

Chapter 5 – D System - Choosing Kegs and Spear System – Considerations

A. CONSIDERATIONS FOR PURCHASE OF KEGS

What size(s) of kegs and what valve system does your proposed market expect or demand? Is there a reason to choose a valve System that is different and sets apart your kegs from the kegs of competitors? Should you stay with one size, two sizes of kegs only? Will you self-distribute or hand your kegs off to a wholesaler for distribution? How many kegs will you need? How will you wash and fill them? How will you maintain and repair them? How will you track or keep track of your kegs? Will it make sense to lease or use pay-per-fill kegs rather than own kegs?

So many questions! And these are answered well in many other places and resources, online and through industry associations. Here we will address the answers from the perspective of the type of spears you will use in your kegs.

Of primary concern when you buy new or used kegs is: kegs and spears are never manufactured by the same company. So when you buy new or used kegs, you must ask the question – and communicate your preferential specification to the seller – which spear System, keg neck type, and spear manufacturer you will accept. Otherwise, you will be purchasing blindly, taking a chance on what you will get.

Next most important: is the keg design good?* Is the total volume capacity of the keg equal to the nominal volume PLUS adequate headspace? Is the raw material high quality stainless steel? Are the welds good? Are the chimbs without sharp edges at the handles? Are the chimbs using heavy enough gauge of steel to withstand normal use and abuse? Is the neck correctly centered and mounted? Do the kegs include pressure relief rupture discs? Is the keg correctly pickled and passivated?

For used kegs: how were they used, for what beverage, how were they cleaned? How long have they been in long-term storage (probably uncleaned)? Were they stored indoors or outdoors? Under cover or in the open? How old are the kegs, how old are the spears and valves? Were these kegs laid aside as leakers, or simply because they were unneeded? Of course, some of these questions will not be answered with any meaningful accuracy. It must be assumed every keg could require deep-cleaning, and every spear may need refurbishment, if not replacement (see also Chapter 12.)

Full stainless-steel, straight-walled kegs have become the market preference, but they are produced with non-standardized dimensions, inconsistent even within regions and in some cases, from the same manufacturer. This inconsistency can be seen evident in many breweries who have purchased kegs from multiple sources, new and used.

In the US some “belly kegs” designed for use with D System spears are still in use, with or without top and bottom chimbs welded on. Even older “belly kegs” with side bungs may still be found, not originally designed for D System CIP cleaning, but retrofitted with drop-in or threaded necks and D System spears, nonetheless. Instead, these must still be washed internally through the side bung hole, by removal and subsequent replacement of the wooden bung. Do not attempt to wash these on a modern keg washing machine!

Full stainless-steel, straight-walled DIN- and EURO-Kegs are manufactured and are considered the highest standard of keg design, following specifications in DIN-Kegs according to German DIN 6647-1. But these kegs are only randomly found in use outside of Europe.

Partially, or entirely polyurethane-covered stainless-steel kegs are also common, also with dimensions inconsistent with other kegs of the same volume.

When the seller provides a Quote for purchase of new kegs, insist on a valid technical drawing of the kegs, necks and spears. For used kegs, ask for photos of the kegs, necks in profile, and spear valves as visible in the necks; or a sample of at least 1-2 representative kegs to be supplied in advance of your commitment to buy. When possible, visit the seller's warehouse to inspect used kegs in person before buying. The purchase agreement for used kegs will likely be "as-is" condition, but ask for a right of refusal of part or all of the shipment if the used kegs are delivered in less than agreed-to condition (damaged beyond use or repair, missing spears or obviously leaking from the shell, chimbs crushed or torn.)

**See the Brewers Association document, "Performance Guidelines for Refillable Kegs" for the full range of manufacturing requirements for new kegs.*

B. D SYSTEM OR OTHER?

In the US and Canada, also largely in Mexico, kegs with D System spears are universally accepted for beer and cider, and increasingly for wine, and wholesale distributors and retailers have very little patience or willingness to take kegs using any other System... with some special exceptions for Guinness and a handful of other beers imported to the US.

Some US and Canada craft brewers have tried using A and G Systems kegs, and eventually abandoned that innovative idea, after much pushback from their distributors and customers.

Unlike North American, around the world, S, A, G, M and D System spears are tapped side-by-side in many regions and establishments.

For cold coffee, wine, kombucha, NA beer (on dedicated draft lines, ideally) in North America, there is not the same level of imposed universality for D System established. So if you produce these beverages in the US, Canada, Mexico, or of course anywhere else in the world, you might consider using S, A, G or M Systems. For NA beer, particularly, alternative spear Systems are being developed that provide some confidence that the keg will not be tapped on incorrect, non-NAB-dedicated draft lines, nor regular alcoholic beer kegs to be tapped on the NA-dedicated draft lines.

Kegs with D System spears are now regularly shipped and tapped around the world, outside of North America. However, D System spears, in kegs of 31 gallon US Barrel fractional sizing units (1/2bbl, 1/4bbl, 1/6bbl), and drop-in type bayonet necks, are filled almost nowhere else in the world.

If you are filling kegs in your facility with a range of products from different categories – beer, NA beer, cider, kombucha, hard tea, for example – you may consider using different spear Systems and/or different keg sizes (US Barrel or metric) in kegs designated for different product categories. But keep in mind the downtime and associated increased costs of the changeover that will be necessary between each filling run with the different spear Systems and kegs. Neck-centering, adapter probe, and other equipment on your keg washing machine or packaging line will need to be swapped out. Settings on the machinery will need adjustment to accommodate the different valve designs' stroke depths, the kegs' H6 dimensions, keg diameters and overall height, fill levels, etc.

All of the modern closed-system keg valve Systems can be a good choice for function, reliability, safety, cleanability and quality assurance... but you must consider all the factors that will ease your washing and filling, market acceptance and selling, also repair and maintenance of the kegs you purchase.

C. DROP-IN OR THREADED NECKS?

The majority of kegs in use for D System spears are manufactured with drop-in necks. Next most common is 2"/14TPI threaded, followed by the SOS type bayonet neck. Of these, threaded necks are the least good option. On kegs with

threaded necks, using all Systems of spears, the threaded spears must regularly be retightened. But in addition to the usual loosening of the threaded spear due to changes in temperature and vibrations during transport, washing and filling, the relatively high torque of repeated tapping/untapping of the D System coupler on these kegs tends to loosen the necks in the kegs – more so that with S System, or any other System of spear installed in threaded neck kegs.

D. SIZES AND SHAPES OF KEGS

Also of great importance is the volumetric sizing of kegs for your specific market(s). In the US, the fractional US Barrel sizing of D System kegs is nearly universal; however, since around 2010, metric 50L kegs have gained some acceptance. In Canada and Mexico, metric sizing of kegs is more common. If you are filling D System kegs anywhere else in the world, you should use the metric fractional sizes: 20l, 30l and 50l. Some regional rules and regulations may require this. If you are filling D System kegs in North America for distribution overseas, either US Barrel or metric sizing will likely be accepted.

E. KEG / NECK / SPEAR TECHNICAL DRAWINGS

(Generic, what to look for – see also Chapters 8, 19, 20)

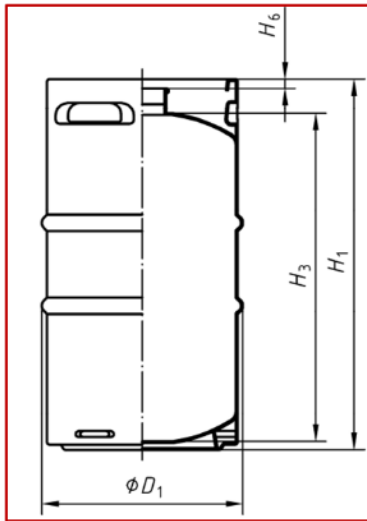
1. Keg Technical Drawings

Of primary concern is that nominal vs total volume should be indicated on all keg technical drawings; the difference indicates the design head space in those kegs. So if a US ½-Barrel keg with a nominal fill volume of 15.5 gallons (58.66l) has a total volume capacity of 15.75 gallons (59.62l), then the head space volume resulting after filling with 15.5 gallons of liquid will be 0.25 gallon (0.95l)..

Typical Head Space,	
1.5% to 2.0%:	
20L	= .4 l
30L	= .6 l
50L	= .8 l
1/6bbl	= 9 oz
1/4bbl	= 13 oz
½ bbl	= 32 oz

Kegs must be filled by metered volume or by weight to ensure they are not over- or under-filled. But also, beware of some manufacturers’ kegs that do not accommodate adequate head space, or any head space at all, by their design! Many of these are known to be in the market.

Other specifications to be noted include: item code/drawing number and product description; overall height and diameter, as well as all other dimensions of the keg; embossed or etched text information to be included on the top dome, top chimb and sidewalls – both proprietary and legally-required in your distribution area; tare weight of the keg including the spear; raw material(s) used for the keg shell; neck type; spear System and spear manufacturer; test pressure ratings; shipping internal pressure; safety pressure relief disc if included.

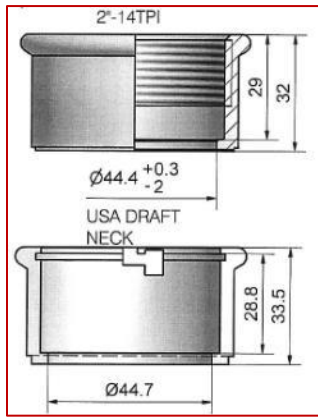


Dimensions to be found on keg technical drawings, those most relevant to use are:

- a. **H1:** total height of the keg, outside
- b. **H3:** height inside the keg, from bottom to sealing surface in the neck
 - **The H3 of the Keg is obviously the important keg dimension for determining correct spear length. Note that some Keg Manufacturers do not include the H3 dimension on keg drawings. The H3 dimension of the keg is usually expressed as being +/- 2mm (industry standard.)**
- c. **H6:** difference in height between the top of the top chime and the top of the neck
 - This dimension should ideally be consistent within your keg fleet, as it provides a reference for determining by external inspection if the gap between bottom of the spear down tube and bottom inside of the keg has been compromised – increased or decreased – by damage. If the keg has been deformed by freezing, hydraulic force by thermal expansion of liquid contents, impact to the neck or bottom dome, or other cause, both keg washing and dispense may be negatively affected, depending on the degree of deformation.
 - It may be necessary to keep the H6 consistent among all kegs in use in your brewery to ensure your keg washing machine or packaging line stations will seal and open each of the spears properly. This is only a problem on certain designs of semi-automatic keg washing machines and packaging lines.
- d. **D1:** outer diameter of the Keg
 - Depending on the cleaning and filling machine you are working with, outer diameter inconsistency among your kegs may result in some not being properly centered when clamped into position at stations for cleaning and filling, resulting in poor sealing or damage to the spear.
- e. **Total Capacity** (construction capacity) and **Nominal Capacity** (intended fill capacity)
 - These specifications should be shown on all keg technical drawings, but are not always. The difference is the intended head space requirement for safe and effective filling to nominal capacity. Micro Matic strongly recommends to use only kegs with verified adequate head space allowance in the design, relative to the nominal capacity of the keg. This will help prevent damage to the keg and to valves in the spear when ambient temperature rises, potentially causing extremely high hydraulic pressure to be generated.

2. Neck Technical Drawings

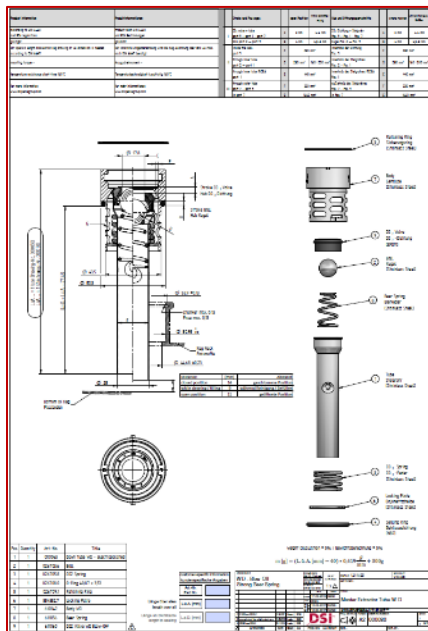
These are not often made available by the keg manufacturer, but should be requested, to help ensure that the spears you specify for your kegs will match perfectly with the necks used by the keg manufacturer.



3. Spear Technical Drawings

Spear Technical Drawings should be requested when purchasing new kegs, after specification for your choice of keg, neck, and spear System and manufacturer has been agreed with your new keg supplier. The keg manufacturer may refer you to the separate spear manufacturer for this drawing, and care must be taken to coordinate communications between all parties that you are getting the correct drawing, and the correct spears, based on the Item Code and formal Description of the spears. Also important is to insure that the spears you specify are fully compatible with the keg necks used by your keg manufacturer.

The spear technical drawing will include Item Code/Drawing Number; product description and basic information; critical dimensions of the spear’s neck interface; individual parts identification and raw materials used, possibly also special treatments of the parts during manufacture, such as electro-polishing; stroke depth(s) for valve function; and may include critical dimensions required for the neck itself. It may or may not also include the specified length of the spear for the kegs you are purchasing.



F. CONSIDERATIONS ON KEG / SPEAR MAINTENANCE AND REPAIR

Upon inspection of kegs inbound to your brewery from the market cycle, after segregating kegs for routine scheduled maintenance, or for repair upon discovery of damage or excessive wear... will you conduct the maintenance and repair

operations in-house, or send them out to a service provider for this work? Consideration of spear System for use in your kegs may be influenced by access (or lack of practical access) to a qualified service provider, access to the correct tools, parts and replacement spears. For example, in the US and Canada, it may be difficult or expensive to source tools and parts, or find a qualified service provider to repair A, G, or any other System than D System spears.