



OGP Materials Standardisation Workshop, London 7-8.02.07

Company presentation by Hydro

Ragnar Mollan
Hydro Oil & Gas
2007-02-07

Presentation content

- **Brief information about Hydro**
- **Strategy for work with standards and inhouse company specifications in Hydro.**
- **Existing codes and main standards used by Hydro and the inhouse company and projects materials specifications.**
- **Proposals for future harmonisation and/or international standards work**

Brief information about Hydro

- **Two main business areas:**
 - Oil & Energy
 - Aluminium
- **Number of employees:**
 - Total Hydro: Approx. 33.000.
 - Hydro Oil & Gas: Approx. 5.000.
- **Oil production:**
 - Own: Approx. 550.000 boe/d.
 - Operate: Close to 1 million boe/d.
- **Strong position on the Norwegian Continental Shelf.**
- **Increased international business – operations in more than six countries.**
- **Plans to merge Hydro Oil & Energy and Statoil in 2007.**

A large offshore operator



- Hydro operates 1 million boe a day
- 30 % of Norwegian oil production
- 15 installations on Norwegian Shelf
 - 10 platforms, four subsea installations, one terminal

Oil and gas activities throughout the world



Vision

- **Hydro's technical requirements will be based on ISO, IEC and other internationally recognized standards.**
- **Amount of requirements contained in Hydro's own specifications will be limited.**

Strategy

- **Hydro will actively contribute to the development, maintenance and use of relevant set of ISO, IEC and other internationally recognized standards for effective execution and operation of the company's national and international tasks.**
- **Specifically Hydro will work actively for:**
 - Focusing on and participation in international standards work to influence it to develop standards that also reflects Hydro's needs.
 - Delete Norsok standards where international standards covers the main requirements and transfer the remaining Norsok standards to formal "Norsk" Standard.
 - Stop development of new Norsok standards.

Hydro material specifications

- **The total list of Hydro material specifications for Oil&Energy projects:**

▼ Materials		
NHT-R51-00002 03M	Materials for submarine pipeline systems	DNV OS-F101
NHT-R51-00016 03M	Welding and NDT of submarine pipeline systems	DNV OS-F101
NHT-R51-00043 02M	Concrete coating for submarine pipelines	
NHT-R51-00045 02M	Insulation and corrosion protection of submarine pipeline systems	DNV RP-F106
NHT-R51-00047 01M	Material specifications for pressure equipment based on EN-standards	NORSOK M-630
NHT-R51-00048 01M	Pipeline Field Joint Coating and Field Repair of Linepipe Coating	DNV RP-F102
NHT-R51-00049 01M	Cathodic protection design for carbon steel subsea pipelines	ISO 15589-2

- **Having few specifications has been possible because Hydro has given priority to standardisation work, NORSOK, DNV and ISO.**
- **Most specifications cover materials and corrosion protection of pipelines/flowlines, based upon DNV rules.**
- **Propose to share Hydro specifications with others at password protected OGP website.**

Background for Norsok standards

- **When Hydro started to develop Oil&Gas fields in Norway in the beginning of the 80ies, it was common in the industry to use company and project specifications.**
- **In 1993 it was decided to change this practice in Norway and the Statoil, Hydro and Saga Petroleum company specifications were scrutinized and formed the basis for the Norsok standards.**
- **The Norsok standards are available on the Internet and are used in many countries outside Norway on a voluntary basis. (Address: <http://www.standard.no/imaker.exe?id=535>)**

Experience with Norsok material standards

- **The Norsok Materials standards have been well received, and have since they were issued been maintained and revised by working groups with representatives from the contractors, suppliers, authorities and the oil companies.**
- **By being active in the Norsok standard working groups the Hydro requirements have been well taken care of and there has been need for very few Hydro company specifications.**
- **The working groups are arenas for experience exchange, and the agreements made are implemented by the participating contractors and suppliers enabling use of less resources in realization projects.**
- **The way the Norsok material standards have functioned in Norway have demonstrated some learning points of importance for international standardisation :**
 - In order to maximize the benefits of standardization, standards should be used without modification wherever possible.
 - Company specifications should be minimised and written, where possible, as functional requirements.
 - Accordingly the ambition level for international standardisation work should be that most of the requirements needed should be covered by the standards. As a minimum the standards should have options that are “informative” and that easily can be made “normative” by the user.

List of Norsok Materials standards

NORSOK STANDARDS

- M-001 Materials selection (Rev. 4, August 2004)
- M-101 Structural steel fabrication (Rev. 4, Dec. 2000)
- M-102 Structural aluminium fabrication (Rev. 1, Sept. 1997)
- M-120 Material data sheets for structural steel (Rev. 4, June 2004)
- M-121 Aluminium structural material (Rev. 1, Sept. 1997)
- M-122 Cast structural steel (Rev. 1, June 2003)
- M-123 Forged structural steel (Rev. 1, June 2003)
- M-501 Surface preparation and protective coating (Rev. 5, June 2004)
- M-503 Cathodic protection (Rev. 2, Sept. 1997)
- M-506 CO2 corrosion rate calculation model (Rev. 2, June 2005)
- M-601 Welding and inspection of piping (Rev. 4, July 2004)
- M-622 Fabrication and installation of GRP piping systems (Rev 1 April 2005)
- M-630 Material data sheets for piping (Rev. 4, January 2004)
- M-650 Qualification of manufacturers of special materials (Rev. 3, April 2004)
- M-710 Qualification of non-metallic sealing materials and ..., (Rev. 2, Oct. 2001)

WORKING PROGRAMME (planned publication date):

Revised: M-503 Cathodic protection (4th quarter 2006)

For voting / comments: M-503 Cathodic protection (Draft for Edition 3, September 2006)

Hydros interests in international standardization

- Hydro is an international company in an international industry which uses international and national contractors/suppliers and partners in many national regimes.
- International standards and commonly recognized common norms will therefore be essential for much of our work.
- Maximum business results can be obtained when all are using the same industry standards.

This is valid for all our business areas.



“Internationalization” of NOROK standards

- **Since the NOROK standards were issued in 1993/94 it was planned to start work to implement the NOROK standards in international standards, preferably ISO. This has been done to some extent. (ISO 19902 Steel structures, EN 10225 Structural steels.)**
- **The NOROK material standards function well in Norway, but Hydro has not considered them to be suitable for use in contracts for projects outside Norway. This to a large extent because standards function best when they are known to the contractors/suppliers on beforehand. (Predictability)**

Design/Material requirements – Subsea Standardization activity last 2 years

- **Work initiated due to several costly failures the last years. An activity to define necessary additional requirements to existing ISO (and NORSOK) standards for subsea production systems.**
- **Piping systems in subsea production systems given focus.**
 - Design code selection: ASME B 31.8 most suitable.
 - Avoiding Hydrogen Induced Stress Cracking (HISC) was key issue.
- **Companies participating in initial work in Norway:**
(Piping and Materials, Five working groups.)
Kvaerner Oilfield Products, Vetco Aibel, FMC, DNV, Petroleum Safety Authority, Statoil and Hydro.
- **Partly from this work, and partly from an international JIP, the following guidelines for avoiding Hydrogen Induced Stress Cracking (HISC) have been developed. (Both available on Internet)**
 - Draft DNV RP F-112 Design of Duplex Stainless Steel Subsea Equipment exposed to Cathodic Protection.
<http://www.dnv.com/technologyservices/qualinno/services/technicalstandards.asp>
 - M-WA-01 Design guideline to avoid hydrogen induced stress cracking in subsea duplex stainless steels (Rev. 1, October 2005) (NORSOK)
<http://www.standard.no/imaker.exe?id=11090>

Design/Material requirements – Subsea Standardization activity last 2 years, cont.

- **In a task group to API/SC17 and ISO/TC67/SC4/WG6 suitable material requirements to the ISO 13628-1 standard have been developed.**
- **API identical adopt-back issued as API Spec 17/ISO 13628-1.**
- **Proposed amendments to ISO 13628 Petroleum and natural gas industries — Design and operation of subsea production systems — Part 1: General requirements and recommendations.**
Draft Amendment to ISO 13628-1 consisting of two parts:
 - A new Clause 6 of ISO 13628-1, "Materials and corrosion protection", and
 - A new Annex L, "Materials and welding of manifolds and flow loops".
- **Schedule:**
 - Kick-off meeting April 2005,
 - Technical part completed by June 2006.
 - Editorial work completed October 2006,
 - Documents sent for balloting together with a New Work Item Proposal in November 2006. (Requirement for NWIP overlooked.)

This shows that standards can be developed in a short timeframe if suitable base documents are available, and a dedicated group is working.

ISO standards – Improvement of material requirements

- **Hydro would like to work for development of ISO standards that could cover our needs in a similar way as the Norsok standards have done in Norway.**
- **Even though the Norwegian community is very satisfied with the Norsok materials standards, better documents can be developed by bringing in more experience, and raising the standards to an ISO level.**
- **This has been clearly demonstrated in the work with development of the Amendments to ISO 13628-1.**

ISO standards – Improvement of material requirements, cont.

- **For Hydro first priority is to develop a new standard for Materials Selection, based upon Norsok M-001 and other similar documents.**
- **Other areas that could be candidate areas for international standardisation are:**
 1. Piping:
Common requirements in the form of standardised selection of options/supplements in ASME/ASTM standards, and some additional requirements. (Norsok M-601, M-630.)
 2. Structural steel:
Requirements to critical components made from forgings and castings. (M-122, M-123.)
 3. Qualification of non-metallic sealing materials.
(M-710. MERL proposal to run JIP to make ISO standard.)
 4. Fabrication and installation of GRP piping.
(M-622. Revise ISO 14692.)

Hydro is a Fortune 500 energy and aluminium supplier with 33,000 employees in 40 countries. We are a leading offshore producer of oil and gas, the world's third largest aluminium supplier and a leader in the development of renewable energy sources. Our mission is to strengthen the viability of the customers and communities we serve.

www.hydro.com

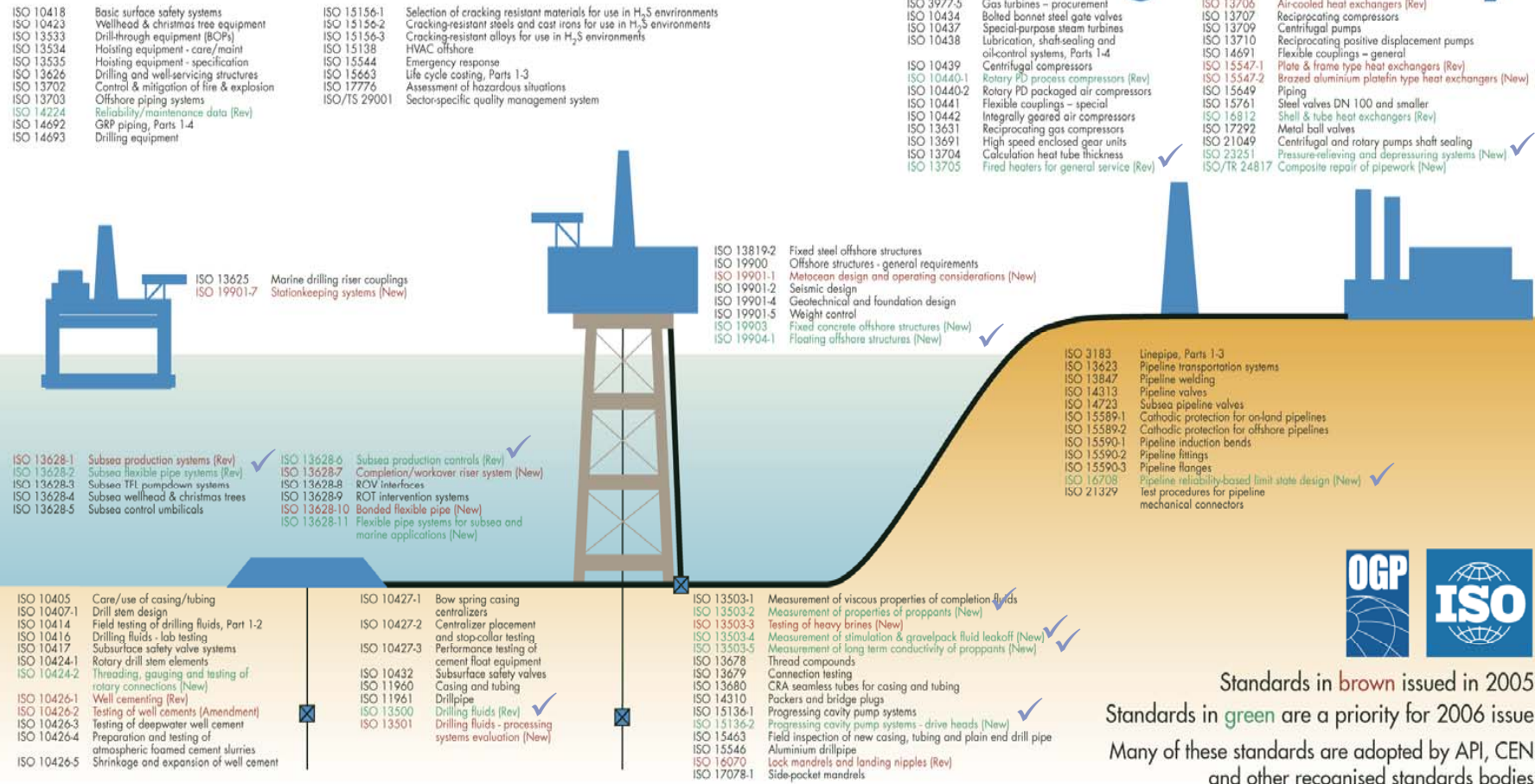


HYDRO

Progress of a different nature

Back-up slides

ISO Standards for use in the oil & gas industry



Standards in brown issued in 2005
 Standards in green are a priority for 2006 issue
 Many of these standards are adopted by API, CEN and other recognised standards bodies

- ISO TC67 has published 143 standards.
- API has adopted 49 of these as joint API / ISO standards.
- CEN has adopted 100 of these as joint European EN ISO standards.
- Materials issues normally included in equipment standards



GLOBAL STANDARDS USED LOCALLY WORLDWIDE

ISO – CEN – API (rev 7)

ISO TC67	EN	API	TITLE
ISO 14693 : 2003	EN ISO 14693 : 2003	API Spec 7K 4th edition	P&NGI – Drilling and well services equipment
ISO 14723 : 2001	EN ISO 14723 : 2001		P&NGI - Pipeline Transportation Systems - Subsea pipeline valves
ISO 15136-1: 2001	EN ISO 15136-1: 2001		Downhole equipment for petroleum and natural gas industries - Progressing cavity pumps systems for artificial lift - Part 1 : Pumps
ISO 15138 : 2000 (in revision)	EN ISO 15138 : 2000 (in revision - WI 178)		P&NGI –Offshore production installations - Heating, ventilation and air-conditioning
ISO 15156-1 : 2001	EN ISO 15156-1 : 2001	NACE MR 0175	P&NGI - Materials for use in H2S containing environments in oil and gas production - Part 1: General principles for selection of cracking-resistant materials
ISO 15156-2 : 2003	EN ISO 15156-2 : 2003	NACE MR 0175	P&NGI – Materials for use in H2S containing environments in oil and gas production – Part 2 : Cracking resistant carbon and low alloy steels, and the use of cast irons.
ISO 15156-3 : 2003	EN ISO 15156-3 : 2003	NACE MR 0175	P&NGI – Materials for use in H2S containing environments in oil and gas production – Part 3 : Cracking resistant CRAs (corrosion-resistant-alloys and other alloys.

ISO 13628-1 : 2005	EN ISO 13628-1 : 2005	API RP 17A 3 rd edition	P&NGI - Design and operation of subsea production systems - Part 1 : General requirements and recommendations
ISO 13628-2 : 2000 (in revision)	EN ISO 13628-2 : 2000 (in revision - WI 159)		P&NGI - Design and operation of subsea production systems - Part 2: Flexible pipe systems for subsea and marine applications
ISO 13628-3 : 2000	EN ISO 13628-3 : 2000	API RP 17C 2 nd edition	P&NGI - Design and operation of subsea production systems - Part 3: Through flowline (TFL) systems
ISO 13628-4 : 1999 (in revision)	EN ISO 13628-4 : 1999 (in revision - WI 160)		P&NGI - Design and operation of subsea production systems - Part 4 : Subsea wellhead and tree equipment
ISO 13628-5 : 2002		API Spec 17E 3 rd edition	P&NGI - Design and operation of subsea production systems - Part 5: subsea control umbilicals
ISO 13628-6 : 2000 (in revision)	(Wi 145)	API Spec 17F 1 st edition	P&NGI - Design and operation of subsea production systems - Part 6: Subsea production control systems
ISO 13628-8 : 2002		API RP 17H 1 st edition	P&NGI - Design and operation of subsea production systems - Part 8: Remotely operated vehicle (ROV) interfaces on subsea production systems.
ISO 13628-9 : 2000		API RP 17M 1 st edition	P&NGI - Design and operation of subsea production systems - Part 9: Remotely operated tool (ROT) intervention systems.