An Alternative Standard for Hydraulic Hoses

How the ISO 18752 standard can streamline design and improve productivity.

Parker

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Why Hydraulic System Designers Should Adopt ISO18752

A global standard aligned with pressure and service class, not hose construction type.

Hydraulic hoses can be found in countless applications across industries and markets around the world. There are also complex standards developed and augmented by organizations regionally and globally that regulate the construction and performance specifications for these hydraulic hoses. While standards are constantly evolving with the progression of technology to meet industry demands, many companies, manufacturers, and end customers stand to benefit greatly from improved standards, such as the newer global ISO 18752 hydraulic hose specification.

There are several aspects of this new global standard that could have direct financial and operational impacts on your business. More importantly, switching from more traditional standards could help hydraulic system designers boost efficiency, improve uptime, and streamline the selection process for products globally.

Traditionally, OEMs of hydraulically driven equipment, such as material handlers and other types of mobile equipment, have specified their hydraulic hoses using engineering standards common to the region where those machines were being manufactured.

For example, North American builders of mobile equipment like tractors and excavators have long used SAE standards, created by the U.S.-based standards organization SAE International (traditionally known as the Society of Automotive Engineers), to provide general, dimensional, and performance specifications for hydraulic hoses.

Another common group of standards used for specifications are the collection of ISO standards, written by the International Organization for Standardization. This global organization has created several standards relating to hydraulic hoses used in various industries and applications. These standards support the technology used by OEMs and end users, and consistently ensure the quality and proper usage of materials and products across markets.

Organizations around the world rely on these standards, many

of which have been around for decades. In fact, the traditional SAE and ISO standards are often described as manufacturer-driven, because they were created by committees of engineers from different organizations.

In addition to these two major standard organizations, entities within individual countries and regions have also created their own standards for hydraulic hose specification, such as Germany's DIN (Deutsche Industries Norm) standard, or the European Union's EN (European Norm) standard.

While having their own set of standards may be useful for engineers based in a particular country or region, it can be confusing for engineers based outside that region trying to replace equivalent parts or build new products that will be sold in regions that recognize a different standard for their hydraulic systems.

Overview of Traditional Hydraulic Hose Standards

North American hydraulic system designers have most commonly used the SAE standards for specification, says Philip Novak, a senior engineer with Parker Hannifin's Hose Products Division. "Twenty or 30 years ago in the United States, every hose you would have bought was typically made to an SAE specification," he says.

The current SAE standard for hydraulic hose is SAE J517, which provides general, dimensional, and performance specifications for the hoses most commonly used in hydraulic systems on mobile and stationary equipment. Originally published in 1968, the SAE standard has been revised more than 20 times. SAE J517 currently contains more than a dozen sub-standards, such as 100R1, 100R2, and 100R19.

Each of these sub-standards describes a specific type of hydraulic hose for a given application. For example, different standards apply to hydraulic hoses with a one-wire braid reinforced construction, two-wire braid reinforced construction, or a four-wire spiral construction. Pressure classes for many of the sub-standards vary by hose size, as the traditional SAE standards do not generally apply to hydraulic hoses capable of handling constant working pressures across sizes.

Hoses rated to SAE standards meet specified dimensional and performance criteria as determined by SAE, ensuring similarity between products from different participating manufacturers aligned to SAE standards. Likewise, hoses rated to different regional standards or older ISO standards specify different criteria related to construction and performance that hoses must meet.

Even though these standards have been revised over the years to account for changes in materials, applications, and processes, the legacy SAE and ISO standards remain centered around hose style and construction for specific pressure classes, whereby braided hoses are used for lower pressures, and spiral hoses accommodate higher pressures. This emphasis upon hose design, construction, and pressure ratings makes standards highly technical and complicated. In speaking to these characteristics, the standards must cover a vast number of materials and techniques as well as various application parameters.

Limitations of Traditional Standards

While the SAE sub-standards have been useful for defining hydraulic hose pressure classes, sizes, and constructions, traditional hydraulic industry standards are unable to maintain relevance when competing with new, updated standards for many OEMs and customers on the global scale.

Novak points out that the legacy standards define varying pressure ranges for each size. That means the smaller diameter hoses are generally made to handle higher pressures, while larger diameter hoses are built for lower pressures within the same product family.

The vast range of products and applications makes specification and product selection complex, especially considering most applications have systems operating at a single pressure, and designers may need hoses with different diameters that are capable of handling the same pressures. With traditional standards such as the SAE 100R1 and 100R2, the pressure rating degrades as hose diameters increase, explains Matt Pritchard, marketing manager for Parker's Hose Products Division.

"That's where the legacy SAE specifications made it difficult; users had to determine the different pressures for each hose size required, and it was likely that machines could not be fully fitted with a singular hose family," says Pritchard. "You would often need multiple product families installed to make sure the hydraulic system was built appropriately and could operate safely."

Novak indicates that while the traditional standards do recognize some constant working pressure hoses, there is no standard for constant working pressure hoses that includes hose outside diameters (O.D.) from a quarter-inch in diameter up to two inches. "As a result, it creates complications when choosing hoses for a single pressure class in different sizes," Novak explains.

In addition to construction types, traditional SAE and ISO standards also require products to withstand defined temperature ranges. However, with the wide range of hose styles and applications on the market, the temperature criteria vary by sub-standard, with maximum working temperatures ranging from 212F (100C) to 257F (125C).

"Different application parameters can be an issue too," Novak says. "If your application requires a higher temperature hose, there might not be an existing SAE standard that covers it." This is problematic because using different specifications for various hydraulic connections within a system frequently means that the engineer or designer must select from

multiple product lines or series of hydraulic hoses to find the properly rated hoses needed for a specific application.

The same is true for system designers using traditional ISO specifications geared to hose construction and style, rather than pressure classes. These older specifications haven't, for the most part, been written to cover hoses that offer constant working pressures across sizes.

Pritchard points out that while SAE standards have evolved over the years to cover different hose styles and applications, sorting through the different criteria and specifications can be confusing and over-complicated because of the vast number of sub-standards associated with the J517 standard for hydraulic hose.

"You essentially have to determine piece by piece what your hydraulic system needs, and figure out which pressure your application requires, and then determine which hose will meet that, based upon the size you need for that pressure," Pritchard says.

A separate issue that arises when equipment designers use certain regional or manufacturer-based standards, such as SAE, is that it's difficult to switch hoses from one region to another, where a different prevailing hydraulic hose standard may be the norm.

While standards and specifications differ between regions, their purpose is universal: provide products that ensure quality and performance for their designated application. Machines and equipment sold locally are expected to conform to locally accepted standards. Not only does this ensure availability of the correct replacement parts, it also guarantees that customers are receiving equipment made to the quality and performance specifications required by their application and promised by their manufacturer.

However, if a piece of equipment is manufactured in a different geographic region, and thus aligned to a different hose standard, it will be difficult for the manufacturer to find the same parts locally.

For instance, U.S.-based manufacturers may specify hoses with the SAE standard, while European counterparts are using the EN standard to select their hoses. That means that not only will finding an exact product match be difficult between regions, but there will be differences between the hydraulic hoses manufactured in each area, and the different regional specs will have different qualifications. Thus, manufacturers with operations in more than one region are tasked with finding equivalent hose products in each region, which can have a negative impact upon efficiency and productivity.

Likewise, global organizations with operations in different countries may struggle to find the hoses they need for certain systems and applications in different regions that use different standards. "They are building hydraulic systems and equipment with different materials and specifications," Pritchard points out, but OEMs in different regions increasingly want to have access to the same parts for their applications no matter where they're located.

The Global ISO 18752 Standard

The newer ISO 18752 standard for hydraulic hoses solves many of the issues concerning pressure classes, hose sizes, and product uniformity in different regions. Introduced in 2006, ISO 18752 centers around 10 maximum working pressure classes, ranging from 500 psi to 8,000 psi.

With the introduction of this standard, ISO is helping large global OEMs and their customers to apply the same specifications to their systems, no matter where in the world they are made or sold. That means manufacturers can be assured of receiving the same hydraulic hoses, tested to the same specifications, to meet the needs of their applications globally.

Under ISO 18752, hoses are identified by pressure class, and each pressure class accommodates an entire range of hose diameters. This is in contrast to traditional SAE standards, which provide general, dimensional, and performance specifications for the most common hoses used in hydraulic systems based on hose construction. By specifying hose based upon pressure and performance, the ISO 18752 standard streamlines the selection process, making it easier for equipment designers to find hoses for their applications.

"What the ISO 18752 spec allows you to do is just simplify your selection process by narrowing down your product range to a singular hose family based on application pressure requirements. If the maximum pressure requirement for your application is 3,000 psi, you could utilize one hose family operating with a constant working pressure of 3,000 psi across all diameters for your hydraulic system," Pritchard explains.

In addition to requiring constant working pressure performance ratings in each pressure class for different hose sizes, the ISO 18752 standard introduces four different classes of service, A through D, which correlate with each class's resistance to impulse pressure. In order to be rated to the ISO 18752 standard, hydraulic hoses undergo rigorous testing for durability and performance to ensure products possess the high quality necessary to meet the demands of tough applications. For each grade of hose, every ISO 18752 hose for a single pressure class must test to high impulses, extended cycles, and higher pressure and temperature criteria to be rated to the new global standard.

Additionally, each grade is classified further by its outside diameter (O.D.) as either standard (AS, BS, CS) or compact (AC, BC, CC, DC). Compact hose types have a smaller O.D. and tighter bend radius than the standard types.

Another benefit of hoses made to the ISO 18752 standard is establishing uniformity between locations. Written by the global standards organization, ISO engineers around the world can use this standard in place of their regional standard to designate hoses by size and pressure class for their application.

"It's a real advantage, especially for large OEMs wanting to build equipment in various countries. The same ISO specs would apply, no matter where your factory is located," Novak says.

Specifying constant working pressure hoses using the ISO 18752 standard provides opportunities for OEMs and end users to improve efficiency in operations, increase uptime with a streamlined selection process and longer service life, and provide dependable performance and quality across the globe.

How OEMs can Benefit by Making the Switch

OEMs who decide to adopt and use ISO 18752 standards can expect to gain numerous benefits financially as well as reduce engineering complexity.

Moving to the ISO 18752 standard allows OEMs and distributors to benefit in terms of inventory reduction because ISO 18752 hoses are classified by pressure class rather than construction. Stocking hoses rated for a single pressure class in numerous sizes decreases inventory needs and simplifies the selection process. Hoses made to the ISO 18752 standard meet all the same requirements as SAE hoses, but require fewer types of hose to do so.

Having the ISO-rated hoses also helps OEMs remain relevant in the global marketplace. End users, particularly those with global operations, expect to have access to products regardless of their location and to be able to purchase readily available equipment designed and tested to the latest standards.

Pritchard says OEMs that don't adopt this new global standard may find their customers questioning the quality and performance of their products, and eventually looking elsewhere for improved efficiency, higher quality, and easier accessibility. "Customers begin to worry, what is the quality of this product, how safe is this product for my application and users, and why is this product not rated to the latest standard," Pritchard adds.

Dependability and high performance are uniform qualities of hoses rated to the ISO 18752 standard, since hoses conforming to this standard have had to undergo rigorous testing to meet the spec. In that way, having an ISO 18752 designation for their hydraulic hoses helps the end customer to feel confident about the quality of the product they receive.

Increased Interest in a Global Alternative

While interest in the ISO 18752 standard is rising among OEMs around the world, the rates of acceptance and use for this standard are growing a bit more slowly.

"While many OEMs see the value of ISO 18752 and are accepting the newer standard," says Pritchard, "it still requires a decent amount of explanation."

Novak points out that some of the world's larger OEMs have adopted ISO 18752, and that while it's probably more prevalent in Europe than the U.S., there does seem to be a shift taking place. He explains that larger OEMs planning to market their products globally want to have access to the same dependable products tested to the same standards regardless of their location. Hydraulic hoses rated to ISO 18752 undergo the same testing and offer the same quality and high performance across sizes for each pressure class. Therefore, specifying equipment with ISO 18752-rated hoses guarantees reliability and longevity of operations while streamlining the purchasing process with easy-to-select products.

Perhaps helping the standard to gain footing across industries was the recent announcement by the Japanese government that its manufacturers would switch exclusively to this global standard for hydraulic hoses. "They feel that the switch to ISO 18752 is going to make their companies and manufacturers more relevant around the world," Novak adds.

Many engineers, accustomed to specifying their hoses with regional standards like SAE, can be reticent to change without some sense of urgency, customer demand, and confidence in the engineering soundness of that move. Refitting every piece of equipment and replacing inventories of hydraulic hoses that meet regional standards in favor of hoses tested to a new global standard is costly.

"When engineers are designing new pieces of equipment and machines, hydraulic hoses are only one piece of the larger product, and thus are not typically the major concern," Novak says. "It can be a bit of nuisance for engineers, because not only do they have to design and build the machine, but then they have to verify that the new components will meet the demands of their applications."

However, Pritchard says, if there is any demand among OEMs to purchase ISO 18752 hoses to replace traditional SAE hoses, "I think the urgency we see is the drive from the OEMs to be able to buy the same high quality, high performance products from suppliers like Parker around the world."

Pritchard says he believes the standard is accepted by about half of all equipment designers, with a smaller percentage using the standard internally for most of their hydraulic systems.

"The issue we run into is the bandwidth of engineering capacity for our customers," says Pritchard. "They are not necessarily opposed to adopting ISO 18752, but it means they need to update their prints or their own internal specs, and they just don't have time."

In the interest of efficiency, Novak explains, OEMs will find it easier to adopt the new standard for redesigned equipment, rather than with existing models. Changing the standard for existing equipment would be somewhat more difficult, because the plants are already likely set up to order and stock SAE-approved components. "It can be a fairly complex process for the larger manufacturer to switch over. The approval process can be complex and time consuming in order to change one part number." Novak says. "It's easier to start fresh with new drawings than to change one that's five or 10 years old," he says.

Pritchard agrees, noting that anytime an OEM is securing quotes for a new platform, such as a new tractor, using the ISO 18752 standard to find and quote parts can be a time- and money-saving way to move to the new standard.

Resources to Help Make The Conversion from SAE

Converting from traditional SAE standards to the ISO 18752 standard is a simple process using cross-reference guides, such as those Parker has created comparing GlobalCore hoses with similar SAE and ISO standards.

Parker created these conversion guides to assist hydraulic system designers in making the switch to GlobalCore hoses, whether they were using an SAE spec or a competitive product. "We provide both ways to drive toward the right Parker part number," says Matt Pritchard, marketing manager for Parker's Hose Products Division.

Use "GlobalCore vs. SAE and ISO hoses" to find the GlobalCore hose aligned to certain SAE J517 sub-standards. Likewise, use the ISO 18752 Performance Definitions chart to identify the grade and type of GlobalCore hose to match different criteria such as temperature, impulse pressure, or cycle ratings.

And Pritchard points out, Parker can lend engineering and technical assistance to companies working to incorporate hoses tested and rated to the ISO 18752 specification into current and future designs.

GlobalCore vs SAE and ISO Hoses

Spec	Temp	-4	-6	-8	-10	-12	-16	-20	-24	-32	Impulse Test Cycles
SAE 100R1	212°F	3,250	2,600	2,325	1,875	1,525	1,275	900	725	575	200,000
Global**Core Hose**	212°F / 257°F	487	387	387	387	387	387	187	187	187	200,000+
	212°F	5,800	4,800	4,000	3,625	3,100	2,400	1,800	1,300	1,150	200,000
	212°F / 257°F	797	787	487	487	487	387	387	387	387	200,000+
SAE 100R12	257°F	*	4,000	4,000	4,000	4,000	4,000	3,000	2,500	2,500	500,000
Global**Core Hose**	212°F / 257°F		777	777	777	777	777	387	387	387	500,000+
SAE 100R13	257°F	*	*	*	*	5,000	5,000	5,000	5,000	5,000	500,000
Global**Core Hose**	212°F / 257°F					787	787	787	787	787	500,000+
SAE 100R15	257°F	*	6,000	6,000	*	6,000	6,000	6,000	6,000	*	500,000
Global**Core Hose**	212°F / 257°F		797	797	797	797	797	797	797		500,000+
	212°F	3,000	3,000	3,000	3,000	3,000	3,000	*	*	*	200,000
	212°F / 257°F	387	387	387	387	387	387				200,000+
SAE 100R19	212°F	4,000	4,000	4,000	4,000	4,000	4,000	*	*	*	200,000
Global**Core Hose**	212°F / 257°F	487	487	487	487	487	487				200,000+
ISO 11237-1-2SC	212°F	5,800	5,000	4,000	3,625	3,100	2,400	1,800	*	*	200,000
	212°F / 257°F	797	787	487	487	487	387	387			200,000+
ISO 1436-1-1SN	212°F	3,250	2,600	2,325	1,875	1,525	1,275	900	725	575	200,000
Global**Core Hose**	212°F / 257°F	487	387	387	387	387	387	187	187	187	200,000+
	212°F	5,800	4,800	4,000	3,625	3,100	2,400	1,800	1,300	1,150	200,000
	212°F / 257°F	797	787	487	487	487	387	387	387	387	200,000+
ISO 3862-1-4SP	212°F	6,500	6,450	6,000	5,000	5,000	4,000	3,000	2,650	2,400	400,000
Global**Core Hose**	212°F / 257°F			797	787	787	487	387	387	387	400,000+
	212°F	*	*	*	*	6,000	5,500	4,700	4,200	3,625	400,000
	212°F / 257°F					797	797	787	787	487	400,000+

*Not covered by spec.

ISO 18752 Performance Definitions (4.2 Grades and Types)

Grade	Type[a]	Resistance to Impulse		
		Temperature	Impulse Pressure (1% of MWP[b])	Minimum Number of Cycles
A	AS	100°C (212°F)	133%	200,000
	AC			
B	BS	100°C (212°F)	133%	500,000
	BC			
C	CS	120°C (250°F)	133% and 120%[c]	500,000
	CC			
D	DC	120°C (250°F)	133%	1,000,000

[a] Standard or compact, e.g. CS is grade C and standard type.
Standard types have larger outside diameters and larger bend radii and compact types have smaller outside diameters and smaller bend radii.
[b] Maximum working pressure.
[c] 120% of the MWP shall be used for classes 350, 420 and 560 instead of 133%.
ISO 18752 classifies according to their resistance to impulse into four grades: A, B, C and D. Each grade is classified by outside diameter into standard types (AS, BS and CS) and compact types (AC, BC, CC and DC) as shown in this table.

Why Parker Moved Towards the New Global Standard

OEMs and end users are looking to streamline their selection and implementation processes to improve productivity and increase profit margins across industries. Going forward, the ISO 18752 standard will only continue to hold higher appeal with both end customers and OEMs for its simplicity, its ability to streamline inventories and costs, and its relevance on a global scale.

"This has been a big push from a lot of our customers that are global and that build equipment all over the world," Pritchard says. With hoses made to the global ISO 18752 standard, customers are assured that they are receiving the same high quality, high performance hose, regardless of where their application is globally.

Due to the increased demand from our customers, Parker designed and engineered a hydraulic hose family in 2014, GlobalCore, that meets the ISO 18752 specification. With Parker's GlobalCore hoses, the cohesive collection of hoses makes specification far easier for OEMs needing to find certain sizes of hoses for specific pressure classes. And with the GlobalCore product family, OEMs are assured of finding whatever hose they need.

"The hoses are identified by pressure, in which case we have 1,000, 3,000, 4,000, 5,000, and 6,000 psi," says Novak. "Each pressure covers the whole range of sizes." The family of GlobalCore hoses is broad enough to cover virtually every hydraulic application.

"From a complexity standpoint, it's a significant reduction for customers, yet they still have the same, if not better coverage, so there's fewer dollars tied up in inventory, a greater ease of selection, and a smaller footprint in their warehouse," Pritchard says. With GlobalCore hoses, some distributors may be able to go from carrying 15 different hose part numbers down to six.

The switch from traditional standards to adopting the ISO 18752 standard was driven largely by the demand for a better product. Parker's GlobalCore family of hoses is a competitive product line designed, built, and tested to the ISO 18752 specifications, providing a comprehensive line of hoses in the most commonly used constant working pressures in hydraulic industries. Tested to twice the ISO 18752 specification, GlobalCore guarantees high performance with a tighter bend radius and low force-to-flex for ease of installation anywhere in the world. The cohesive product line provides a longer lifespan and improved safety with information-rich, color-coded laylines for easy identification and a simpler selection process.

Parker's GlobalCore range of hydraulic hoses gives OEMs the largest selection offered to-date of hoses made and tested to the ISO 18752 standard. GlobalCore includes hoses sized from one-quarter inch up to three inches, and rated to pressures ranging from 1,000 to 6,000 psi. While other manufacturers offer some ISO hoses for specific pressures within this range, no other organization has covered the broad range of pressure classes across sizes that GlobalCore covers. "We are proud to say that GlobalCore completes the full scope of ISO 18752," Pritchard observes.

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