

Standard Issues

Like making law and sausages, standards development is an important, but messy process.

Nancy Bartels

Standards are not unlike gears themselves: mundane, but complex, ubiquitous and absolutely vital. Standards are a *lingua franca*, providing a common language with reference points for evaluating product reliability and performance for manufacturers and users. The standards development process provides a scientific forum for discussion of product design, materials and applications, which can lead to product improvement. Standards can also be a powerful marketing tool for either penetrating

new markets or protecting established ones.

No wonder then that their development and publication is an important part of the work of major technical societies, including AGMA. AGMA's input into gear standards development here and overseas causes ripples that reach all the way to the floors of the tiniest gear shops.

Because of the globalization of manufacturing, interest in developing common international standards has grown. AGMA plays an important role in this development. In addition to developing

national standards, it serves as the secretariat for work on international gear standards. Working through ANSI, the American National Standards Institute, it is responsible for processing documents as they are developed. It also oversees and arranges the various committee meetings, organizes ballots, supervises editing, handles logistics, distributes reports of meetings, etc.

Fig. 1 shows the relationship of the various national standards bodies. In reality, the process of developing common standards is not nearly so tidy. Different company and national interests, various interpretations and understandings about what is important, differing personalities and agendas on the part of the delegates, all have to be factored into the equation.

An Ever-Receding Horizon

In truth, developing all universal gear standards may not be possible, at least in the foreseeable future. For example, until U.S. gear buyers accept metric units, if they ever do, two sets of measurements will be used.

AGMA continues to develop its own standards for use in the U.S. Its goal is to harmonize its standards with those of ISO, but at the same time, parallel development continues. At present, AGMA has standards regarding some issues that ISO does not cover. ISO's 18 standards

cover rating nomenclature, tooling and geometry, while AGMA's 58 standards also cover materials, enclosed drives, lubrication and other issues.

At the same time, AGMA closely evaluates ISO gear standards development and decides whether to incorporate its work into AGMA standards. It also sends delegates to ISO standards meetings to ensure that the U.S. has input into ISO standards development.

According to AGMA Technical Director, Bill Bradley, the goal of AGMA and ISO is to have good international standards that everyone can use. The approach to this goal is an incremental one. Standard by standard and meeting by meeting, AGMA and the other national standards-making organizations are working to bring their various standards closer and closer together.

Consensus by Compromise

According to Bradley, some of the issues that make international standards development an exercise in the fine art of compromise are the varying formulas used for determining gear performance and design, differences in understanding what these formulas mean and how they are to be implemented, differing national and company interests and different cultural expectations.

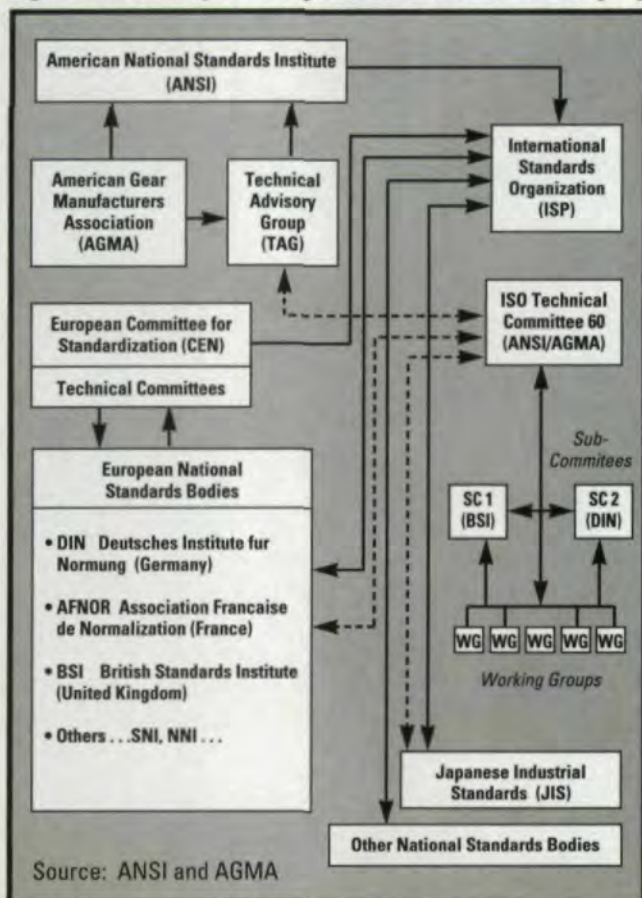


Fig. 1 — Framework for the development of international gear standards.

CURRENT AGMA STANDARDS PROJECTS

STANDARD/INFO SHEET	AGMA COMMITTEE	DOCUMENT NAME
903-AXX	7c	Scoring Design Guide—Aerospace Gears
912-AXX	3a	Mechanisms of Gear Tooth Failures
913-AXX	3a	Profile Shift (Addendum Modification)
916-DXX	3b	Fine-Pitch, On-Center Face Gears
917-BXX	3b	Design Manual; Parallel Shaft Fine-Pitch Gearing
920-AXX	3c	Plastic Gearing Materials
921-AXX	7g	Guide for Wind Turbine Drives
922-CXX	6e	Load Classification & Service Factors; Flex Couplings
923-AXX	5c	Gear Material Grade Specifications
924-AXX	5c	Metallurgical Practice for Ind. Carburized Gearing
925-AXX	5a	Lubrication Effects on Distress (Scuffing, etc.)
926-BXX	7c	Procedure for Carburized Aerospace Gears
927-AXX	5a	Gear Tooth Load Distribution Calculations
928-AXX	4b	Inspection Data Electronic Interchange Protocol
929-AXX	5b	Calculation for Bevel Gear Topland Tooth
930-AXX	3d	Load Capacity of Powder Metal Gears
931-AXX	4c	Calibration Alignment
1002-BXX	4a	Gear Cutting Tools, Fine- and Coarse-Pitch Hobs
1006-AXX	3c	Tooth Proportions for Plastic Gears
1106-AXX	3c	Metric Tooth Proportions for Plastic Gears
2003-BXX	5b	Rating Pitting Resistance & Bending Strength, Bevels
2009-AXX	4b	Classification & Inspection of Bevel Gears
2011-AXX	6a1	Wormgear Tolerance & Inspection Methods
2113-AXX	4c	Measuring Machine Calibration—Alignment
6001-DXX	5e	Design of Components of Enclosed Drives
6007-AXX	3c	Test Methods for Plastic Gears
6008-AXX	3d	Powder Metallurgy Gears
6009-AXX	6c	Gearmotor, Shaft Mount & Screw Conveyor Drives
6010-FXX	6b	Spur, Helical, Herringbone & Bevel Enclosed Drives
6011-HXX	7b	Specification for High-Speed Helical Gear Units
6025-DXX	4d	Vibration Enclosed Helical & Spiral Bevel Drives
6030-DXX	6a2	Design of Industrial Double-Enveloping Wormgears
6033-BXX	7a	Standard Marine Gear Units, Materials
6110-FXX	6b	Spur, Helical, Herringbone & Bevel Enclosed Drives
9001-BXX	6e	Lubrication for Flexible Couplings
9004-AXX	6e	Flexible Coupling Mass Properties
9008-BXX	6e	Dimensions for Gear Coupling Flanges
9009-DXX	6e	Nomenclature for Flexible Couplings
9102-AXX	6e	Metric Bores & Keyways for Flexible Couplings

Take the case of developing a formula for applying load to gear teeth as an example. There are a number of ways to do this. Which way should go into the standard? Should two or three ways be put in and let the user decide which to use, or should one be specified? If so, which one? Or should a new formula that incorporates the best of all of them be developed?

All of these issues—and similar ones for every standard—have to be hammered out.

One of the most obvious cultural differences that must be worked around is the reluctance of the U.S. to adopt the metric system. ISO

wants—and needs to have—standards stated in metric. But it's not enough to convert measurements from one system to the other. ISO would prefer to have standards in "hard" metric; that is, developed in metric from the ground up. Such standards for gears are easier to work with if tooling is already set up in metric increments.

On the other hand, many U.S. companies are still oriented toward working in inches and feet, and it does not seem likely that the U.S. will abandon the old pound-inch measurement system any time soon. Given that fact, AGMA standards will

have to accommodate both measurement systems for some time to come.

Another important difference that affects the way standards development shakes out is the manufacturing orientation of AGMA and other U.S. standards. "Standards development should be a market-driven process. There should be a market need for a given standard before it's developed," says Bill Bradley. "Standards are no good unless they are usable in a contract."

AGMA's standards tend to reflect the "state of the market," lagging behind the "state of the art." Typically, they rely on simple empirical equa-

tions in contrast to others, such as the DIN standards, which tend to include more complex equations based on element-by-element lab testing of ideal gears. Advocates of the DIN methods point out the advantages of a strong theoretical basis, while AGMA's supporters stress ease of use and years of successful applications over a wide range of sizes and configurations. Finding a common ground between these positions is a slow process.

A factor which is of less importance to Europeans, but which is crucial to U.S. standards, is the issue of product liability. In the U.S., standards have to be very explicit about



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their applicability, the range of their application, etc. Language like "... is outside the scope of this standard," is frequently found in U.S. standards. The less litigious nature of European countries makes that language unnecessary in ISO standards.

Corporate & National Interests

AGMA has long been encouraging manufacturers to get more involved in standards development by sending delegates to standards committee meetings. "They should be involved," says Bradley, "because they're the ones who know what the markets have been asking for. They have the field experience to say what's realistic."

But this involvement can impede compromise. Obviously, individual companies have specific interests they want protected. However, as time goes on, and American manufacturers become more globally oriented, the need for compromise becomes more apparent and looking beyond narrow self-interest becomes easier.

The same is true of various national interests. The way standards are written can, intentionally or not, favor practices in one country over those of another. Overcoming this national interest in the push for a common benefit is one more element that has to be accommodated in the process.

Perhaps surprisingly, this obstacle is not as big as it might be. "There's not as much nationalism or company protectionism as you might think," says Bradley. "People on the committees tend to think more about the technical aspects of the prob-

lem. We've all learned to develop a consensus."

A Knowledge Bank

In the midst of all this jockeying for position and accommodating a variety of interests, one important function of gear standards making tends to get lost: that of providing a repository of gear knowledge. The professionals who serve on the standards committees bring a wealth of theoretical and practical experience to the table. In the process of hammering out the final form of the standards, much of this knowledge gets preserved and transmitted. If gear standards served no other function, this would be a vital one.

"The U.S. gear industry is old and is consolidating," says Bradley. "There are fewer good, experienced gear engineers, and we need all of them to work on standards in order to keep up their quality. If one waits for others to do the standards development, they will! For the U.S. to continue to be truly competitive, we must participate and take a leadership roll in developing industry standards."

The 9000 Series Controversy

At present, the standards that are getting the most attention are the 9000 series of quality standards. AGMA does not have a comparable set of standards and has no official position on whether these standards should be adopted by individual companies. ISO 9000 series standards can be applied to the entire manufacturing process, but AGMA is interested only in gear standards. It does not write quality method standards.

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However, these standards have caused a good deal of controversy. Many people both in the U.S. and Europe feel that the ISO 9000 standards were never intended to be vehicles for third-party certification, but rather were meant to be used internally by companies for their own evaluation purposes. The development of a lucrative third-party certification industry, the concerns of smaller companies about the high cost of qualification, and the debates about the qualifications of registrars and consultants have led some to reconsider the entire ISO 9000 certification process.

The advent of the Big Three automakers' QS-9000 program has only complicated the issue. This program is not a product of the original ISO 9000 series, but a separate set of quality standards which is now being demanded by Ford, GM and Chrysler. The pros and cons of this program and its effect on the ISO 9000 series are the subject of still more debate.

AGMA's Overall Goal

The development of common standards may seem glacially slow at times, but progress is definitely being made. At any given time, AGMA has between twenty and twenty-five active committees at work on one and sometimes two or more standards. (See the attached list of current AGMA projects.) In addition, some committees are working on information sheets, which contain material that is not included in standards, but is useful or needed to apply standards effectively.

AGMA's goal is to bring AGMA and ISO standards into harmonization as soon as the gear industry will accept a single standard, but progress is slow and tedious. It takes two to three years to revise or develop a standard, depending on how active a committee is. And committees are all made up of volunteer members.

The Best of Times; The Worst of Times

Ironically, times like these, when business is good, can be one of the worst times for standards development. Some companies are too busy to let valuable employees have time away from the office to attend standards committee meetings. On the other hand, when business is poor, companies can't afford to let employees attend. Willingness and commitment on the part of both individuals and their employers are crucial to the success of the various standards committees.

International standards development may be a bit like making law and sausages—a messy process whose result is not necessarily to everyone's liking. But it is an important one. As business becomes more and more global, the push to harmonize standards, although it may come in fits and starts, will certainly continue. ⚙

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