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ISO 19906 ANNEX B – DESCRIPTION AND USE

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ABSTRACT

In 2002, the International Standards Organisation (ISO) approved the development of a Standard for Arctic Offshore Structures under Technical Committee 67 (TC67), Sub-Committee 7 (SC7 - Offshore Structures). Working Group 8 (WG8), formed to organize the development of the Standard, established 14 Technical Panels to actually write the Standard. TP1 (Environment) was tasked with describing the general ice and metocean environment and developing regional descriptions for the ice covered areas to which the standard would be applied. TP2c (Metocean) was tasked with providing meteorological and oceanographic input as required for the regions.

TP1 included representatives of all the countries that border the Arctic Ocean or have ice-covered waters with oil and gas operations as well as experts from countries such as The Netherlands and the UK which do not fit this description. TP1 soon ran into the problem of obtaining sufficient data to adequately describe the environment in many of the regions, much less attempting to define data of a sufficient quantity and quality to describe ice feature design events. This lack of data lead TP1 to the compromise of providing data in the form of indicative "average annual" values and a "range of annual" values. In providing this limited information, the intent was that the user of ISO 19906 would be made aware of the ice scenarios to be considered for the region and would consult with ice and metocean specialists to develop site specific physical environment design criteria. Even so, for many of the regions "no data" became the default description for ice features due to the lack of measured data.

TP1 members from the country in which the region was situated obtained ice parameter data - where this was available. Metocean data were provided by TP1 members and supplemented by TP2c (responsible for Metocean) as required. Excluding ice parameters, the reference source of Metocean data remains the ISO 19901-1 document; the relationship between ISO 19901-1 and 19906 is outlined in this paper.

Annex B of ISO 19906 provides this information for the 21 regions that are affected by ice-covered waters in the Northern Hemisphere.

This paper provides a description of Annex B preparation, the editing and review processes undertaken and the resulting Regional Descriptions.

INTRODUCTION

As discussed in Spring, et al (2011), TC67/SC7 approved the Canadian initiative to develop an Arctic Offshore Standard in 2002 and formed Work Group 8 (WG8) to perform the task. WG8 started this task by holding its first meeting in Toronto Canada in July 2002. At this and subsequent meetings, among items discussed was the formation of technical panels that would actually write the document. In addition to asking specific individuals to lead the Technical Panels, WG8 also asked leading experts from around the world to help staff the panels.

Technical Panel 1 (TP1) was formed to write the environment section and to develop descriptions of ice-covered areas that would provide information on the ice features that should be considered in the design of exploration and production facilities for the regions. They developed the environmental Normative and Informative sections of the Standard and in addition, developed regional descriptions which were incorporated into Annex B of ISO 19906 Arctic Offshore Structures. This paper discusses the philosophy developed to write these descriptions, their development and provides a brief description of them.

TP1 FORMATION

TP1 had its first meeting on 20 June, 2004 in St. Petersburg Russia and only held three subsequent meetings in conjunction with conferences and WG8 meetings. Due to the international nature of its members, and to limit travel, most of its activities were carried out by email. Panel members and their affiliation are shown in Table 1.

Table 1. TP1 membership and affiliation.

Name	Country	Affiliation
Walt Spring – TP Leader	USA	Bear Ice Technology
Yevgeny Mironov – TP Deputy Leader	Russia	Arctic and Antarctic Research Institute (AARI)
Karl-Ulrick Evers	Germany	Hamburgische Schiffbau-Versuchsanstalt (HSVA)
Knut Høyland	Norway	University of Norway in Svalbard (UNIS)
Mauri Määttänen	Finland	Helsinki University of Technology (HUT)
Anatoly Polomoshov	Russia	SakhalinMorNefteGaz (SMNG)
Orson Smith	USA	University of Alaska – Anchorage
Garry Timco	Canada	National Research Council of Canada – Canadian Hydraulic Center
Peter Wadhams	UK	University of Cambridge, UK
Qianjin Yue	China	Dalian University

PHILOSOPHY IN DEVELOPING THE DESCRIPTIONS

Before starting to prepare the document, several issues were discussed and addressed regarding what to put in the regional descriptions and what not to put in. The topics included the following items;

Parameter distributions

Providing parameter distributions for ice features, such as a sail height, consolidated layer thickness and rubble keel depth for a first-year ridge (see Figure 1) was first discussed. It soon became apparent that the Panel did not have the resources (manpower or funding) to develop these parameter distributions from data in the open literature. Data available to research institutions or oil companies was also not made readily available due to either monetary considerations (the data still had value) or legal considerations (the data was tied up by legal restrictions and could not be shared). For some regions, there was little or no data available and it was going to be difficult to provide any information on certain parameters much less a parameter distribution. Finally, even when the data are available, it is still a significant effort to provide parameter distributions that are anything but indicative.

Based upon these considerations, the Panel decided not to provide individual parameter distributions. As site-specific data collection efforts are always necessary, this is not considered to be a significant deficiency.

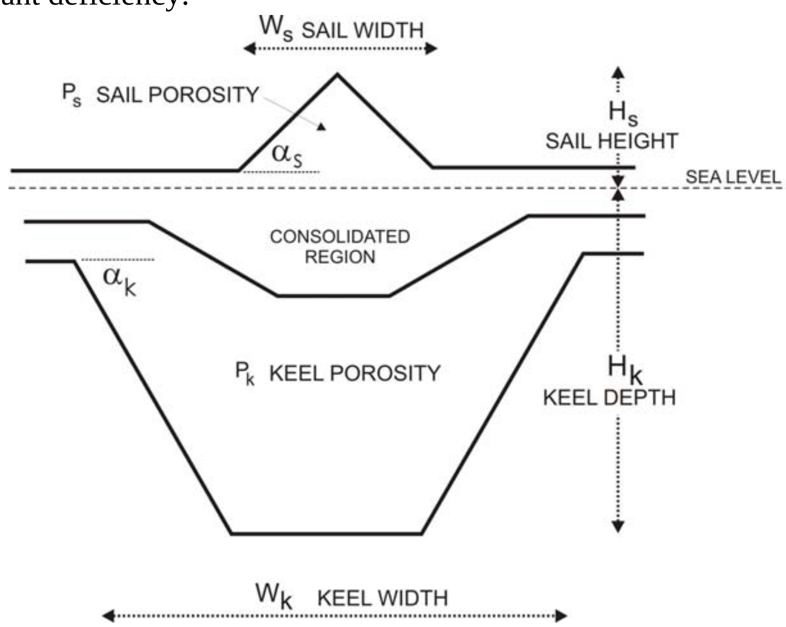

Figure 1. Illustration of the definition of the key properties of first year ridges (after Timco and Burden 1997).

Return period parameter values

The need for extreme return period estimates of various parameters was discussed. Generally to provide reasonable estimates of these parameters, measured data for a number of years should be obtained or hindcast for each parameter. As data on many parameters were not available for all regions that were to be considered, and in some cases when available were of too short a time period, any estimates that could be provided could have been in error.

Also providing a return period ice feature would not necessarily help the engineer correctly design a platform. Providing a 100 year return period ridge total ice thickness would not help the engineer perform a probabilistic design (which is what the code was going to recommend) as he or she really needs distributions for sail height, consolidated layer thickness and rubble thickness.

Providing 100 year return period values for each of the parameters would imply up to a 10^6 return period event as the parameters are not truly independent. Providing lower return period parameters (say a 10 year return period sail height, consolidated layer and rubble keel) would still imply up to a 10^3 return period event. Providing even lower combinations of these parameters (say a 1 year sail, a 20 year consolidated layer and a 5 year rubble keel) would soon lead to speculation on our part of which parameter was going to govern the platform design.

To eliminate this concern, it was agreed to provide only an estimated annual mean value and a range of annual estimates not tied to any return period.

Use of experts

An issue that was discussed many times was how to include the fact that the Annex was not going to provide "design" parameters as many without, and even some with, Arctic expertise were hoping for. To them, a "cookbook" was what they wanted and the "cookbook" should list all the ingredients required, therefore "design" parameters should be included. Unfortunately a "cookbook" was exactly what TP1 did not want to (and could not) provide as designing an Arctic platform was more complicated than something that could be designed by a "cookbook". To ensure that the intent was clear, the following sentence was added to the Introduction of the Annex;

"Appropriate specialists should be consulted in the determination of parameters relating to the physical environment for use in the design of offshore facilities."

As the development of metocean and ice data for use in permitting and facility design are some of the first issues addressed in any exploration and development efforts, the inclusion of appropriate specialists at the onset is highly recommended.

This philosophy of recommending the use of specialists is the same as was adopted in 19901-1 Metocean; given that the values presented are indicative only, and no detailed guidance is provided on the best approach to derive one's only values.

Ice parameter selection

A general ice parameter list, shown in Table 2, was agreed upon that included significant ice features found in all regions. The main ice types (level ice, first year, multiyear, ridges, rubble fields and icebergs) would be included, but specific subsets (such as landfast ice) would be excluded. General information on these parameters (such as ridge sail height and keel depth) would be provided, but some details (such as consolidated layer thickness) would not be included due to insufficient data on these parameters in most areas. Ice movement was also to be included for both the nearshore and offshore areas. Frequency of occurrence (such as number of ridges per km or per km^2) was a parameter that was highly desirable to be included, but again sufficient data to make realistic estimates in most areas was found lacking.

If a parameter is not found in the region (say icebergs in the Bering Sea), it would be deleted from the list to ensure the reader realizes it is not found in the region.

In addition to the information on ice parameters provided in the table, a written description of the ice environment was included for each region.

Metocean parameters
The inclusion of meteorological and oceanographic parameters in the regional descriptions was highly desirable and TP2c - Metocean (chaired by C.J. Shaw) was contacted and asked to provide the appropriate parameters. Table 3 provides a list of the metocean parameters that are included in Annex B for each region. Again the list is very basic and generally provides an estimate of the severity of the Metocean environment and requires the reader to contact experts in the field to provide design level parameters.

Table 2. General ice parameters included in Annex B

Sea Ice	
Occurrence	First Ice
	Last Ice
Level Ice (First Year)	Landfast Ice Thickness (m)
	Floe Thickness (m)
Rafted Ice	Rafted Ice Thickness (m)
Rubble Fields	Sail Height (m)
	Length (m)
Ridges (First Year)	Sail Height (m)
	Keel Depth (m)
Level Ice (Second and Multi- Year)	Floe Thickness (m)
Ridges (Second and Multi- Year)	Sail Height (m)
	Keel Depth (m)
Rubble Fields (second and Multi-year)	Average Sail Height (m)
	Length (m)
Ice Movement	Speed in Nearshore (m/s)
	Speed in Offshore (m/s)
Icebergs	
Size	Mass (tonnes)
Frequency	Months Present
	Number per Year
	Maximum Number per Month (# / month)

Again, the level of information required to define even the parameters in Table 3 is surprisingly poor in many of the regions, mainly because these are still frontier areas that have not yet attracted the attention of the offshore industry. It should be remembered that the data reviewed for this Annex are “public data” and that data held under proprietary restrictions, or by the Navy of the region in question, may be more voluminous in nature. Where there is industry activity (say the Gulf of Mexico, the North Sea or West Africa), industry has funded the development of hindcast models which have enabled us to derive reliable estimates of extreme Metocean parameters such as ‘hundred year’ wave heights and wind speeds. The development of these models requires significant time, funding and commitment as well as the basic data to use as input for the models. For ice-affected areas, the problem is exacerbated by the uncertainty surrounding the ice conditions which in turn affects the fetch and hence the wave conditions and the combination of wave and ice conditions.

In due time, many of these frontier areas will no doubt attract the effort required to develop more reliable metocean and ice parameters to assist the offshore industry. In the meantime, the reader is referred to ISO 19901-1 for more reliable metocean parameters for areas which have been adequately studied. In due course, it is the intention that 19901-1 will be expanded to include these frontier areas.

For now, ISO 19906 contains a general meteorological and oceanographic description for each region.

Table 3. General meteorological and oceanographic parameters included in Annex B

Meteorological	
Air Temperature	Annual Maximum (°C)
	Annual Minimum (°C)
	Freezing Degree Days
Wind Speed @ 10 m elevation	10 Minute Average (m/s)
Wind Direction	Dominant Winter (Direction / % Occurrence)
	Dominant Summer (Direction / % Occurrence)
Precipitation	Annual Rainfall (mm)
	Annual Snowfall (mm)
Visibility (fog, snow, etc.)	Annual Number Days with Visibility < 5 miles
Oceanographic	
Waves - Offshore (> 100m Water Depth)	Significant Wave Height (m)
	Range of zero-crossing periods (sec)
Current	Near Surface Maximum Speed (cm/sec)
	Mid Layer Maximum Speed (cm/sec)
	Bottom Maximum Speed (cm/sec)
Tidal Current	Maximum Surface Speed (cm/sec)
Tide	Tidal Range (total) (m)
Wind Induced Surge	Water Depth Increase Range Total (m)
Water Salinity	Average Surface Salinity (ppt)
	Average Mid Layer Salinity (ppt)
Water Temperature	Summer Surface Maximum (°C)
	Summer Surface Average (°C)

General description parameters

A few general parameters were agreed upon that would describe the region. These include a latitude and longitude range that encompasses the region, the range of water depth found within the region and a winter and summer season length.

Ice gouge depth and seismic parameters were also included when available.

Area selection
As stated in Spring et al (2011), ISO 19906 covers all regions with either seasonal, or infrequent, ice-covered waters. The regions included under this guideline are shown in Table 4. A primary "author" was assigned to each region and it was expected that he would consult with other experts with information on the region to provide the write-up and input to the various tables.

Table 4. Regions included in Annex B. Also shown is the primary author responsible for the regional write-up.

Name	**Assigned to**
Baffin Bay and Davis Strait	Timco
Labrador	Timco
Newfoundland	Timco
Canadian Arctic Archipelago	Timco
Greenland	Wadhams
Beaufort Sea	Timco, Spring
Chukchi Sea	Mironov, Spring
Bering Sea	Spring
Cook Inlet	Spring
Okhotsk Sea	Polomoshnov/Verlaan
Tatar Strait	Polomoshnov
Bohai Sea	Yue
North Caspian Sea	Verlaan, Spring
Baltic Sea	Evers, Määttänen
Barents Sea	Mironov, Høyland
Kara Sea	Mironov
Laptev Sea	Mironov
East Siberian Sea	Mironov
Black Sea	Mironov
Sea of Azov	Mironov

Annex B Development
Work started on the Informative and Normative environment sections and on the regional descriptions after the July 2004 meeting. As anticipated, work on the regional descriptions was slow and lagged significantly behind completion of the Normative and Informative sections. A complete Committee Draft was finished by December 2007, but several regional descriptions were still incomplete or not even started. It was not until November 2008, with the completion of the Draft International Standard, that all the regional descriptions were available for review and because of this; it was not until the review of this draft that significant comments were received for action by TP1. These were acted upon and the Annex was available for country balloting with the Normative and informative sections.

The completed Annex has a large number of the tables containing the term "ND" for "No Data". While this is understandable for regions were there has been little activity, such as the East Siberian Sea, it is not explicable for regions such as the Baltic Sea. Some regions have had significant activity for many years and the “ND” is most likely a reflection of not getting access to the appropriate information in time for inclusion in the document.

It is not the intent of these regional descriptions to replace the need for an operator in the region to prepare a detailed physical environment design report prepared either by a qualified contractor or in-house specialists. However the information in the Annex can supply a basic overview of the ice conditions and knowledge in the region.

If a country believes that more detailed information (such as various return period parameters) on these physical parameters is required for the region, then it should be their initiative to obtain the required field data and analyze it to provide this information in the form of a Regional Annex.

Future actions

TP1 and TP2c will remain in place and as can be anticipated, future actions will be geared towards filling in the “ND” boxes in the various tables.

References

Timco, G.W. and Burden, R.P. 1997. An Analysis of the Shapes of Sea Ice Ridges. Cold Regions Science and Technology 25, pp 65-77.

Spring, W, D. Blanchet, R.F. McKenna, G.A.N. Thomas, 2011; ISO 19906: An international standard for Arctic Offshore Structures. Paper presented at the 21st International Conference on Port and Ocean Engineering under Arctic Conditions (POAC11), 10 – 14 July 2011, Houston, Texas.