Developing Flexible Couplings Standards

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Flexible couplings? When or how did they become a type of gear drive or a component thereof and result in a committee within AGMA? Why would they even be a part of AGMA?

Well I don't know the exact answer, but many gear drives would not be turning without one of these flexible couplings on the input shaft, nor would the power be transmitted to the end application without one. So it makes some sense to be a part of AGMA. Many gear drive manufacturers also manufactured flexible couplings or used these products manufactured by others. There seemed to be a need for standardization of basic items such as bore-to-shaft fits. Creating such standards allowed for coupling manufacturers and power transmission distributors to stock many different couplings in the "rough stock bore" condition (reducing their inventory) and yet be able to provide consistent and interchangeable components.

My personal involvement with the committee goes back to 1984 when I attended my first AGMA Flexible Coupling Committee Meeting. I was readily accepted as a member and developed many new friends from our competitors. This was a new experience for me. This group did not act like competitors (although we are always aware of our company's competitiveness in the marketplace). Our goal was to try to understand our customers' technical and commercial needs and then standardize our products, where possible, to better fit those needs. Among our companies, there was a vast amount of technical expertise in many areas, bridging from general-purpose, off-the-shelf couplings stocked and sold by power transmission distributors, to the high performance type couplings used with gas turbines in the power generation or petrochemical industries.

I became chairman of the committee in the mid 1990s. My goal was to develop two new standards. One was a pure metric bore and keyway standard (similar to one already existing for the inch system) with the hopes that it would become an ISO standard, and a "basis for rating" standard. The metric bore and keyway standard was needed because the metric world had many standards (each company using its own combinations), but no standardization. The U.S. industry also had the problem of converting the metric bores and shaft sizes into the inch system and then trying to fit them into the inch standard. The "basis for rating" standard was needed if we were to truly have a service factor standard (which we had, but ultimately it was demoted to an information sheet as we had no standardized method for rating of flexible couplings).

The flexible coupling committee is currently composed of the following members and their associated companies: chairman Glenn Pokrandt (myself), Rexnord Industries, LLC; vice chairman Todd Schatzka, Rexnord Technical Services Corporation; Amy Lane, AGMA; Brian Greenlees, A-C Equipment Services Corporation; Doug Lyle, Ameridrives Couplings—Altra Industrial Motion Group; Tom Glasener, Emerson Industrial Automation; Chris Hatseras, KTR Corporation; Elliot Wilson, Lovejoy, Inc.; and Don Hindman, Rexnord Industries, LLC.

The committee is responsible for 10 current standards, two standards pending release, one information sheet and one new standard under development. Current standards and information sheets must be reviewed and re-affirmed every five years to confirm their applicability and that there are no updates or revisions required.

AGMA 9000-C90, "Flexible Couplings—Potential Unbalance Classification," is probably the most referenced flexible coupling standard specified by end users and system suppliers of both general purpose and high performance flexible couplings.

AGMA 9000-Dxx, "Flexible Couplings—Potential Unbalance Classification (Inch Edition)," is an update of AGMA 9000-C90. It is planned for release in 2011. This standard relates to flexible couplings' potential unbalance (and not the residual unbalance of rigid rotors). Flexible couplings have both runout and clearances between mating parts. They are normally shipped as a group of unassembled components, field assembled and sometimes disassembled and re-assembled. As you can see, there is a great difference when compared to the balancing of a high speed shaft with integral pinion or an intermediate shaft with the gear and pinion already mounted when balanced. These parts are not expected to be disassembled prior to being put in the gearbox and subsequent operation.

AGMA 9110-Axx, "Flexible Couplings—Potential Unbalance Classification (Metric Edition)," is a pure metric version of AGMA 9000-Dxx and will be able to be used by those preferring the metric system. It is also planned for release in 2011. The AGMA balance class required or calculated will be the same from either standard.

This standard recognizes the coupling weight and the speed at which it will be operating. The standard then suggests a "balance class" and a corresponding maximum amount of potential displacement of the principal inertia axis of the

coupling relative to the axis of rotation (unbalance) permitted based on the system sensitivity. Ultimately, the purchaser of the coupling is responsible for the balance class specified and may override the standards recommendation based on his operating experience. The standard also provides a "tutorial" on how the coupling manufacturer will determine the potential displacement of the principal inertia axis of the coupling relative to the axis of rotation and if and how the coupling should be balanced to achieve the end results required. The annexes provide example calculations for both general purpose and high performance type requirements.

AGMA 9002-B04, "Bores and Keyways for Flexible Couplings (Inch Series)" (and its predecessors) combined several individual standards into one and has been used by coupling manufacturers for many years. It standardizes the recommended bore tolerances and bore to shaft fits based on the standard shaft sizes and tolerances used by both motor and enclosed drive gear manufacturers. The bore to shaft fit choices are clearance or interference (0.0005 inches interference per inch of shaft diameter). It also contains the recommended key/hub keyway dimensions and tolerances based on shaft diameter. The annexes contain information on the inspection of both straight and tapered bores and their keyways.

AGMA 9112-A04, "Bores and Keyways for Flexible Couplings (Metric Series)" is a pure metric version similar to AGMA 9002-B04. It does not convert the inch series to metric, but rather uses the metric standards employed by the metric world for their system of "standardized" shafting and tolerances (ISO R775:1969 which is no longer active, but was the basis for their shaft data being used today). The metric system is based on the "basic hole" system and results in a different system than those familiar with the domestic system (basic shaft system). Shaft diameters will be larger than indicated (for shaft diameters over 30 mm which use the k6 or m6 shaft tolerance). The k6 and m6 tolerances are plus to a greater plus tolerance over nominal. The recommended bore will typically uses an H7 tolerance and will be nominal size with a plus tolerance. The resulting bore to shaft fit will be a transitional fit (clearance to interference depending on tolerance combinations). This standard also contains tables of bore tolerances which will result in bore to shaft fits similar to those found in AGMA 9002-B04 (clearance and interference) which the domestic community is familiar with.

AGMA 9008-B00, "Flexible Couplings—Gear Type, Flange Dimensions, Inch Series," recognizes and specifies the standard flange diameters and mounting hole dimensions for both shrouded and exposed bolt gear couplings (nominal sizes 1½ thru 7). This standard was the result of the coupling industry meeting the domestic steel industry needs for the standardization of these dimensions for interchangeability/purchasing and stocking requirements that industry demanded. There is no metric equivalent as the domestic gear coupling (which historically finds worldwide usage) is only available as an inch product.

AGMA 9003-B08, "Flexible Couplings—Keyless Fits" and AGMA 9103-B08, "Flexible Couplings—Keyless Fits (Metric Edition)." The intent of these standards is to offer rotating equipment designers and users a standard for design practice and dimensions regarding keyless fits for flexible couplings. In general, the information in these standards is a consolidation of the most common practices and standards currently in use in the industry.

AGMA 9004-B09, "Flexible Couplings—Mass Elastic Properties and Other Characteristics" and AGMA 9104-A06, "Flexible Couplings—Mass Elastic Properties and Other Characteristics (Metric Edition)." These standards were developed through intensive study of existing practices, standards, text books and literature. The intent of these standards is to offer to rotating equipment designers, builders and users, a standard for design practice and methods of calculation of certain physical and mass elastic properties of flexible couplings.

AGMA 9009-D02, "Flexible Couplings—Nomenclature for Flexible Couplings" was developed to reduce the language barriers that arise between designers, manufacturers, and users when attempting to designate or describe various types of flexible couplings and their elements.

AGMA 9001-B97, "Flexible Couplings—Lubrication" covers the lubrication of gear couplings, chain couplings and metallic grid couplings and generally applies to other types of lubricated couplings.

Coupling lubrication requirements are unique. High speed couplings act as centrifuges and will displace the heavier components of the lubricant (typically not the oil component of a grease) radially outward into the working zone of the coupling. Conversely, low speed couplings do not disperse or resupply the lubricant into the working zone.

Information Sheet AGMA 922-A96, "Load Classification and Service Factors for Flexible Couplings" remains in waiting for the completion of the new standard "Basis for Ratings." When the "basis for rating" standard is completed, the committee will review and modify the data in this information sheet and release it as a standard for use by all coupling manufacturers that follow the rating requirements of AGMA 9006-Axx.

The new standard being worked on is **AGMA 9006-Axx, "Flexible Couplings—Basis for Ratings."** The committee started working on this standard in 1998. Progress has been impeded by the need for existing standard reaffirmation, the need to prepare metric equivalent standards for those written in the inch system (an AGMA requirement) and the need to expand AGMA 9000-C90 into AGMA 9000-Dxx and its metric equivalent, AGMA 9110-Axx. Now that these requirements have been completed, the committee will spend the next several meetings devoted full time to this new standard.

If after reading this article you feel you would like to contribute to our efforts, we welcome your input and assistance. We can learn from each other. We would especially like to involve additional elastomer type coupling manufacturers to participate. We generally meet twice a year (in the spring and fall) at cities to be determined at each meeting. Contact AGMA headquarters at (703)-684-0211 for the agenda and next meeting location.

Purchasers of couplings conforming to AGMA standards are assured of quality products made to uniformly accepted quality standards and design criteria.