The oil and gas industry sees International Standards as a cost-effective and technically rational solution

An interview with Graham Thomas, *BP Amoco,* and Peter Critchley, independent rotating machinery consultant [1)]

One sector where standardization activity has started to surge is the oil and gas industry *(see p. 2)**. New standards have been introduced in this industry, which should make it more competitive. Engineering initiatives in the development cycle mean that the next generation of gas turbines will see the use of recuperators, intercoolers, humidified cycles, lean premix combustors, catalytic combustors, brush seals and new compressor blade profiles, all of which will advance gas turbine application. Three technical areas in particular – cooling system design, materials development and thermal barrier coatings – have experienced significant advances that will permit the firing temperatures necessary to reach the latest specifications for efficiency. The US Department of Energy advanced turbine (ATS) programme is expected to demonstrate pre-commercial examples of the new-generation gas turbines before the end of the year 2000. Those rated at* 20MW *and below, including those in use in the offshore oil industry, will have a 15 % improvement in simple-cycle efficiency. Meanwhile, against a background of continuing technical improvement, operators are seeking new standards of implementation and operation to match the improvements in design capability.*

1) from an article "International Hydrocarbon 2000" that appeared in *International Hydrocarbon*, published by Sterling Publications, London, United Kingdom. Reproduced by kind permission.

Keeping down the costs of operation of oil fields

Since the industry-wide initiative in the United Kingdom North Sea fields began in 1993, the Cost Reduction Initiative in the New Era (CRINE) programme has sought to reduce costs. The North Sea fields were very expensive to operate, and recent further falls in oil prices have shown the initiative was necessary and timely.

With support from operators, regulators and government, CRINE sought to bring to an end the era of adversarial contracts and replace it with alliances and partnerships to share the risks and rewards of oil and gas field developments. The move towards downsizing gave added impetus to the CRINE programme.

From the beginning it was recognized that detailed specifications frequently contained preferential engineering and prescriptive requirements for non-standard items. If off-the-shelf alternatives could be supplied by pre-qualified suppliers instead, everyone in production in the North Sea could benefit.

Graham Thomas of BP Amoco is the chairman of the BSI (British Standards Institution, ISO member for the United Kingdom) committee for the oil and gas industry committee for materials and equipment, PSE/17. He says: "We are part of an international initiative to develop more than 100 ISO Standards for the oil and gas industry, most, if not all of which, will become British Standards. Many of these will support the CRINE goals for UK industry to be competitive worldwide."

CRINE produced some 25 functional specifications for major equipment packages for North Sea platforms. Among these principal equipment packages is that for main power generation which is driven by gas turbines.

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Gas turbines represent a cost-effective solution

Gas turbines have been adopted in place of diesel generation systems on significant numbers of platforms because they can be locally powered, and since 70 % of operational costs are in fuel, they can be very cost-effective on a platform where the gas supply comes at well-head prices.

In larger installations, gas turbines provide not only electricity, but also compression for delivery pressures. Lightweight, self-fuelled gas turbines are well suited to such tasks. The only operational constraints are on efficiency, given that there is no combined cycle efficiency gain and so technical developments in turbine design may turn out to be of direct benefit on production platforms.

Gas turbines are brought to market with a range of manufacturer and design variables. As a result, standards developing within the industry relate to manufacture and to application and installation, or what is called in the USA 'terms of delivery'.

Says Thomas: "The functional specification for main power generation came into the CRINE programme early, as the pathfinder, to be the model for the remainder of the programme. The objective was to use industry standard equipment, as represented by International Standards. At that time, the American Petroleum Institute (API) standards were, and still are, generally used in the oil industry. However, in 1989, a key set of API standards was offered to ISO to become ISO Standards, prompted in part by the European Commission initiatives for the Single Market that included a requirement for European Standards for the oil and gas industry. Our industry unanimously took the view that unfamiliar standards would not be of benefit.

"To that end, my committee provided UK input for work towards establishing international industry standards, working with ISO/TC 67, *Materials, Equipment and Offshore Structures for the Petroleum and Natural Gas Industries* which was reactivated in 1989, and is managed by API. Within that structure, API Standard 616 and API Specification 11PGT were offered to ISO. ISO committee TC 192, *Gas Turbines,* assumed the responsibility for developing this standard in ISO."

Developing a set of international industry standards

What is emerging is the ISO 3977, *Gas turbines — Procurement* — Part 1: *General introduction and definitions*, a multi-part standard of which Part 3 (design) is generic to all turbines and Part 5 (applications) is specific to the offshore oil and gas industry. This route was seen as a cost-effective method for developing a set of international industry standards. The various parts of ISO 3977[1)] are currently published as draft International Standards (DIS).

ISO 3977 owes much to the ASME 133 series on gas turbines, as well as to the API 616 and API 11PGT documents. Common requirements from oil industry users and manufacturers have also been included. All these had to be incorporated in some way if companies were going to be able to specify an established common base that would add value to the industry.

> "The API series has always been global in the sense that US companies have always operated globally, but 'global standards' are not necessarily the same as 'international standards'. Now the world is working together on a single set of standards."

CRINE has provided some funding to assist with drafting the international standard ISO 3977, via the BSI committee, PSE/17. This aims to improve the application standards specifically for gas turbines offshore, and the CRINE functional specification is intended to be revised to be based on ISO 3977 when published.

The work in ISO/TC 67 includes standards throughout the whole oil and gas industry. It will result in ISO Standards for drilling pipe and drilling fluids for subsea equipment and operations derived from API 17 series, as well as Norwegian standards for topsides equipment and platform safety systems, pipelines and refinery equipment.

> "When every turbine is a special build, every turbine is a prototype."

Thomas continues: "Offshore structures design and operation is another major field. Common International Standards for all offshore structures, whether steel, concrete or floating, fixed and mobile, is the aim. The initial drive for this came from Europe, but the process now includes such participants as Russia and China, both of whose industries have been working with us.

"The API series has always been global in the sense that US companies have always operated globally, but 'global standards' are not necessarily the same as 'international standards'. Now the world is working together on a single set of standards. In practice this tends to mean the USA and European countries, with countries such as Russia, China and Japan focusing on particular areas of interest, such as steel pipe. The rest of the world tends to adopt these standards by following the lead of Europe and the USA. The vision of ISO/TC 67 is 'global standards used locally worldwide'.

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"The initial work was on creating the framework for cooperation and in communicating the organization structure and requirements of ISO. We are now working on the standards themselves. This latter stage has gone on in earnest for the last three to four years. ISO/TC 67 published one standard in 1998; the target this year is 20, with 30 in the year 2000.

"Our last meeting to review progress shows we have published five standards already this year with seven more to come. There will be 32 in the year 2000 (including ISO 3977) and 13 in the first quarter of 2001.

"Over the first six months of this two-year programme, that means the industry's committee work may have slipped by just one month, which is a high level of performance given the magnitude of the task."

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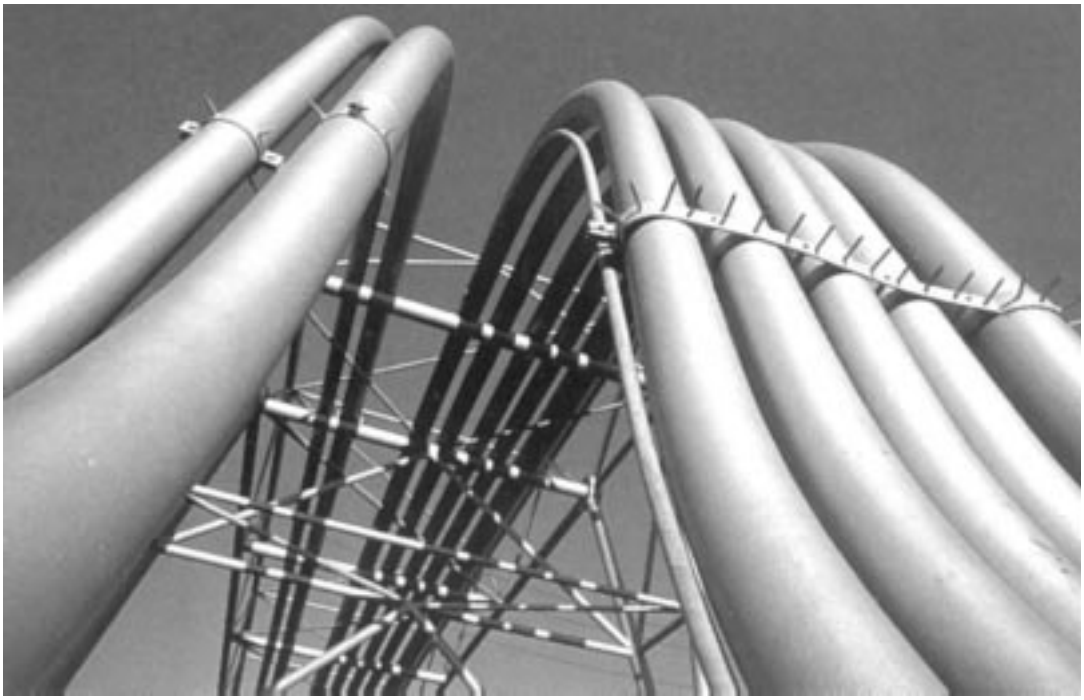
In the second quarter of 2001, the oil and gas industry will have a credible set of industry standards. The Offshore Technology Conference in May 2001 will see the start of a major publicity drive to communicate to industry the value of the standards publication. The TC 67 will start to fulfil its mission: "to create value-added standards for the oil and natural gas industry".

Solving problems with a single international standard on general industrial applications to oil and gas industry

Rotating machinery consultant Peter Critchley formerly worked for BP and now works as an independent consultant. He is a member of the TC 192, *Gas turbines*, joint working group WG 4 for ISO 3977, *Gas*

1) ISO 3977 consists of the following: ***Developed***: ISO 3977-1:*1997 Gas turbines – Procurement* – Part 1: *General introduction and definitions*; Part 2: *Standard reference conditions and ratings.* ***In preparation***: ISO/DIS 3977-*3 Gas turbines – Procurement* – Part 3*: Design requirements*; Part 4: *Fuels and environment*; Part 5: *Gas turbine applications*; Part 6: *Combined cycles*; Part 7: *Technical information*; Part 8: *Inspection testing, installation and commissioning*; Part 9: *Reliability, availability, maintainability and safety.*



TC 67 proposes ISO standards for the oil and gas industry across the board, including vessels, piping, materials and other such commodities through to well-head installations.

Turbine 2). He says: "ISO 3977 went forward to ISO for adoption in late 1999. Covering gas turbines from 2MW to 250MW, including combined cycle turbines too, the outcome will be a single international standard in seven parts which applies to general industrial applications and to oil and gas industry applications.

Funded by CRINE, the objective has been to drive out costs by allowing the procurement of standard items. In the early and mid-1980s, turbines for oil and gas offshore operations were all bespoke items.

When every turbine is a special build, every turbine is a prototype. Each requires a large amount of engineering input, components may be one-off items, there are long supply chains, quality assurance is time-consuming and all these elements add to the cost without adding value.

CRINE arose out of just those sorts of problems. With standard packages the cost of a new turbine can be reduced by up to 40 %. Manufacturers benefit too from standardized designs, gaining scale of production advantages and reduced design and engineering costs.

Critchley continues: "What we expect is that gas turbines will become 80 % standard with 20 % of engineered options at the discretion of the user. But what we hope is that the pre-engineered 80 % will be sufficient to minimize the need for options.

"The standard has already gone forward as a DIS. Comments are being incorporated and finalized from our committee meeting in Frankfurt in October 1999, after which ISO 3977 will go forward for adoption by ISO.

"Its importance is that for the first time there will be a single international standard for industrial gas turbines in all applications. Our joint working group within TC 192, which includes representation from the manufacturers and users from a whole spectrum of industry, combined forces to examine existing standards and from them produce unified international standards."

"The joint working group WG 4 (from TC 192 and TC 67) accepted early on the principle of basing ISO on the US standard, API 11PGT. Based on that, we worked closely with manufacturers and users to ensure the outcome was acceptable to all members.

"Part 5 of the standard consists of specific gas turbine applications for the oil and gas industry. At first the clauses there were not self-evidently sufficient or explanatory. So we looked at ISO 3977 Part 4, API 616 and API 11PGT. We examined all clauses against ISO 3977 and produced a shortlist of additional requirements which were incorporated to produce a standard applicable to industry at large as well as to oil and gas. Members have been involved in workshops every three to four months in the period leading up to the draft we finalized at Indianapolis earlier this year."

Standards apply to all manufacturers as generic and voluntary (except where legislation is involved as, for example, with pressure vessels). There is no legislation currently applicable to gas turbines.

TC 67 proposes ISO standards for the oil and gas industry across the board, including vessels, piping, materials and other such commodities through to well-head installations. It also overlaps with other areas of application currently subject to existing API standards for gas turbines. European requirements are generally framed within the procurement directive.

ISO 3977 will be adopted into Europe for the oil and gas industry. There was a danger of duplication of ISO standards, one for oil and gas, one for other applications. This danger will be removed with the adoption of ISO 3977.

Critchley concludes: "Once in place, our expectation is that the new standard for gas turbines will lead to proven, standardized and thus less costly manufacturing which in turn will lead to lower costs for operators as installation, commissioning and operation become matters of routine." □

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