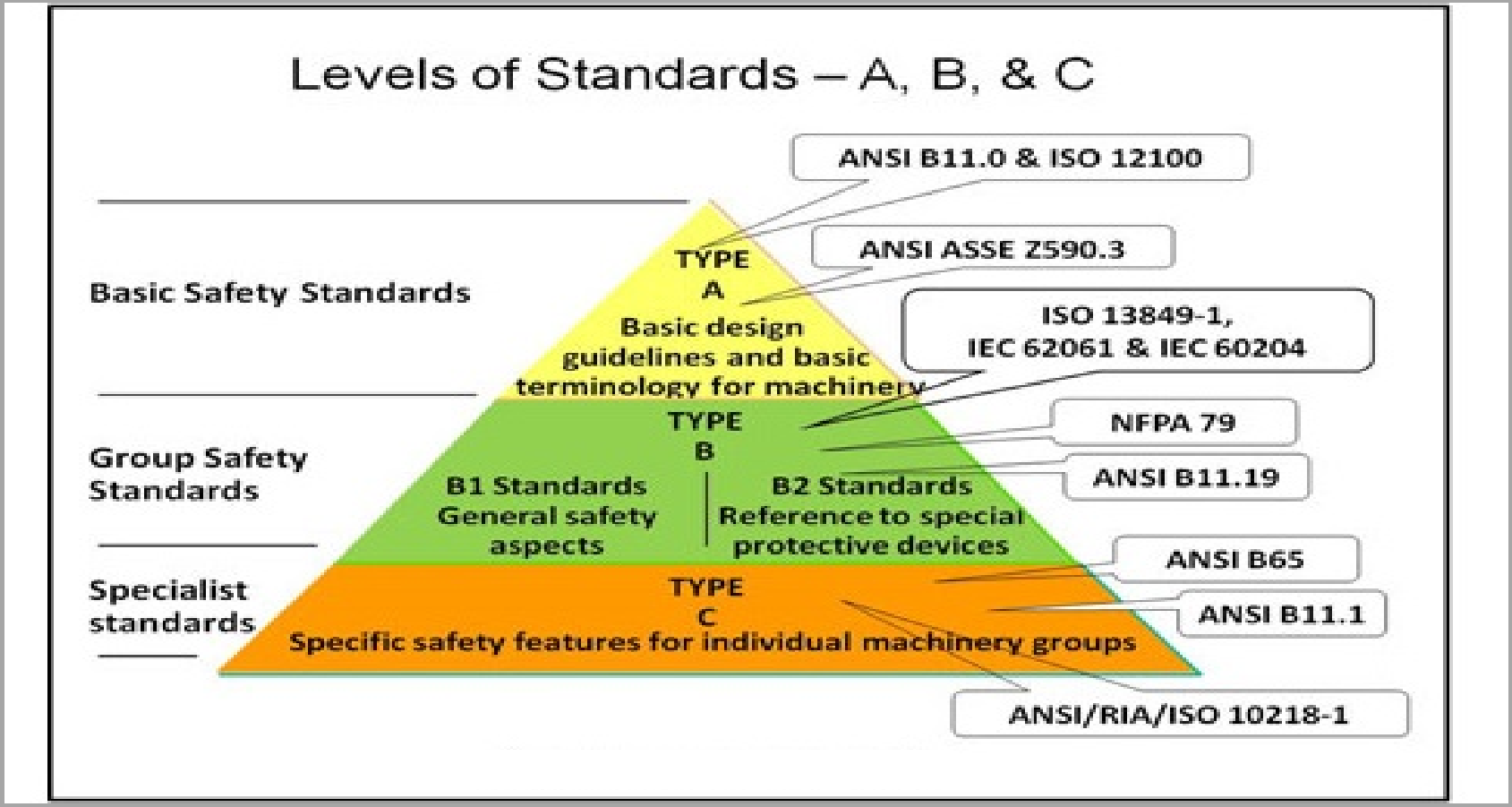
3. **Develop a Mitigation Plan based on ISO/IEC Standards**



Information for Use (Procedures and Training)

ISO12100 Risk Assessment

3. **Develop a Mitigation Plan based on ISO/IEC Standards (Type A,B,C)**



ISO12100 Risk Assessment

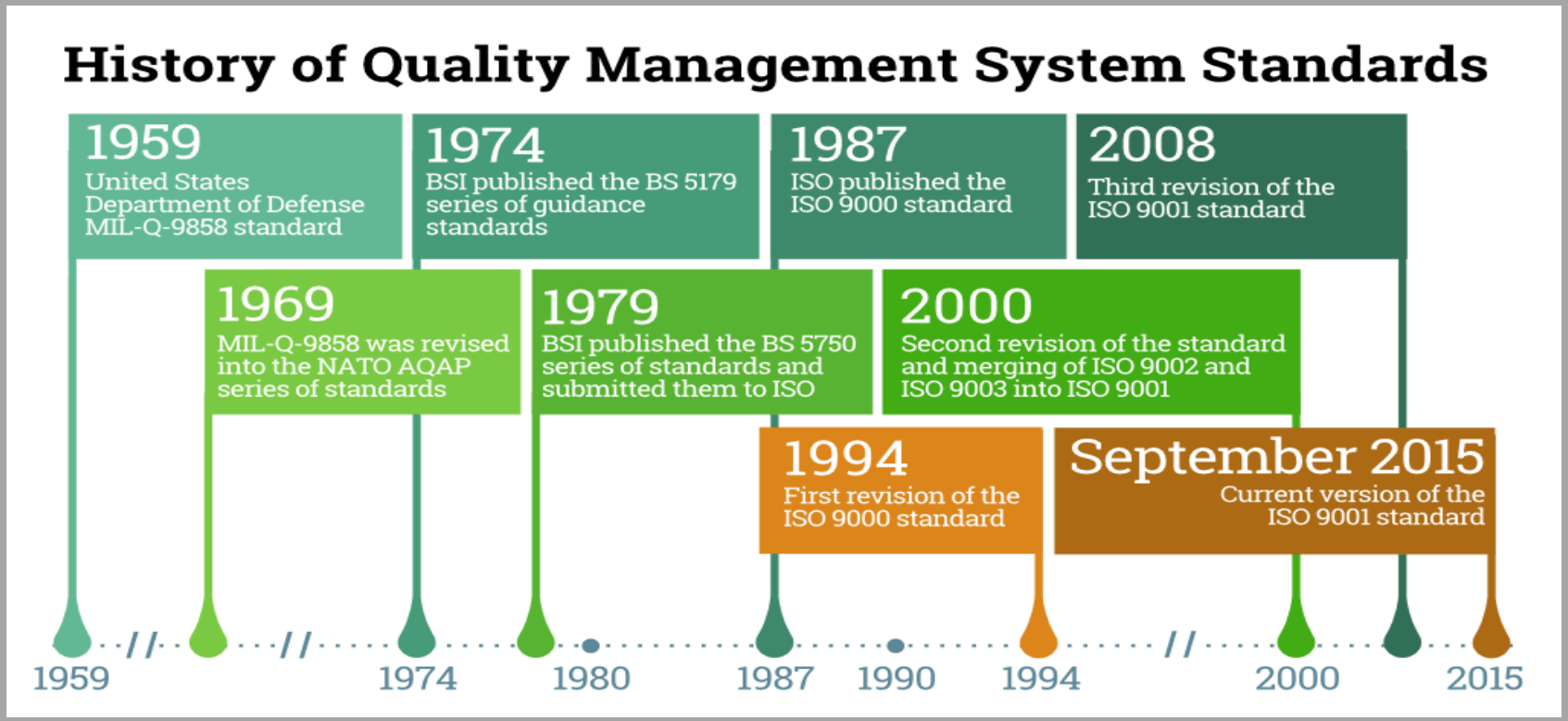
3. Develop a Mitigation Plan based on ISO/IEC Standards (B Type)

• **ELECTRICAL**	**Installations IEC60364 & Machines IEC60204**
• **PNEUMATIC**	**ISO4413**
• **HYDRAULIC**	**ISO4414**
• **CONTROLS**	**IEC62061 or ISO13849-1**
• **NOISE**	**ISO11204**
• **GUARDING**	**ISO14120**
• **ACCESS**	**ISO14122 Series of Standards**
• *ELECTRICAL IGNITION*	*IEC60079 Series of Standards*
• *MECHANICAL IGNITION*	*ISO80079 Series of Standards*

Note: Currently the IEC60079 and ISO80079 are not classified as B-Type Standards

ISO12100 Risk Assessment

4. Implement Plan and Monitor Progress through Quality (ISO9001)



ISO12100 Risk Assessment

End User Feedback:

1. The Global organisation of staff and resources is becoming more critical
2. Internationally there needs to be a much greater awareness of ISO12100
3. Standards Developers need to integrate with the ISO12100 Structure
4. ISO9001:2015 (Risk Based Approach) time for implementation

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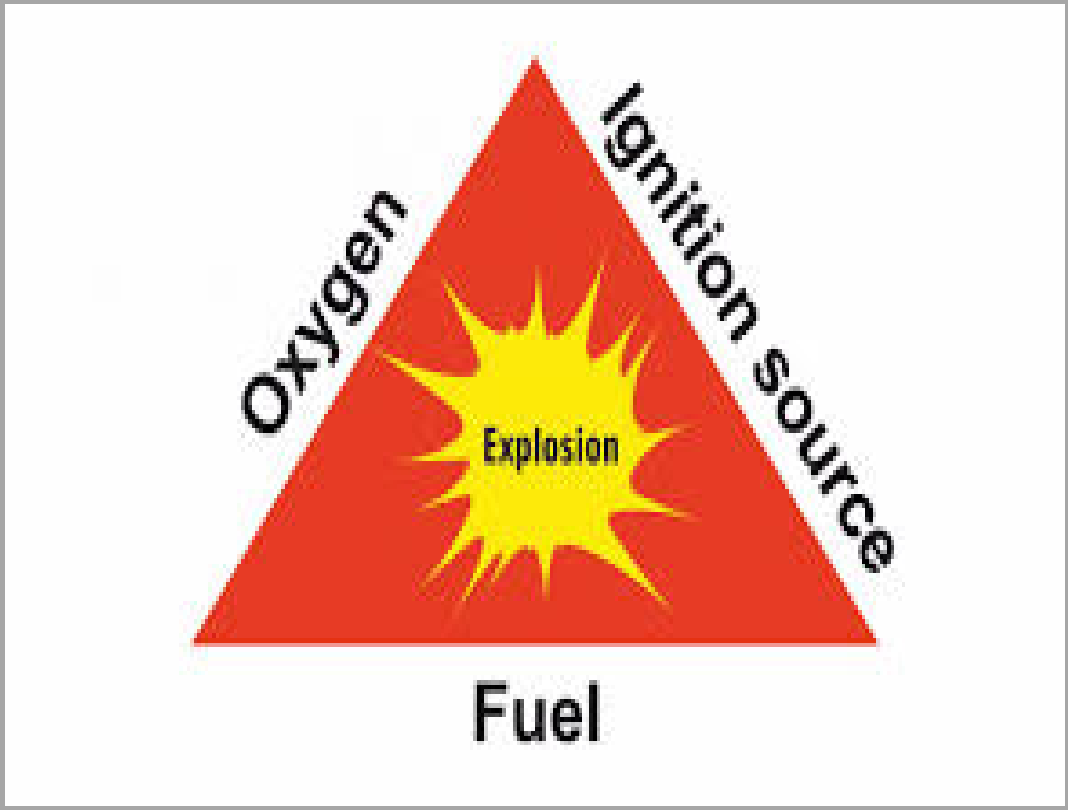
Ignition Hazard Assessment

Back to basics, why do we need to remove the Ignition Source?



Ignition Hazard Assessment

ISO12100 identifies Explosions and Flames as a Hazard

Thermal hazards	— explosion; — flame; — objects or materials with a high or low temperature; — radiation from heat sources.	— burn; — dehydration; — discomfort; — frostbite; — injuries by the radiation of heat sources; — scald.

Ignition Hazard Assessment

ISO12100 identifies Explosions and Flames as a Hazard

Material/ substance hazards	— aerosol; — biological and microbiological (viral or bacterial) agent; — combustible; — dust; — explosive; — fibre; — flammable; — fluid; — fume; — gas; — mist; — oxidizer.	— breathing difficulties, suffocation; — cancer; — corrosion; — effects on reproductive capability; — explosion; — fire; — infection; — mutation; — poisoning; — sensitization.

Ignition Hazard Assessment

Examples of Ignition sources mitigated by to IEC-ISO Standards

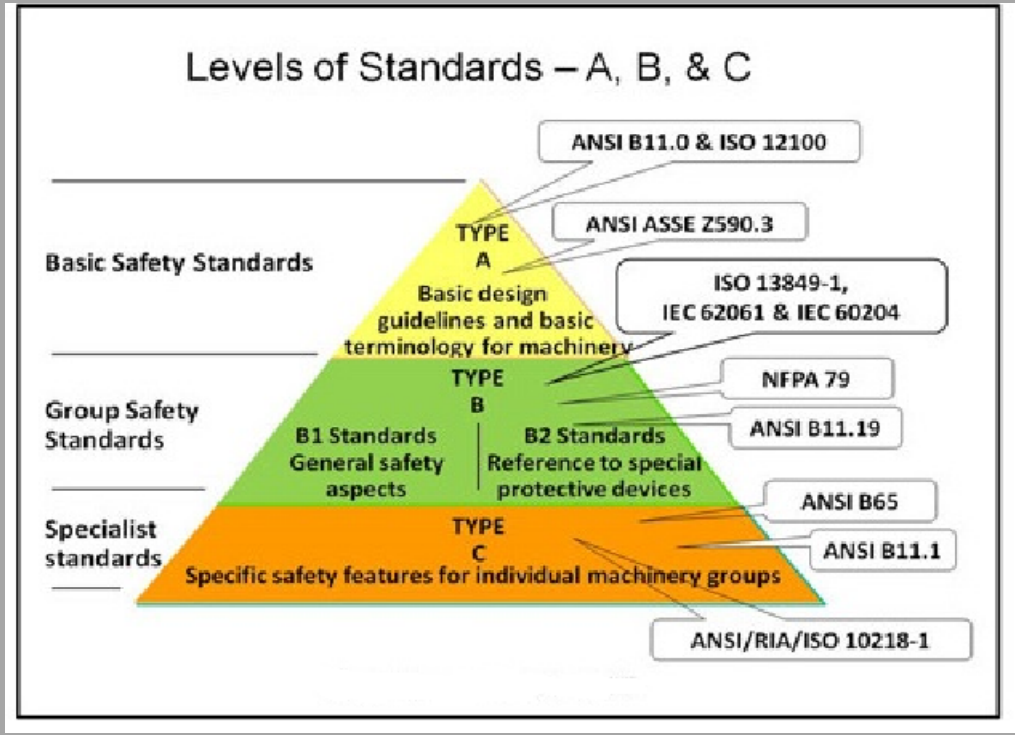
• HOT SURFACES	ISO80079 Series of Standards
• FLAMES & HOT GASES	ISO80079 Series of Standards
• MECHANICAL SPARKS	ISO80079 Series of Standards
• ELECTRICAL APPARATUS	IEC60079 Series of Standards
• STRAY CURRENTS	IEC60079 Series of Standards
• CATHODIC CORROSION	IEC60079 Series of Standards
• STATIC ELECTRICITY	ISO80079 & IEC60079 Series of Standards
• LIGHTNING	IEC62305 Series of Standards

A complete list of all the ignition Hazards is detailed in the IEC80079 Standards

Ignition Hazard Assessment

End User Feedback

We would like to see an International ISO Standard that offers clear guidance on how to identify ALL sources of Ignition. This would significantly assist with the implementation of the ISO80079 Non-Electrical Standards and development of the proposed IECEx Assemblies Standard.



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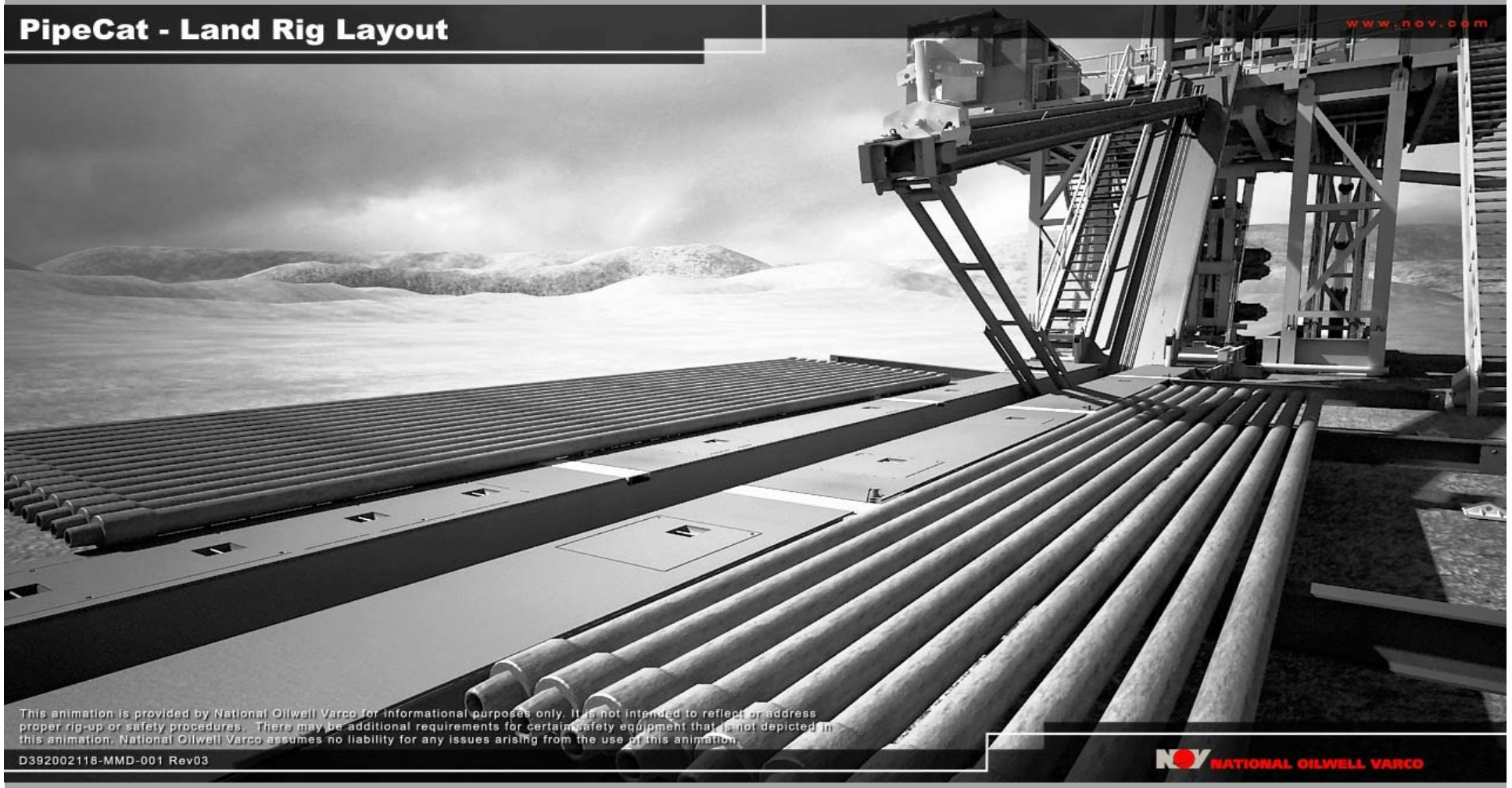
Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources



Example of an Ignition Hazard Assessment

Template for initial assessment of equipment related ignition sources

IGNITION SOURCE	ACTIVE		MEASURES APPLIED	QA Inspection
Hot Surface				
Flames & Hot Gases				
Mechanical Sparks				
Electrical Equipment				
Stray Electric Currents				
Static Electricity				
Lightning				
Radio Frequency				
Electromagnetic Waves				
Ionising Radiation				
Ultrasonics				
Adiabatic Compression				
Shock Waves				
Chemical Reactions				

Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

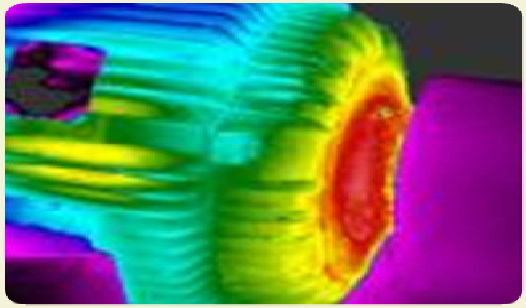
Possible Ignition Source	*Identify all Potential Ignition Sources*
Source of Ignition Examples	*Tabulate Results within NOV Report*
NOV Design Criteria	*Apply the applicable Design Standard*
NOV QA Inspection	*Detailed Inspections Performed & Recorded*
Users Requirements	*Ongoing Inspections by End User & NOV Staff*
Failure Mode Analysis	*ISO9001*

Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

HOT SURFACE

Pipecat Possible Ignition Source	*YES (Normal Operation & Fault Condition)*
Source of Ignition Examples	*Bearings, Chain & Sprocket, Hydraulic Motors.*
NOV Design Criteria	*ISO80079 Series of Standards*
NOV QA Inspection	*Thermographic Camera Survey*
Users Requirements	*NOV Mechanical Inspection Sheet*
Ongoing Failure Mode Analysis	*NOV ISO9001*



Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

FLAMES & HOT GASES

Pipecat Possible Ignition Source	*YES (Fault Condition)*
Source of Ignition Examples	*Hydraulic Spray*
NOV Design Criteria	*ISO80079 Series of Standards*
NOV QA Inspection	*ISO4413 Hydraulic Installation Standard*
Users Requirements	*NOV Mechanical Inspection Sheet*
Ongoing Failure Mode Analysis	*NOV ISO9001*

Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

MECHANICAL SPARKS

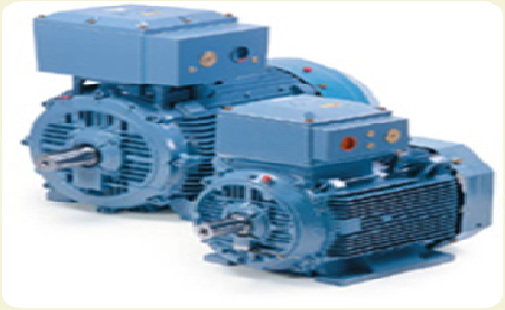
Pipecat Possible Ignition Source	*YES (Normal Operation & Fault Condition)*
Source of Ignition Examples	*Bearings, Chain, Hydraulic Motors, Skate*
NOV Design Criteria	*ISO80079 Series of Standards*
NOV QA Inspection	*Clearance Distances (Fixed & Moving Parts)*
Users Requirements	*NOV Mechanical Inspection Sheet*
Ongoing Failure Mode Analysis	*NOV ISO9001*

Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

ELECTRICAL EQUIPMENT

Pipecat Possible Ignition Source	*YES (Normal Operation & Fault Condition)*
Source of Ignition Examples	*Electrical Equipment and Installation*
NOV Design Criteria	*IEC60079-14 & IEC60204*
NOV QA Inspection	*IEC60079-14 & IEC60204*
Users Requirements	*IEC60079-17*
Ongoing Failure Mode Analysis	*NOV ISO9001*



Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

STRAY ELECTRIC CURRENTS

Pipecat Possible Ignition Source	*YES (Normal Operation & Fault Condition)*
Source of Ignition Examples	*Various*
NOV Design Criteria	*IEC60079-14 & IEC60204*
NOV QA Inspection	*IEC60079-14 & IEC60204*
Users Requirements	*IEC60079-17*
Ongoing Failure Mode Analysis	*NOV ISO9001*

Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

STATIC ELECTRICITY

Pipecat Possible Ignition Source	*YES (Normal Operation)*
Source of Ignition Examples	*Non-Metallic Materials, Hydraulic Fluid Lines*
NOV Design Criteria	*IEC60079-14 & IEC60204*
NOV QA Inspection	*IEC60079-14 & IEC60204*
Users Requirements	*IEC60079-17*
Ongoing Failure Mode Analysis	*NOV ISO9001*

Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

LIGHTNING

Pipecat Possible Ignition Source	*YES (Normal Operation)*
Source of Ignition Examples	*Lightning strike*
NOV Design Criteria	*Users Responsibility*
NOV QA Inspection	*Users responsibility stated in Instructions*
Users Requirements	*National Codes of Practise*
Ongoing Failure Mode Analysis	*NOV ISO9001*

Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

RADIO FREQUENCY

Pipecat Possible Ignition Source	*YES (Normal Operation)*
Source of Ignition Examples	*Electrical Equipment and Installation*
NOV Design Criteria	*IEC60079-14 & IEC60204*
NOV QA Inspection	*IEC60079-14 & IEC60204*
Users Requirements	*IEC60079-17*
Ongoing Failure Mode Analysis	*NOV ISO9001*

Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

ELECTROMAGMETIC WAVES

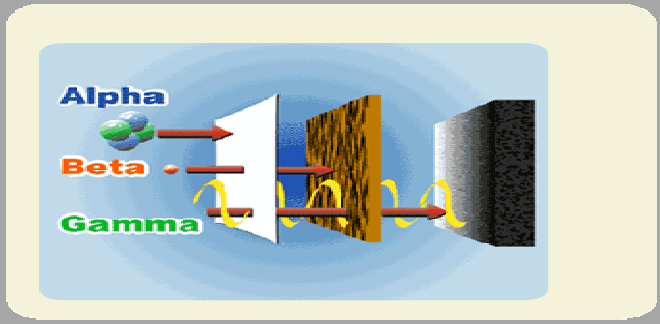
Pipecat Possible Ignition Source	*YES (Normal Operation)*
Source of Ignition Examples	*Electrical and Fibre Optics Systems*
NOV Design Criteria	*IEC60079-14 & IEC60079-28*
NOV QA Inspection	*IEC60079-14 & IEC60079-28*
Users Requirements	*IEC60079-17*
Ongoing Failure Mode Analysis	*NOV ISO9001*

Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

IONISING RADIATION

Pipecat Possible Ignition Source	*No*
Source of Ignition Examples	*None*
NOV Design Criteria	*None*
NOV QA Inspection	*None*
Users Requirements	*None*
Ongoing Failure Mode Analysis	*None*

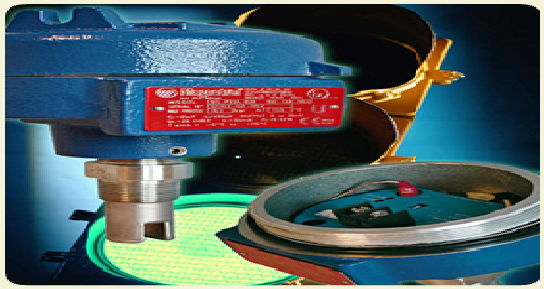


Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

ULTRASONIC

Pipecat Possible Ignition Source	*No*
Source of Ignition Examples	*None*
NOV Design Criteria	*None*
NOV QA Inspection	*None*
Users Requirements	*None*
Ongoing Failure Mode Analysis	*None*



Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

ADIABATIC COMPRESSION

Pipecat Possible Ignition Source	*No*
Source of Ignition Examples	*None*
NOV Design Criteria	*None*
NOV QA Inspection	*None*
Users Requirements	*None*
Ongoing Failure Mode Analysis	*None*

Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

SHOCK WAVES

Pipecat Possible Ignition Source	*No*
Source of Ignition Examples	*None*
NOV Design Criteria	*None*
NOV QA Inspection	*None*
Users Requirements	*None*
Ongoing Failure Mode Analysis	*None*

Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

CHEMICAL REACTIONS

Pipecat Possible Ignition Source	*No*
Source of Ignition Examples	*None*
NOV Design Criteria	*None*
NOV QA Inspection	*None*
Users Requirements	*None*
Ongoing Failure Mode Analysis	*None*

Example of an Ignition Hazard Assessment

NOV Pipe cat initial assessment of equipment related ignition sources

IGNITION SOURCE	ACTIVE		MEASURES APPLIED	QA Inspection
Hot Surface	Yes		ISO80079 Series of Standards	Thermographic Camera
Flames & Hot Gases	Yes		ISO80079 Series of Standards	ISO4413 Hydraulics
Mechanical Sparks	Yes		ISO80079 Series of Standards	Clearance Distances
Electrical Equipment	Yes		IEC60079-14 & IEC60204	IEC60079-14 & IEC60204
Stray Electric Currents	Yes		IEC60079-14 & IEC60204	IEC60079-14 & IEC60204
Static Electricity	Yes		IEC60079-14 & IEC60204	IEC60079-14 & IEC60204
Lightning	Yes		Users Responsibility	Verify NOV Instructions for Use
Radio Frequency	Yes		IEC60079-14 & IEC60204	IEC60079-14 & IEC60204
Electromagnetic Waves	Yes		IEC60079-14 & IEC60079-28	IEC60079-14 & IEC60079-28
Ionising Radiation	No		None	None
Ultrasonics	No		None	None
Adiabatic Compression	No		None	None
Shock Waves	No		None	None
Chemical Reactions	No		None	None

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IECEx Electrical and Mechanical Inspections

IEC60079-14:2013 Explosive atmospheres - Part 14: Electrical installations design, selection and erection advises:

Initial inspection

Equipment shall be installed in accordance with its documentation. It shall be ensured that replaceable items are of the correct type and rating. On completion of the erection and prior to first use, initial detailed inspection of the equipment and installation shall be carried out in accordance with Annex C, which is based on the “detailed” grade of inspection in IEC 60079-17. NOTE IEC 60079-17 includes further information relevant to the initial inspection.

IECEx Electrical and Mechanical Inspections

IEC60079-14:2013 Explosive atmospheres - Part 14: Electrical installations design, selection and erection

Planning

A typical Drilling Rig is divided in to Major Equipment Packages (Drillers Cabin, Drilling Motor), following commissioning each Major Equipment Package undergoes an Initial Inspection by a Competent Team of Inspectors. There can be in excess of 40 Major Equipment Packages on a Drilling Rig and each one can be at different stages of installation or commissioning, therefore detailed planning of the Initial Inspection becomes critical to operations.

IECEx Electrical and Mechanical Inspections

Sample of IEC60079-14 Annex C Initial Inspection Schedules

Check that:		Ex "d"	Ex "e"	Ex "n" Ex "t"
		Grade of inspection: Detailed		
A	GENERAL (ALL EQUIPMENT)			
1	Equipment is appropriate to the EPL/zone requirements of the location	X	X	X
2	Equipment group is correct	X	X	X
3	Equipment temperature class is correct (only for gas)	X	X	n
4	Equipment maximum surface temperature is correct			t
5	Degree of protection (IP grade) of equipment is appropriate for the level of protection/group/conductivity	X	X	X
6	Equipment circuit identification is correct	X	X	X
7	Equipment circuit identification is available	X	X	X
8	Enclosure, glass parts and glass-to-metal sealing gaskets and/or compounds are satisfactory	X	X	X
9	There is no damage or unauthorized modifications	X	X	X
10	There is no evidence of unauthorized modification			

It should be noted that the use of the Inspection Schedules detailed within IEC60079-14/17/19 remains VOLUNTARY.

IECEx Electrical and Mechanical Inspections

Basic IECEx Electrical Equipment Index and Initial Inspection Record

TAG	NOV P/N:	DESCRIPTION	OEM	OEM P/N	MARKING	ZONE	CERTIFICATE	BLOCK	INTERCONNECT	IEC60079-14 ANNEX C TABLE C1, C2 AND C3
HAZARDOUS AREA ELECTRICAL EQUIPMENT INDEX AND INSPECTION RECORDS										

During the Initial (Detailed) Inspection the inspector can record any remedial actions against the conditions detailed in Table C1, C2 or C3 of IEC60079-14. For example if the equipment was not appropriate for the EPL or Zone then they would indicate this in the last column as a failure against condition A1. This format can also be applied for future IEC60079-17 Inspections.

IECEx Electrical and Mechanical Inspections

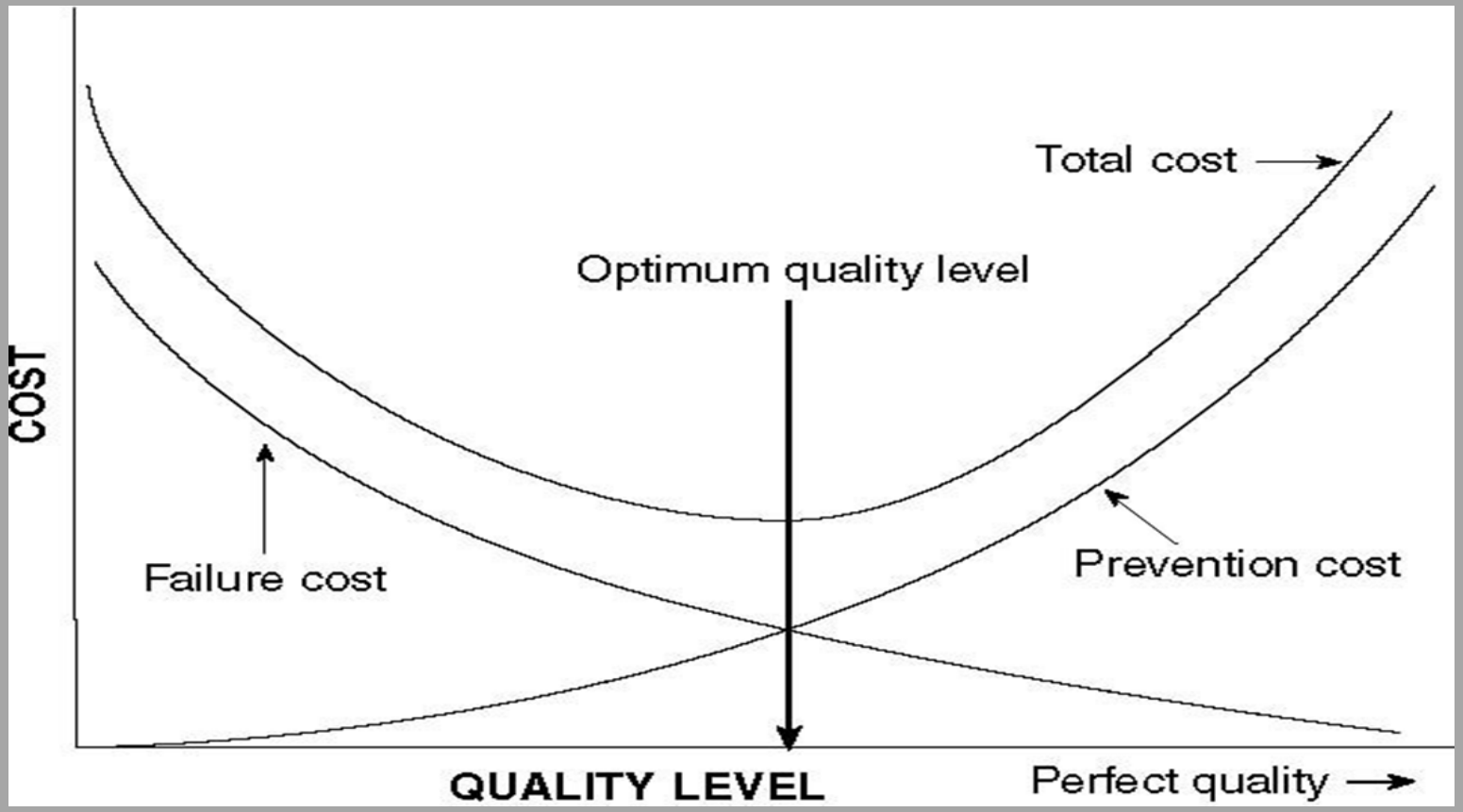
Basic IECEx Mechanical Equipment Index and Initial Inspection Record

TAG	NOV P/N:	DESCRIPTION	OEM	OEM P/N	MARKING	ZONE	CERTIFICATE	BLOCK	INTERCONNECT	IEC60079-14 ANNEX C TABLE C1 1-10
HAZARDOUS AREA MECHANICAL EQUIPMENT INDEX AND INSPECTION RECORDS										

Currently an IEC/ISO Standard for the Installation and Inspection of IECEx Non-Electrical Equipment does not exist. To fulfil this requirement it is possible to apply IEC60079-14 Table C1 Points 1-10 to at least record the most fundamental requirements. Inspectors can also be trained to identify and record potential sources of Ignition (Hot Surfaces, Friction, Sparking, Belt Slippage, Leakage of Lubricant).

IECEx Electrical and Mechanical Inspections

The emerging “Inspection Business” and the rising cost to End Users



IECEx Electrical and Mechanical Inspections

End User Feedback

As part of our Global Market Access Strategy we have seen significant benefits from adopting IEC60079-14, and to continue with this ongoing integration we would positively encourage developments or discussions in the following areas:

- Planning – There needs to be a greater awareness of the need to plan inspections
- Switch off & Electrical Isolation – The need to follow Legal and Statutory requirements
- Prioritising actions – Responsible Persons trained on how to prioritise remedial actions
- IEC60079 Inspection Schedules – Need to advise that these are NOT “Mandatory”
- Competence & Employee Descriptions - Industry refers to Technicians, Engineers, P-Eng
- IEC60079-19 Repair - Repair Facilities need to be aware of Manufacturers Warranties
- Inspection Risk Assessments – Detailed inspections and the hazards & risks to all involved

Next subject

What we are going to cover:

- IECEx Verification Dossier
- ISO12100 Risk Assessment
- Ignition Hazard Assessment
- Example of an Ignition Hazard Assessment
- IECEx Electrical and Mechanical Inspections
- **Global Engineering Competence and Training**
- Future Developments
- Review of End Users Comments

Global Engineering Competence & Training

Global Agreements on Engineering Competence

- International Engineering Alliance (IEA)
- International Professional Engineers Agreement (IPEA)
- Asia-Pacific Economic Cooperation
- International Engineering Technologists Agreement
- The Washington Accord
- The Sydney Accord
- The Dublin Accord
- European Federation of National Engineering Associations (FEANI)
- UK Standard for Professional Engineering Competence (UK-SPEC)

Global Engineering Competence & Training

The International Engineering Alliance

The International Engineering Alliance (IEA) is a global not-for-profit organisation, which comprises members from 35 jurisdictions within 26 countries, across seven international agreements. These international agreements govern the recognition of engineering educational qualifications and professional competence.

Through the Educational Accords and Competence Agreements members of the International Engineering Alliance establish and enforce internationally bench-marked standards for engineering education and expected competence for engineering practice.

Global Engineering Competence & Training

In compliance with International Agreements the UK-SPEC for the definition of Engineering Competence is:

Competence is the ability to carry out a task to an effective standard. To achieve competence requires the right level of knowledge, understanding and skill, and a professional attitude.

Competence is developed by a combination of formal and informal learning, and training and experience, generally known as initial professional development. However, these elements are not necessarily separate or sequential and they may not always be formally structured.

The five generic areas of competence and commitment are:

- *Knowledge and understanding*
- *Design and development of processes, systems, services and products*
- *Responsibility, management or leadership*
- *Communication and inter-personal skills*
- *Professional commitment*

Global Engineering Competence & Training

International Definitions for Competence relative to Engineering Roles:

Technician - EngTech
Engineering Technicians apply proven techniques and procedures to the solution of practical engineering problems.

Engineer - IEng
Incorporated Engineers maintain and manage applications of current and developing technology, and may undertake engineering design, development, manufacture, construction and operation.

Professional Engineer - CEng/PEng
Chartered Engineers develop solutions to engineering problems using new or existing technologies, through innovation, creativity and change and/or they may have technical accountability for complex systems with significant levels of risk.

The current definitions within IEC60079-14 do attempt to follow the international agreed format as detailed above, however it is felt that the roles of a “Responsible Person” and “Designer” should be assigned as either an Engineer or Professional Engineer.

Global Engineering Competence & Training

About Videos Investors News Locations Technology Contact NOV Timeline

Global Engineering Competence & Training

End User Feedback:

We would recommend that any Scheme or Standard being developed to measure the Competence of Engineers involved in Hazardous Area Locations, should be able to fully integrate with existing international agreements. As a minimum requirement, developers should be aware on how the definitions and roles of Technicians and Engineers are currently being applied within existing International Engineering Competence Schemes and the Industry.

To improve the acceptance of any new scheme within the Industry we would recommend that they are accredited with either National or International Continuous Professional Development Programmes (CPD Points). Consideration should also be given to ISO17024 (Certification of Persons).

Industry wants Technicians and Engineers to be able to demonstrate their “Knowledge and Understanding” of the actual IEC or ISO Standards and this could be assessed by End Users (NOV) or 3rd Parties via a Certificate Of Personal Knowledge (COPK with CPD Points).

Next subject

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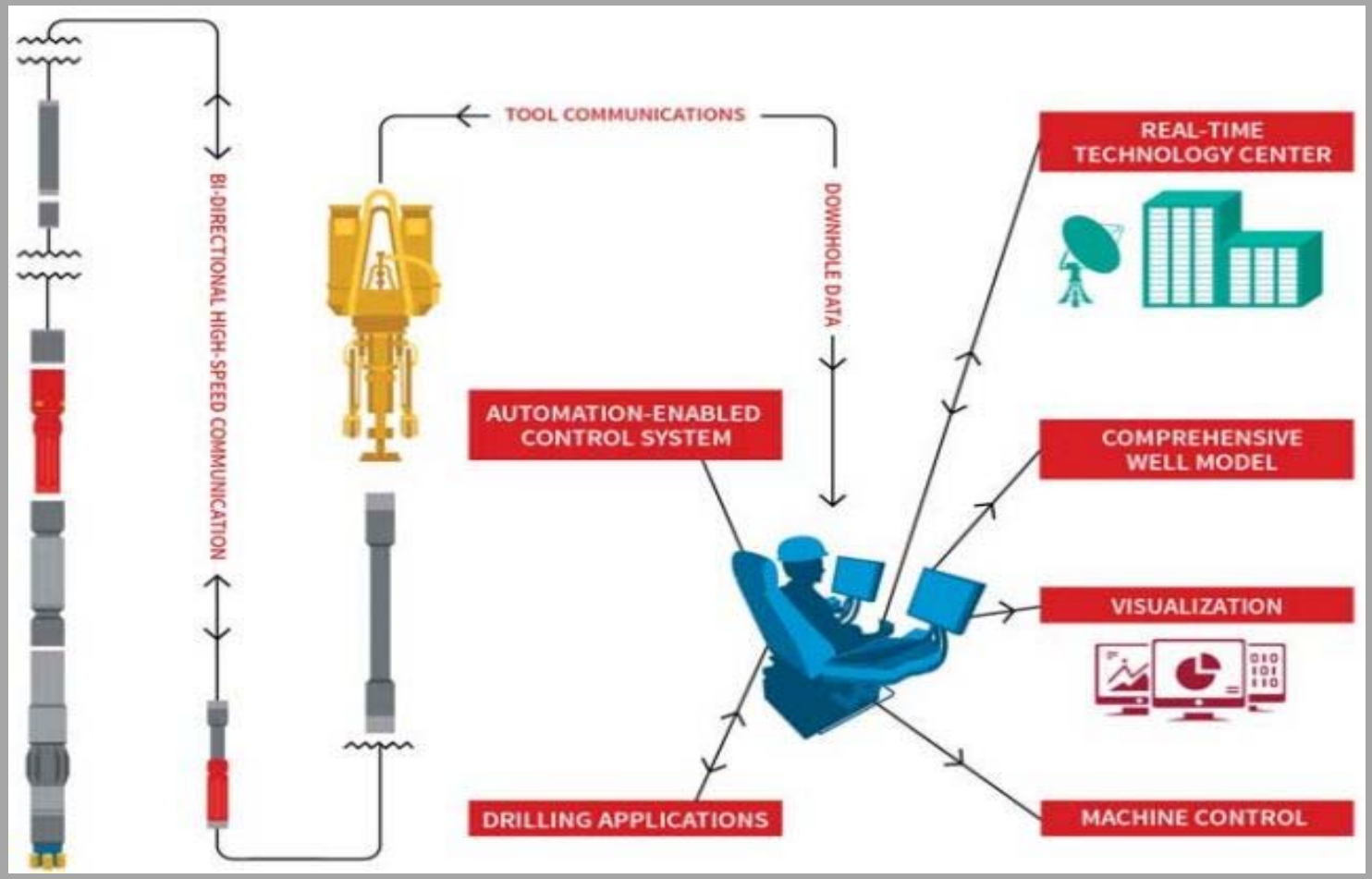
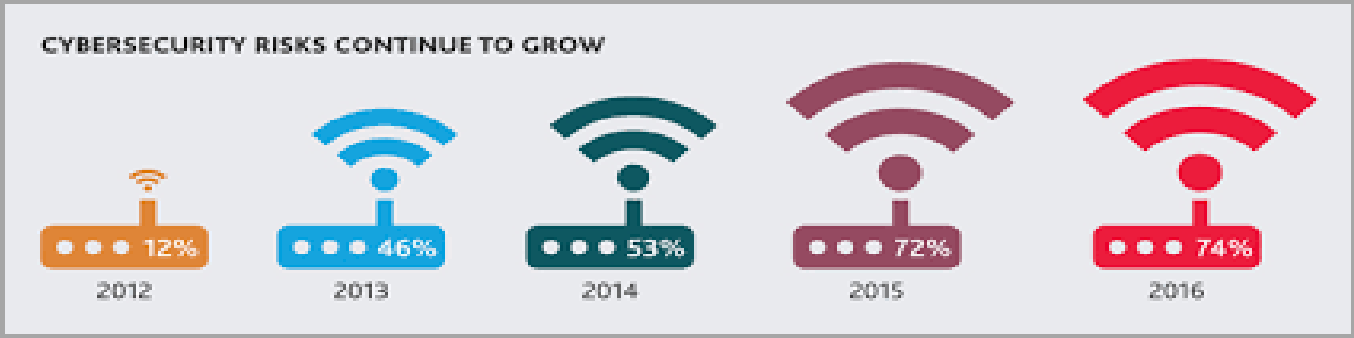
Future Developments

The Future of Drilling Automation in the Oil & Gas Industry



Future Developments

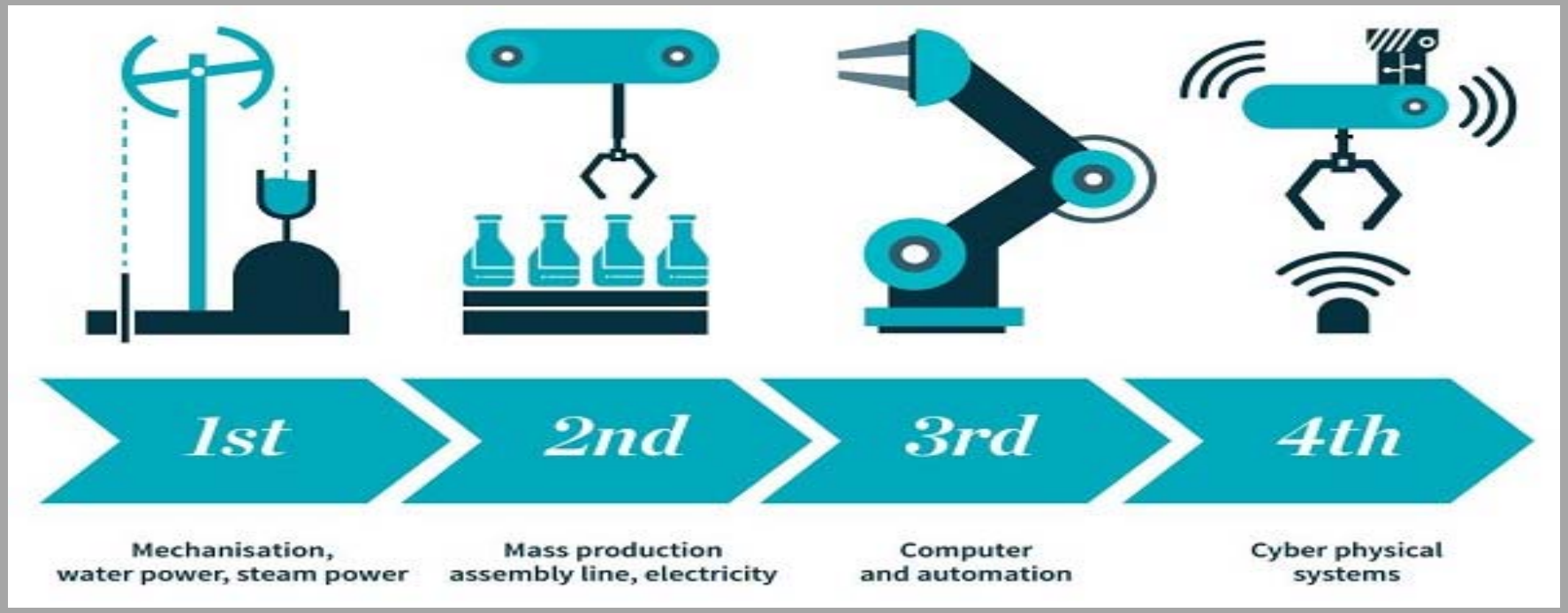
- The Cognitive Era (Artificial Intelligence)
- Co-worker or Cobot?
- Everything Everywhere Connected
- Work Any Time, Any Place, Any Space
- Wearable Health and Safety
- Augmented Reality (AR) and Virtual Reality (VR)



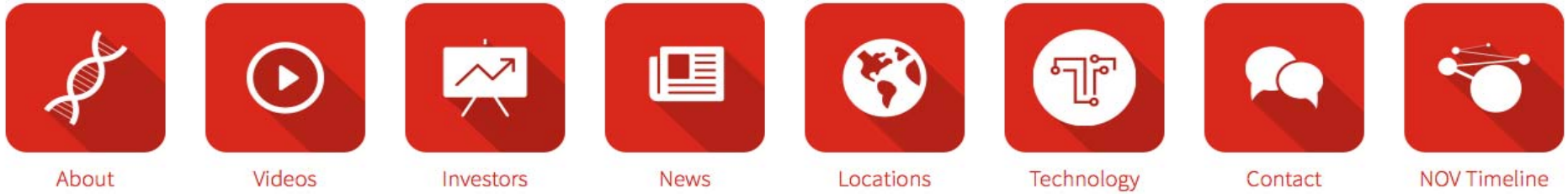
Review of End Users Comments

NOV and IECEx the ongoing integration:

PAST	Global Market Access plan developed since 2010
PRESENT	Industry needs Computer Automation & Complex Machine Integration
FUTURE	Cyber Physical Systems and the next generation



Future Developments



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- **Review of End Users Comments**

Final Review of End Users Comments

NOV & IECEx Success- CE Certification of new European Land Rig

Final Review of End Users Comments

NOV & IECEx Success- CU TR Certification of new Russian Land Rig

Review of End Users Comments

NOV and IECEx the ongoing integration:

As part of our Global Market Access Strategy we have seen significant benefits from adopting the IECEx Certification and Competence Schemes, and to continue with this ongoing integration we would encourage the following:

- A greater awareness of the importance of identifying ALL Hazards & Risks (ISO12100)
- Development of an Internationally agreed standard for identifying ALL Ignition Hazards
- The introduction of IECEx Non-Electrical Installation, Inspection and Repair Standards
- IECEx Assembly Certification Standard based on ALL Ignition Hazards being assessed
- IECEx Competence Scheme (COPC & COPK) - Continuous Professional Development
- IECEx Competence Scheme aligns with industry definitions (EngTech, IEng, CEng)
- Inviting End Users (NOV) to further participate in the development of the IECEx Scheme

Final Review of End Users Comments

IECEx Verification Dossier – This presentation has discussed the following

TITLE	MASTER VERIFICATION DOSSIER	DATE
GUIDEANCE	ISO12100 GUIDELINES	CHK
ASSESSMENT TYPE	PRODUCT/ASSEMBLY/INSTALLATION	APP
DESCRIPTION		ISSUE
ANNEX A	DESCRIPTION	DOCUMENT
1	Limits of the Product/Assembly/Installation	
2	Area Classification Drawings	
3	Manufacturing Drawings	
4	Controlled Certification Drawings	
5	Information & Instructions for Safe Use	
6	ISO12100 Risk Assessment	
7	Ignition Hazard Assessment	
8	Applied IEC & ISO Standards (Mitigation)	
9	Certificates & Declarations	
10	ISO9001 & Quality Assurance	
Annex B	Electrical & Mechanical Inspections	
Annex C	Competence Records	

Review of End Users Comments

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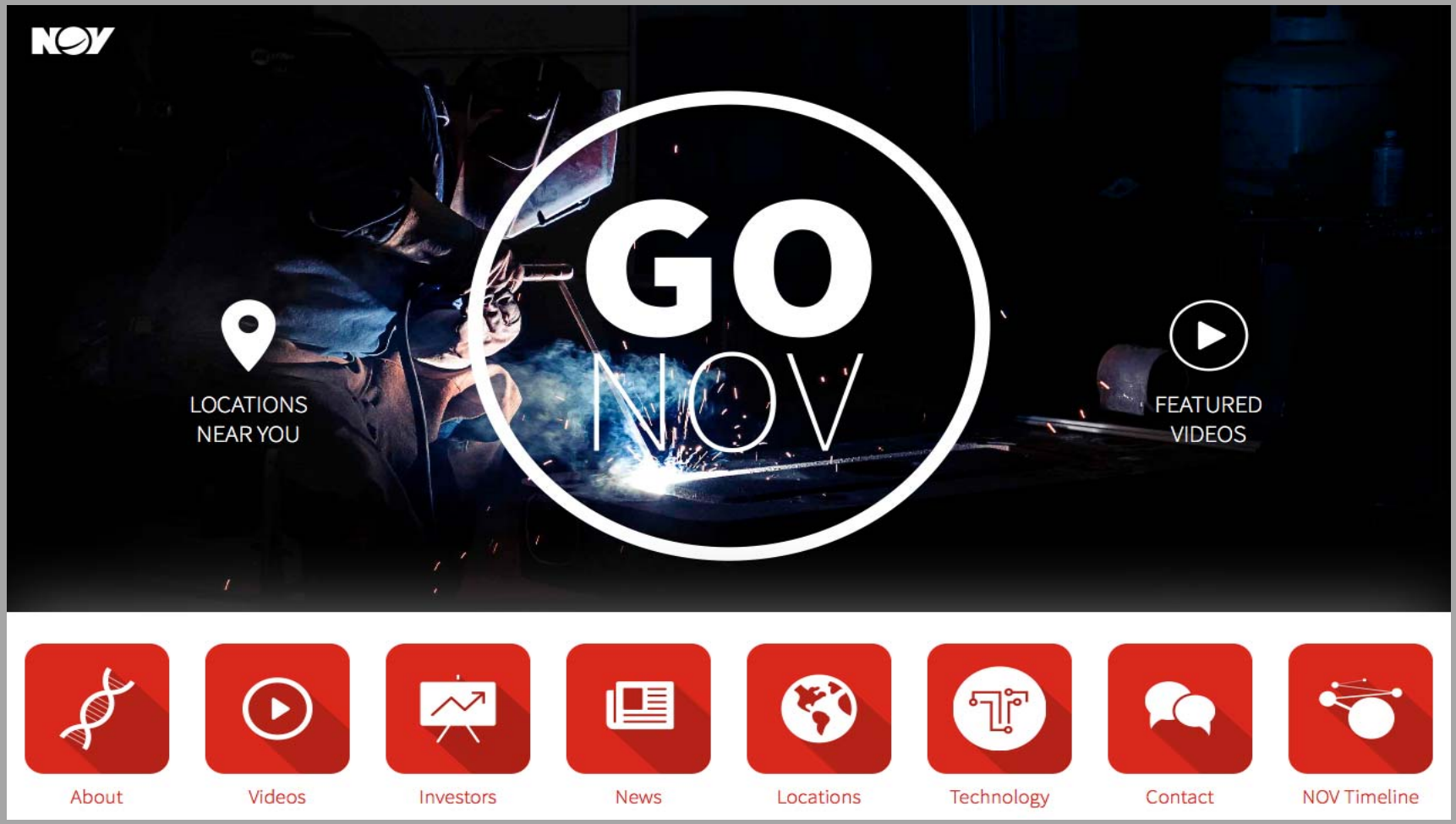
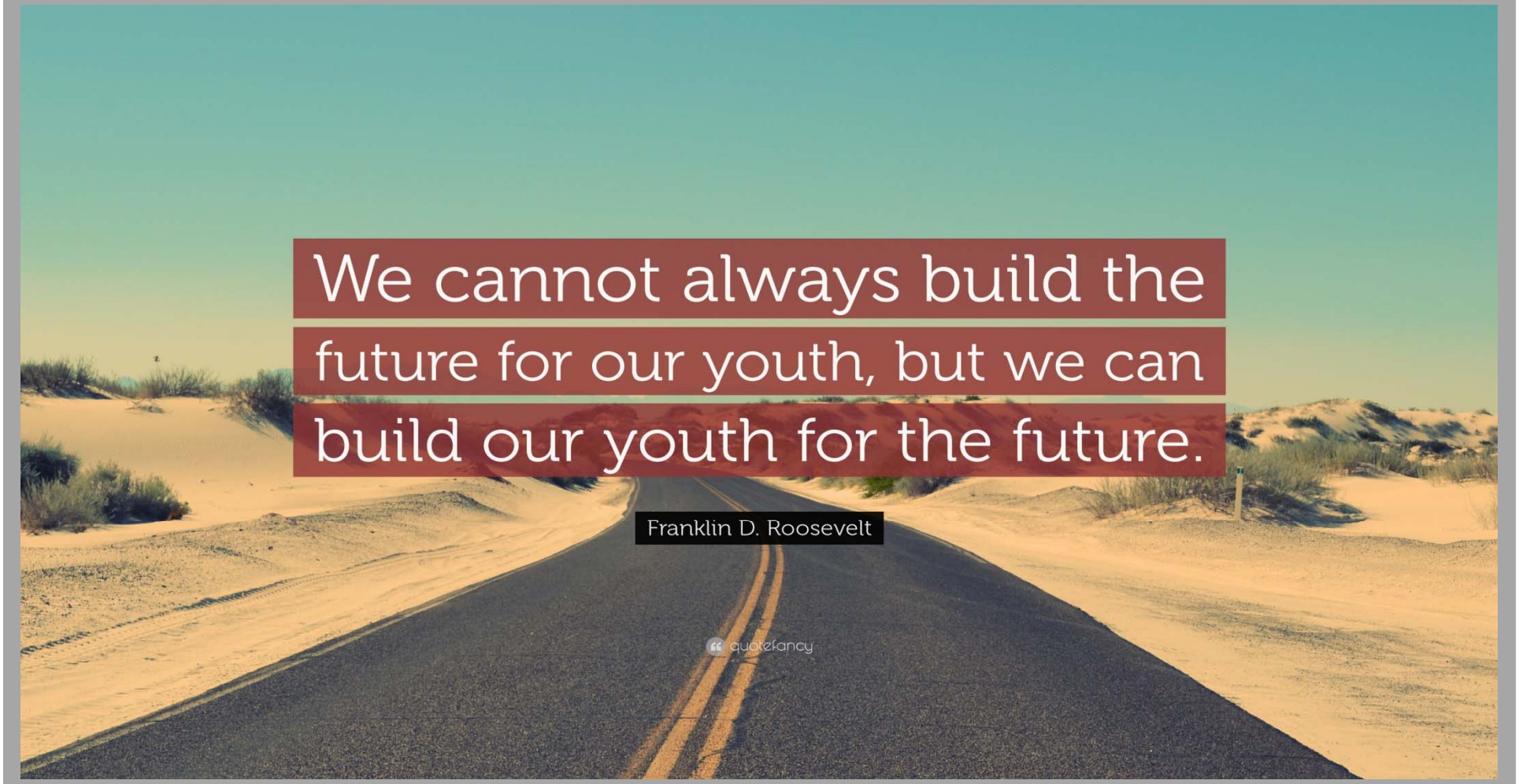


Review of End Users Comments

NOV – 1841 to 2017 (176 Years and counting)



Thank you

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