

Chapter 6 – D System - Keg and Spear Safety, Reliability, Product QA/QC Considerations

SAFETY STATEMENT – Micro Matic advises that normal brewery safety considerations should be standardized and applied to handling kegs, in all areas of brewery operations. This is most important for the technicians and packaging hall employees who may spend an entire shift handling kegs. PPE such as steel-toe work shoes or boots, face shields and/or safety glasses/goggles and gloves should be provided. Assisted lifting may be employed, either manual or mechanical. Only authorized and trained personnel should handle spear tools and work on kegs, etc. Your brewery EHS Manager or advisor, or Operations/Packaging Manager should ensure that relevant written SOPs and manuals addressing safety are available to all personnel who handle kegs.

A. GENERAL SAFETY – PPE, Pressure, Lifting, Stacking, Damaged, Tampering and other Abuse of Kegs

Micro Matic advises that usual safety considerations should be applied to handling kegs, in all cases. Steel-toe work shoes or boots, careful or assisted lifting, only authorized and trained personnel handling spear tools and working on kegs, etc.

Your brewery EHS Manager or advisor, or Operations/Packaging Manager should ensure that relevant written SOPs and manuals addressing safety, are available to all personnel who handle kegs.

Kegs are heavy pressure vessels that are very robust, safe and reliable – until they are not. It is important to have all personnel trained to recognize when a keg may no longer be fit for use due to damage, normal wear-and-tear, or tampering.

From time to time, kegs will be tampered-with by unauthorized persons, using improper tools and techniques to use (abuse) the kegs for their own purposes. Sometimes this will be visually evident externally, other times it will not. All brewery personnel must be trained to spot evidence of tampering and be vested with the authority and responsibility to quarantine kegs when such evidence is discovered (see Chapter 17.),)

Filled 50-liter and US ½ bbl kegs are too heavy for manual lifting by one person; smaller kegs can be lifted manually, but not repeatedly by one person through an entire shift! When manually filling kegs, set up kegs to be filled already positioned on pallets, or mandate a “buddy-system” lifting technique for moving freshly filled kegs from floor to pallet. Mechanical, vacuum-driven lifting devices are available.

Never allow full kegs to be dropped from any height, even down a skid ramp, as a part of normal procedure.

“Stackable” kegs, with bottom chimbs designed to interlock with the top chimb of the lower keg, may be stacked one-keg-on-top-of-another only, and then only for dispense storage purposes. Kegs should never be directly stacked for palletizing or transport.

Palletized kegs, single-layer, must be shrink-wrapped for transit.

When working on keg and spear repair, remember that the last liquid in that keg, likely under pressure, may not have been beer – it could be cleaning or sanitizing chemical solution, or worse if the keg has been misused in the field. Internal pressure must be safely reduced before any work can be attempted, and appropriate PPE in the form of eye and face protection should be worn when removing spears from kegs (see Chapter 17.)

B. OEM TOOLS AND PARTS

For reasons of safety and reliability, and to preserve any manufacturer’s warranty, Micro Matic and DSI strongly recommend using ONLY OEM (original manufacturer’s) parts in spears. Do not attempt to rebuild MM spears with DSI parts and tools; nor vice versa.

Likewise, never attempt to rebuild spears from any other manufacturer using tools and parts from MM or DSI. If you are uncertain about any spear you have in your kegs, send images to MM or DSI Technical Support for aid in positive identification of the spear and its manufacturer.

Further, Micro Matic and DSI have produced many sub-versions of each spear System design, and while spears may look identical at first glance, it's possible they are not the same, and may use different springs, CO2 valves, or other non-interchangeable internal parts. Some older Micro Matic spears still in use are now obsolete; modern tools and parts are no longer available to rebuild these spears.

C. SPEAR INTERCHANGEABILITY

In theory, keg necks installed in kegs should accept installation of spears from any manufacturer who have designed spears for installation in the subject neck. So, if the keg is fitted with a Micro Matic spear, that spear can be removed and replaced with a corresponding DSI spear – and vice versa.

Again, theoretically, this should be true with spears from any other supplier but be sure to verify and even test this in your own kegs before committing to purchasing replacement spears for your kegs.

Similarly, if a keg manufacturer claims to provide kegs fitted with a “US-type Two-ear/Drop-in neck” (aka Barnes neck), for example, these should be identical in every way to the necks in kegs from all other manufacturers making this claim. When purchasing newly manufactured kegs, technical drawings of kegs including critical dimensions of the necks installed should be requested. See Chapters 5 and 7 for greater detail regarding various keg necks.

But since slight variations in neck design have been observed in the market: buyer beware! Remember that the keg neck is, practically speaking, a permanent part of the keg you own or may be purchasing; replacing non-conforming necks in your kegs is not feasible.

D. SPEAR LIFESPAN RECOMMENDATIONS

Micro Matic recommends that kegs should be proactively maintained on a on a 5-7-years cycle depending on the environmental conditions and use/abuse to which your kegs are subjected. Rubber gaskets will age faster in sunny, hot climate; when kegs are mainly stored outside; when kegs are refilled frequently etc.. Rapid cycles in through the brewery and market resulting in many uses per year will degrade spear parts sooner than kegs that only come back to your brewery infrequently.

Therefore, a representative sampling of kegs should be pulled from service regularly, closely inspected, and observations recorded for future preventative maintenance scheduling and planning. Spears due for maintenance, or showing excessive wear or damage, should be replaced or rebuilt with new rubber parts, and new springs, or springs may be tested and reused if within manufacturer's specifications.

5–7-years cycle for preventative maintenance is a rough guideline, and kegs subjected to extremes of environment, usage and cycles through the brewery may need maintenance on a shorter cycle – possibly 4-5 years. Breweries that ID scan kegs in/out of the brewery, or passing through their packaging line, may choose to segregate kegs for preventative maintenance on a cycle-count basis. In this case, the number of cycles between preventative maintenance may range from 20-40, again based on environmental and usage factors.

E. MAXIMUM WORKING PRESSURE OF KEGS

In all cases, kegs will be marked with a Maximum Working Pressure rating, most commonly 60psig. This internal pressure should not be exceeded during Normal Service Conditions – not during manual or automated purging, washing, pressure-testing for leaks, filling via pump, or keg-conditioning (secondary fermentation), nor during dispense.

This puts a limit on the carbonation level of beverage that can be packaged in kegs. Champagne or other highly effervescent beverages cannot be effectively packaged and dispensed at the same high carbonation as is possible from bottles manufactured for this purpose. Reinforcing this pressure limitation of kegs is the fact that PRVs are required on dispense couplers in most regions; these are designed to release at or below 60psig of line pressure.

Likewise, kegs over-filled will be subjected to much higher internal pressure by hydraulic force if the liquid in the keg warms up. Don't over-fill kegs! (see Chapter XX, Section XX)

F. PRESSURE RELIEF FUNCTION OF SPEARS, KEG RUPTURE DISCS

Since 2015, both Micro Matic and DSI ball-type spears are designed to act as safety Pressure Relief Valve (PRV) for the keg, so long as it is not connected with a coupler. The design of the CO₂ valves allows for extreme over-pressurization of the keg to be relieved by controlled failure of the rubber sealing edge of the CO₂ valve.

Micro Matic D System valves release from the beer-side, at the interface with the ball – and deformation of the rubber and color-ring indicates prior over-pressurization. When observed, kegs showing this evidence of abuse should be pulled from service for spear rebuild or replacement.

DSI D System valves release from the CO₂ head space-side, at the interface with the spear body. Rubber deformation will likewise be observable, and these kegs should be pulled from service for spear rebuild or replacement.

In both cases, the keg may still hold some pressure, may be washable and fillable, but should not be until the spear has been rebuilt or replaced, and the keg itself has been inspected for deformation or other stress or damage! Close inspection of all inbound kegs to identify and quarantine these kegs is important to avoid various problems for beer quality and reliable function of the keg.

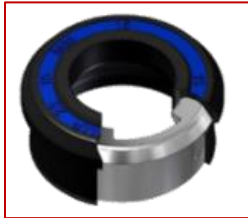
D System valve pressure-relief safety features in spears from both Micro Matic and DSI are intended to reliably prevent catastrophic, explosive failure of the keg, most commonly caused by fire and generation of steam in the keg. When severe over-pressurization is caused by hydraulic pressure of freezing or expansion of liquid in an over-filled keg, explosive failure of the keg is not a major safety concern. In these cases, both Micro Matic and DSI D System spears will generally still fail safely, but not always before the keg is deformed or ruptured.



Two types of D System spear exist in the market: Ball-type and Poppet-type, the latter being manufactured by Micro Matic only. Internal parts are entirely non-interchangeable between Micro Matic ball- and poppet-type spears. Bodies, down tubes, CO2 valves, beer valves and springs are all different, and must not be intermingled when rebuilding spears.

1. D System Ball-type

Micro Matic D System ball-type spears manufactured after 2015, and marked with a color ring date code will provide pressure relief for the keg in the event of severe over-pressurization. The valve will “fail safely” by deformation and tearing of the rubber around the ball interface with the CO2 valve’s specially-designed embedded metal insert. This allows gas (or liquid) to escape the keg at ~30 bar of steam pressure, or ~50 bar of hydraulic pressure.



DSI D System ball-type spears manufactured after 2015 will provide pressure relief for the keg in the event of severe over-pressurization. The valve will “fail safely” by deformation of the rubber around the specially-designed metal insert embedded in the CO2 valve. This allows gas (or liquid) to escape from the head space in the keg at 30 bar of steam pressure, or ~50 bar of hydraulic pressure.



2. D System Poppet-type:

Micro Matic D System poppet-type spears were manufactured from mid-1980’s forward and were designed as a safety pressure-relief valve design alternative to the existing ball-type spears. Originally, D System ball-type spears

were designed to survive the keg in cases of extreme over-pressurization – preventing ejection of ball and CO2 valve was the principal design intent.

The combination of poppet-type beer valve and specialized CO2 valve will provide pressure relief for the keg in the event of severe over-pressurization. The valve will “fail safely” by eruption of the stainless steel “poppet” beer valve (hollow dome beer valve with side vent ports) through and above the CO2 valve, while not ejecting. This exposes vent ports in the sides of the poppet, allowing pressurized gas (or liquid) to escape the keg at ~35 bar of steam pressure, or ~50 bar of hydraulic pressure.



3. Keg Rupture Discs

An additional pressure-relief safety feature of some kegs is found on the bottom dome: a round carving, partway through the metal which will serve as a rupture disc. These typically fail due to higher pressure than needed to safely vent the keg through MM or DSI CO2 valves: around 35-45 bar.

Controlled pressure relief through safe failure of the Micro Matic or DSI CO2 valve makes necessary rebuilding the spear for low cost, while controlled, safe failure of the keg’s rupture disc means the keg must be scrapped.

