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# TDI Visual Inspection Procedures

Ban's Technical Diving

# Introduction

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## Intro, Paperwork, Schedule

# Course overview

Promote safety in the care and maintenance of high-pressure scuba cylinders.

Train in proper handling, filling and inspection techniques.

Identification of various defective conditions.

# Paperwork

Liability Release and Express Assumption of Risk

Medical Statement

# Safe handling of cylinders

# Safe handling of cylinders

## Testing Standards

# Testing Standards

USA:

- DOT: Department of Transport
- CGA: Compressed Gas Association

Canada:

- TC: Transport Canada

Europe:

- BS: British Standards
- EN: European Nation

Thailand:

- TIS: Thai Industrial Standards

# DOT: Department of Transport

Steel cylinders:

- CGA C-6
  Standard for Visual Inspection of Steel Compressed Gas Cylinders

Aluminium cylinders:

- CGA C-6.1
  Standard for Visual Inspection of High Pressure Aluminum Alloy Compressed Gas Cylinders

Composite cylinders:

- CGA C-6.2
  Standard for Visual Inspection and Requalification of Fiber Reinforced High Pressure Cylinders

# Europe

Steel cylinders:

- BS EN 1968
  Transportable gas cylinders. Periodic inspection and testing of seamless steel gas cylinders

Aluminium cylinders:

- BS EN 1802
  Transportable gas cylinders. Periodic inspection and testing of seamless aluminium alloy gas cylinders

Composite cylinders:

- BS EN ISO 11623
  Transportable gas cylinders. Periodic inspection and testing of composite gas cylinders

# Europe:

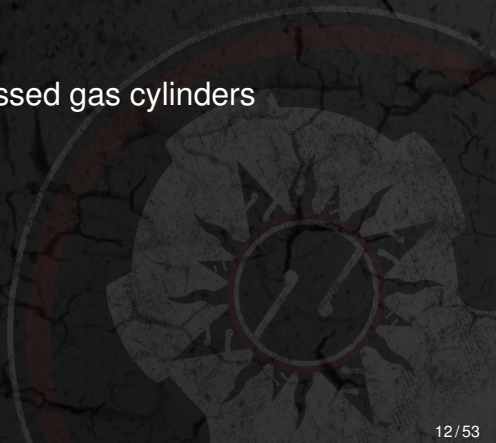
Summary of the standards:

- Hydrostatic test: 5 years
- Visual inspection: 2 1/2 years
- Stamping: YYYY/MM
- Content label: BS EN ISO 7225 (Air, Nitrox, Trimix - Compressed Gas - Oxidizing)
- Color coding: EN1089-3 (For "Diver at work")

# Thailand

All cylinders:

- TIS 358-2551
  Use and maintenance of compressed gas cylinders



# Safe handling of cylinders

## Chapter review

# Chapter 2: review

1. *What is the recommended fill rate for scuba cylinders?*
   300-600 psi/min or 20-40 bar/min

2. *If you suspect that your customer put his own EOI sticker on his cylinder, what can you do about it?*
   In any doubt, tell the customer and inspect the cylinder

3. *Can you stamp a 3AL over an SP6498 that the hydro people forgot to do?*
   No, it can only be done by an hydro facility.

# Chapter 2: review

4. *Describe the appearance of an approved burst disc as well as two exemple of an unapproved one.*
   Approved: Vent holes in the side of the assembly.
   Unapproved: single hole in the end or no hole

5. *An EOI sticker applied to a cylinder within the past year is ample evidence to authorize filling?*
   No. The sticker is in itself not legal justification. The operator is responsible for assuring that the cylinder is safe to fill.

6. *As an inspector, what can you tell by the marking in the photograph below?* Not safe to fill.
   SP6498: Need to be stamped 3AL over
   9 $\Uparrow$ 74: Hydro over due.

# Tools

# Tools

## Valve

# Removing the handle

## Tank knob screwdriver

# Removing the valve

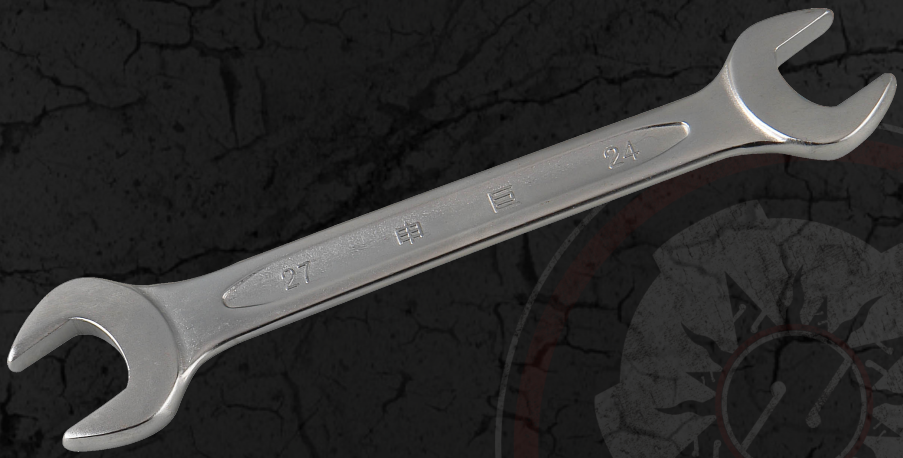
Valve removing tool (DIN):

# Removing the valve

Adjustable Wrench:

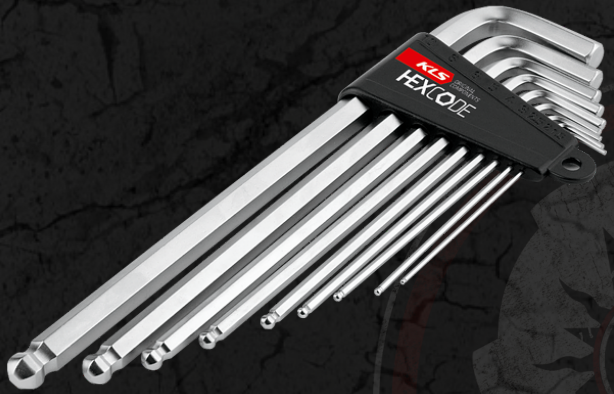
# Valve inspection

Various set of wrench, depending of the manufacturer:



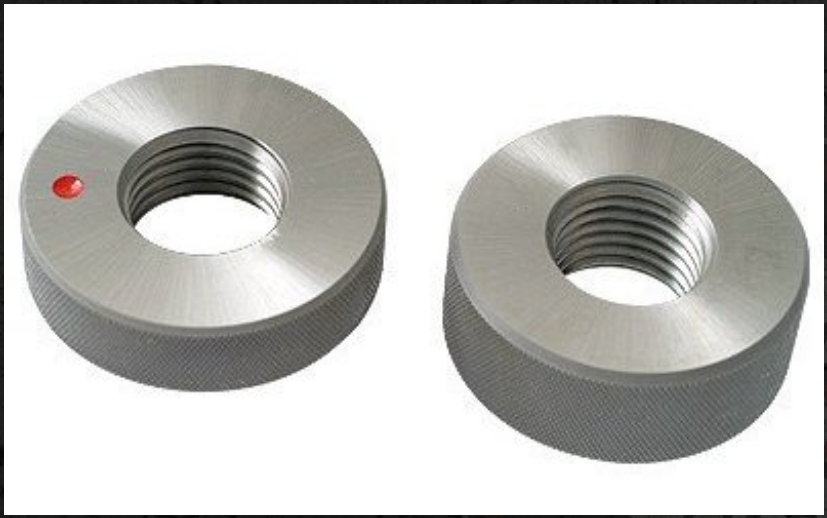
# Valve inspection

Set of allen key (dip tube):



# Valve inspection

Go-NoGo gauge:



# Tools

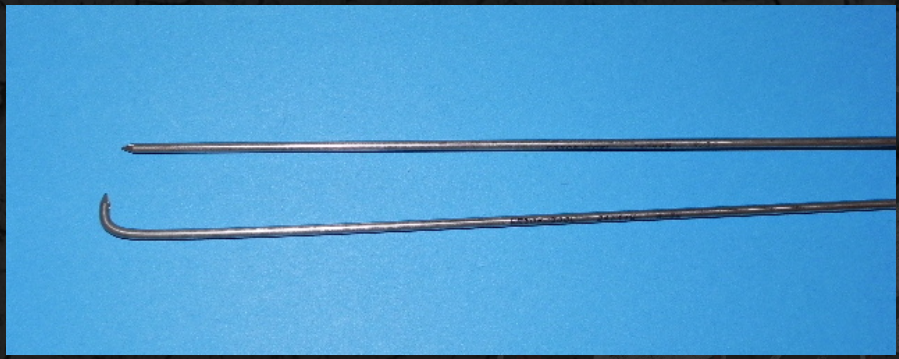
## Tank Inspection

# Tank Inspection

Bright light:

# Tank Inspection

Pit gauge:



# Neck Inspection

Dental mirror:

# Neck Inspection

Opti-viewer:

# Neck Inspection

Go-NoGo gauge:

# Cleaning

Brass or nylon brushes:

# Procedures

Identification Preparation External visual inspection Internal visual inspection Neck and threads Pressure test Inspection of valve Final

# Visual inspection

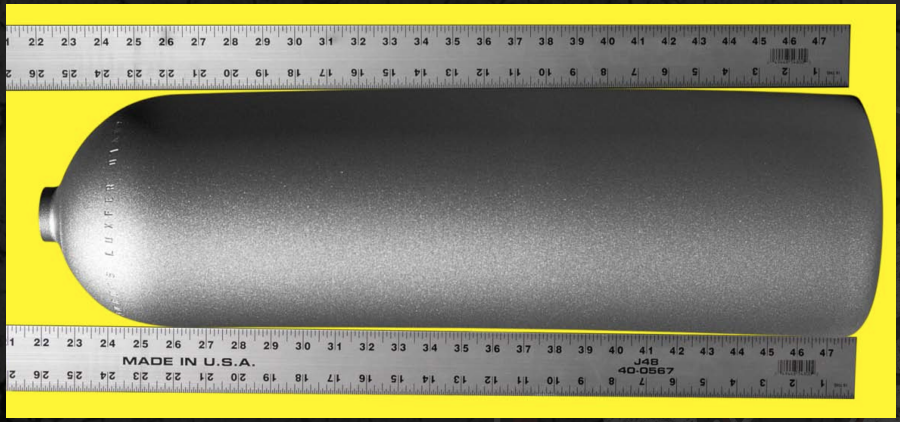
# Cylinder Inspection

# Cylinder Inspection

## Exterior

# Bow

Slight curve in the sidewall of a cylinder. Not dangerous and does not affect cylinder performance. Commonly know as "banana shape"



# Bulges

Visible swelling of the cylinder. Extremely rare and dangerous condition.

# Cuts and digs

Defect that are indicated by removed or upset metal caused by contact with a sharp object.

# Dents

Deformation of the cylinder caused by a blunt object so that the metail is relocated and the wall thickness is not reduced.

# Fire damage

Excessive general or localized heating of a cylinder.

# Cylinder Inspection

## Interior

# Crack

Split or rift in the metal.

# Fold and valley

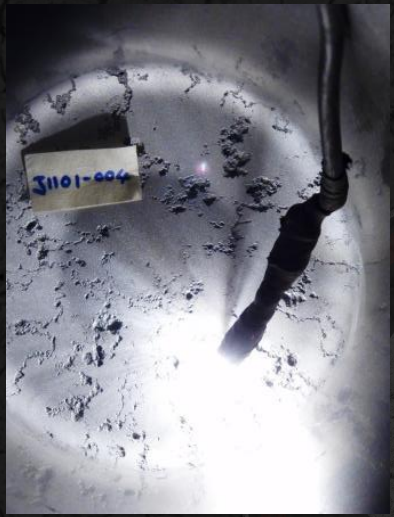
Sharp visual groove (fold) or shallow and smooth depression (valley), usually found in the crown area

# General corrosion and rust

Uniform loss of metal reducing the wall thickness

# Corrosion pits

Corrosion forming isolated craters, without significant alignment



# Cylinder Inspection

## Chapter review

# Chapter 4: review

1. *What is corrsion in an aluminium cylinder and how can you identify it?*
   Oxydation of the metal or damage caused by galvanic corrosion. Usually appears as a white crust or dust.

2. *What is corrosion in a steel cylinder called?*
   Rust

3. *What causes galvanic corrosion?*
   Electrochemical process in which one metal corrodes preferentially to another when both metals are in electrical contact, in the presence of an electrolyte (salt water).

# Chapter 4: review

4. *What causes a tool stop mark and why does it causes us concern in the visual test procedure?*
   The stop mark is caused by a tool stopping in its process, and starting again (threading tap). It can easily be mistaken for a crack.

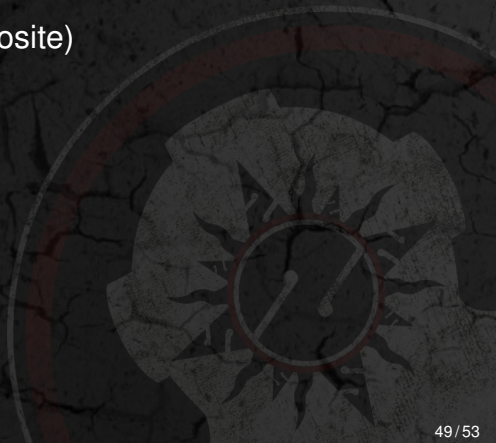
5. *Explain the difference between broadspread and line corrosion*
   Broadspread: General corrosion over a wide area.
   Line corrosion: String of pits arranged in somewhat of a line.

# Rejection and condemnation

# Criteras

Depend on:

- Type of cylinder (alu, steel, composite)
- Law in the country
- Manufacturer recommendations



# Exterior

| | |
|---|---|
| Bow | Not an issue |
| Bulges | Condemn all of them |
| Cuts & digs | Any cut deeper than $1/32''$ (0.76$mm$).<br>15% of the wall thickness if known |
| Dents | Any dent deeper than $1/16''$ (1.53$mm$)<br>Diameter of less than 2'' (50.8$mm$) |
| Fire | More than 350°$F$ |

# Other services

# Other services

## Valve inspection

# Other services

## Cylinder cleaning