

# Mismatched Scuba Valves to Cylinder Outlets

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The valve on the left is suitable for 3/4-inch NPSM cylinder threads. The valve on the right will erroneously thread into a 3/4-inch NPSM cylinder neck for about three to five threads before it begins to bind.

A VALVE-TO-CYLINDER mismatch recently resulted in a deadly outcome in Europe. This issue is preventable with formal, function-specific training and a basic understanding of scuba tank valves and cylinder threads.

## WHY DOES THIS HAPPEN?

In the U.S., the most common parallel cylinder neck thread today is the 3/4-inch National Pipe Straight Mechanical (NPSM) with 14 threads per inch (TPI). The most common metric cylinder neck thread is the M25 x 2 – ISO with 12.7 TPI, which is often erroneously called the metric equivalent to a 3/4-inch NPSM.

While a valve with a M25 thread may initially appear to fit a 3/4-inch NPSM cylinder neck, it will necessitate more force to tighten and likely not seal correctly, requiring significant overtightening to achieve a seal. This can have — and has had — disastrous consequences. To further complicate matters, an M25 threaded valve will also appear to fit a 3/4-inch British Standard Pipe (BSP) cylinder, but only after damaging the threads.

## HOW DID WE GET HERE?

Prior to 1958, the majority of U.S. scuba cylinders were 1/2-inch National Gas Tapered (NGT) threads. A gradual transitioning to the parallel 3/4-inch NPSM for

scuba followed and around 1970 was accepted as the standard. In 2006 the U.S. government accepted International Standards Organization (ISO) cylinders for use in the United States and its territories. ISO metric threaded cylinders must have the outlet thread stamped on the crown (e.g., M25 x 2).

The Compressed Gas Association (CGA) recommends that cylinders certified to the U.S. Department of Transportation (DOT) specification be stamped with a CGA code, an often omitted or misunderstood recommendation. The CGA stamp marking for the 3/4-inch NPSM thread is SP12. The CGA equivalent for the ISO M25 x 2 thread is 25P. After 2009 CGA has required cylinder valves to also be stamped with the same marking.

A prudent scuba technician would use a thread gauge or thread checker to verify threads when no markings are present.

## OUTCOME

Due to the wide acceptance of ISO metric cylinders, there has been an increase in mismatched valve-to-cylinder connections. An M25 x 2 valve will start to thread into a 3/4-inch NPSM about three to five threads

and then begin to bind. Inexperienced technicians might assume this is normal and use a wrench to continue installing the valve, thus cross-threading it. The difference in thread design of the metric valve causes cross-threading into the U.S. threaded cylinder outlet with potentially catastrophic consequences.

## ESSENTIAL GUIDANCE

One should **never** force an O-ring sealed parallel threaded valve into a cylinder. Hand tightening is all that is needed to install the valve, whether U.S. or metric, to where the valve is touching the top face of the cylinder. After hand installation of the valve, one must apply torque to compress the O-ring, ensure a robust seal, and prevent inadvertent loosening.

Torque is a unit of measure defined as pound feet force (lb<sub>f</sub>·ft) or Newton meters (N·m). The torque specification for scuba cylinders is usually 50 lb<sub>f</sub>·ft or 67.5 N·m.

A prudent scuba technician should attend formal training to better understand all aspects of cylinder and valve connections and the tools used to ensure that the threads are correct as well as to ensure an understanding of threads, O-rings, lubricants, and torque specifications. **AD**