The Bulletin

sanas
South African National Accreditation System

Newsletter of the South African National Accreditation System

Issue 28, October 2016

INSPECTION FOCUS ON:
INSPECTION OF GAS CYLINDERS AND OCCUPATIONAL HYGIENE REGULATIONS

BY LINDA GRUNDLINGH

1. Occupational Hygiene Regulations:

1.1 Noise-Induced Hearing Loss Regulations, Government Notice No. R 307 of 07 March 2003:

a. Noise dosimetry is excluded from SANAS accreditation and should be indicated as such in reports generated by accredited Occupational Hygiene Inspection Bodies (AIAs)

b. Only Area Monitoring is legislated - until this changes in the Regulation, Area Monitoring results shall be identified as being accredited. It's only noise dosimetry that is excluded from SANAS accreditation and therefore noise dosimetry results shall be identified as being non-accredited.

c. This does not mean that AIAs should stop providing the service as the results provide customers with valuable information that can be used when implementing hearing conservation programmes.

1.2 Regulations for Hazardous Chemical Substances (HCS), Government Notice No. R 1179 of 25 August 1995:

a. Static HCS samples are excluded from SANAS accreditation and should be indicated as such in reports generated by accredited Occupational Hygiene Inspection Bodies (AIAs).

b. Only personal sampling is legislated – until this changes in the Regulation, static sample results shall be identified as being non-accredited.

c. Static sampling may be beneficial for AIAs and their customers and they may choose to provide this service, although not accredited.

2. Testing of Gas Cylinders

Gas Cylinders are inspected by SANAS accredited Gas Test Stations. During SANAS assessments we identified the need to clarify some technical issues for the benefit of our Gas Test Stations and the users of Gas Cylinders. The following topics are covered:

2.1 Interpretation of Gas Cylinder Shoulder Stamp Markings

There are many stamp markings located on gas cylinders and in the vast majority of cases these are on the cylinder shoulder for seamless steel and aluminium alloy cylinders or the valve guard for cylinders of a welded construction. Some cylinders of a welded construction may have markings on the footring of the cylinder. Composite cylinders typically have the markings

(continued on page 2)

on a label attached to the cylinder. Markings can also be found on the base of cylinders however such markings usually relate to the material batch information. These marks are rarely required to be interpreted by a gas test station.

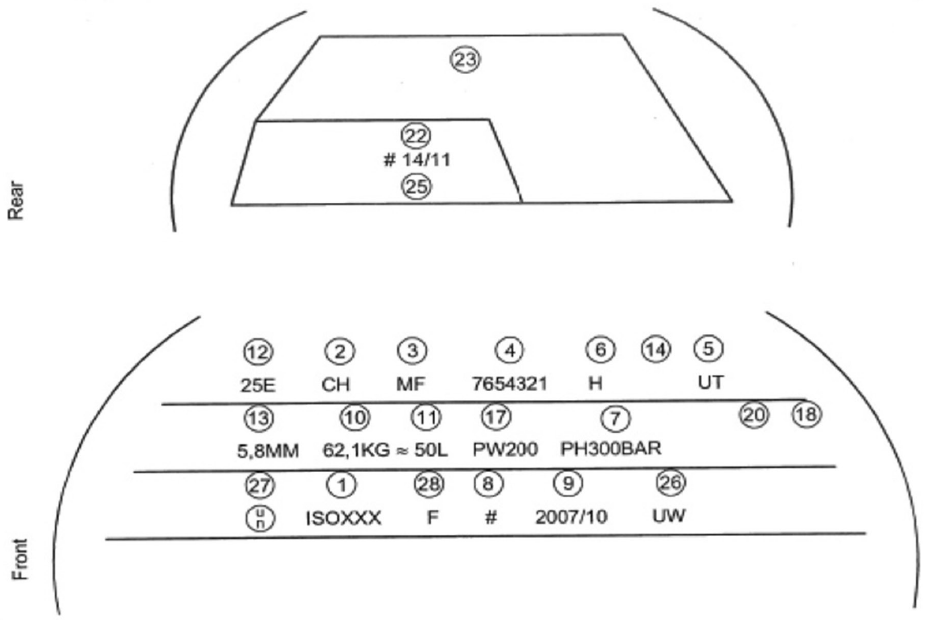
Since the year 2000, Industrial and Medical gas cylinders manufactured to ISO standards will have their stamp markings laid out on the cylinder shoulder in a sequence as defined in ISO 13769.

Industrial gas cylinders manufactured to the American DOT or Canadian ICC standards will be marked according to the respective DOT or ICC manufacturing standard for example DOT 3AA.

The markings on gas cylinders manufactured to other standards will be marked according to the requirements of the individual standard. In some cases there is no defined layout which makes the interpretation of the markings more complicated.

When in doubt it is always best to consult the manufacturer of the cylinder.

Below is an example of a stamp marking layout for compressed gas cylinders taken from ISO 13769.



Key

1 standard
2 country of manufacture
3 manufacturer's identification
4 manufacturing serial number
5 stamp for non-destructive examination (if applicable)
6 identification of steel compatibility (if applicable)
7 test pressure
8 inspection stamp
9 initial test date (year/month)
10 empty weight
11 water capacity
12 identification of cylinder thread
13 minimum guaranteed wall thickness
14 identification of aluminium alloy (if applicable)
15 —
16 —
17 working pressure
18 maximum permissible filling weight (if filled by weight)
19 —
20 tare weight
21 —
22 inspection stamp and date of periodic inspection (year/month)
23 space for additional optional markings or for application of labels
24 —
25 service life for composite cylinders
26 underwater use of composite cylinders
27 international mark(s)
28 country of approval for stamp mark No. 27

2.2 Cylinder Neck Threads

Cylinder neck threads are detailed in table 11 of SANS 10019.

It is to be noted that the listed thread specifications only shows those in use for cylinders manufactured to a current ISO cylinder design standard.

Up until about 2006 it was not a requirement to stamp the cylinder neck thread details on the cylinder. Gas Test Stations will be aware that there are therefore many cylinders in circulation that do not have the thread details stamped on the cylinder.

(continued on page 3)

(continued from page 2)

This does pose an identification problem when carrying out the thread inspection as a required part of the inspection and test procedures.

Cylinder neck threads are either a tapered thread or a parallel thread. The type of thread used is determined according to the cylinder type. Typically seamless steel gas cylinders have a tapered thread, seamless aluminium gas cylinders most commonly have a parallel thread and welded steel gas cylinders a tapered thread.

2.2.1 An exception to the above is diving (SCUBA) cylinders which have a parallel thread irrespective of the cylinder material. Another point regarding diving cylinders is that whilst the most common thread is M25 x2 there may be other thread forms in use depending on the source of manufacture or design specification. Typical of these would be ¾ NPS or 7/8 UNF – to be noted is that the ¾ NPS thread is greater in diameter than the 7/8 UNF thread.

2.2.2 Table 11 in SANS 10019. is based on the ISO cylinder design standards. There are many cylinders in use in South Africa which have been manufactured to the American DOT regulations which do not follow the same neck thread specification used in the ISO or European cylinder design standards. The most common thread on DOT cylinders would be ¾ NGT-14.

Extra care is required when establishing the actual neck thread used on cylinders to be inspected to make sure that the thread is checked using the correct thread gauge for the cylinder in question.

2.2.3 A specific point to note is that there are two taper thread specifications in use where the diameter is almost identical and the thread pitch is identical. These are 25E and ¾ NGT-14.

Whilst the thread pitch on both the indicated threads is 14 TPI, the thread form angle on the 25E threads is 55° whereas that on the ¾ NGT-14 thread is 60°.

A further difference between the 25E and ¾ NGT-14 thread forms is that the 25E thread profile is cut at 90° to the taper whereas the ¾ NGT thread profile is cut at 90° to the central axis of the thread.

Of critical importance however is that the thread taper is completely different.

25E threads have a taper angle of 3 degrees 26 minutes per side- a ratio of 3 in 25 on diameter.

¾ NGT-14 threads have a taper angle of 1 degree 47 minutes per side- a ratio of 1 in 16 on diameter.

It is obvious from the above that it is not possible to use a 25E thread gauge to check a ¾ NGT-14 thread or vice versa.

As the 25E thread has a greater taper angle than the ¾ NGT-14 thread, a 25E thread gauge whilst appearing to fit correctly at the top of the thread will be quite loose at the bottom.

Conversely a ¾ NGT-14 thread gauge whilst appearing to fit correctly at the bottom of the thread will be quite loose at the top.

2.3 Thread Gauges

There are three common types of thread gauges used to check cylinder threads. These are:

a) Threaded plug gauges
b) Plain plug gauges
c) Thread pitch gauges

2.3.1 Threaded Plug gauges

These have a full form male thread to be screwed into the cylinder neck. Typically the gauges would be double ended with one end being the GO gauge and the other being the NO-GO gauge.

The gauges must be of hardened steel with a ground thread. The gauge must be permanently marked with the thread identification and the serial number of the gauge.

This type of gauge will be able to check if the outside and pitch diameters of the thread are within the specified tolerances.

It will not be able to indicate whether the root diameter is within tolerance.

This type is thread gauge is required to be calibrated to national or international standards and a calibration certificate for the gauge issued by an accredited calibration laboratory must be available. When purchased from an overseas supplier the

(continued on page 4)

(continued from page 3)

calibration certificate supplied with the gauge must be issued by a calibration laboratory accredited by an accreditation body that is a signatory to ILAC Mutual Recognition Agreement (MRA).

2.3.2 Plain Plug Gauges

These have no thread but as the name implies have a plain surface finish. For taper threads a typical plain plug gauge would have a step or a machined groove at the large end as a reference to indicate the GO and NO GO limits of acceptance.

The gauges must be of hardened steel. The gauge must be permanently marked with the thread identification and the serial number of the gauge.

This type of gauge will be able to check if the root diameter of the thread is within the specified tolerances.

It will not be able to indicate whether the outside or pitch diameters are within tolerance.

This type is thread gauge is required to be calibrated to national or international standards and a calibration certificate for the gauge issued by an appropriately accredited calibration laboratory must be available. When purchased from an overseas supplier the calibration certificate supplied with the gauge must be issued by a calibration laboratory appropriately accredited by an accreditation body that is a signatory to the ILAC Mutual Recognition Agreement (MRA).

2.3.3 Thread Pitch Gauges

These flat steel gauges have a row of teeth at various indicated pitches to enable the user to establish the pitch of the thread being checked. They are available for the 55° and 60° thread forms.

They are also useful when checking if the crest of the thread being checked has been excessively truncated due to damage or wear.

They cannot however be used to check the specific thread specification.

This type of gauge can be used to check external and internal thread forms.

2.4 Gas Cylinder Tare Weight vs Empty Gas Cylinder Weight

The following definitions use the term weight which can be read to have the same meaning as Mass.

When weighing and recording the weight of an empty gas cylinder we must be sure that we use the correct terminology as set out below.

We also need to ensure that the Raw Data sheet and all other pertinent documentation used by a Gas Cylinder Inspection Body makes use of the correct terminology in regards to Tare and Empty cylinder weight.

Here are the definitions taken from ISO 13769 for Compressed and Liquefiable gases including CO_2 Fire extinguishers.

There are additional Tare weight definitions for Acetylene gas cylinders which can be found in ISO 13769.

TARE WEIGHT: For cylinders for liquefied gases including Fire extinguishers and where regulation requires filling by weight for compressed gases. The tare weight in Kilograms is the sum of the empty weight, the mass of any coating (e.g. paint) used in service, the weight of the valve including the dip tube / syphon tube if fitted, the weight of any fixed valve guard and the weight of all other parts that are permanently attached (e.g. by clamping or bolting) to the cylinder when presented for filling.

For CO_2 Fire Extinguishers the Tare weight on the manufacturer's instruction label affixed on the Extinguisher excludes the weight of the horn, hose and CO_2 content.

The Total weight (Gross weight) of a CO_2 Fire Extinguisher as marked on the label will include the Tare weight + horn and the hose + filled weight of CO_2.

It is not common to find the Tare weight stamped on cylinders that are filled by pressure and temperature. The marking on these cylinders used for compressed gases will relate to the empty weight of the cylinder. This must not be confused with the Tare weight of the cylinder.

(continued on page 5)

(continued from page 4)

For cylinders for liquefied gases including CO_2 Fire Extinguishers where the tare of the cylinder differs from the stamped tare by more than the value shown in Table 1 in the respective Periodic Inspection and Testing Standard, (see SANS 1825 for a list of Periodic Inspection and Testing Standards) and it is not due to damage, the original tare shall be cancelled and the correct tare shall be marked in a durable and legible fashion (see ISO 13769) after approval by a competent person. The empty weight shall not be altered.

EMPTY WEIGHT: The weight of the cylinder in kilograms, including all integral parts (e.g. neckring, foot ring, etc.). This weight shall NOT include the weight of the valve, dip tube / syphon tube, valve cap or valve guard, any coating and in addition for CO_2 Fire Extinguishers the horn and hose are excluded.

For compressed gas cylinders filled by pressure and temperature when determining any loss of material from the empty cylinder shell, it is important that only the Empty cylinder weight is used in the calculation. As a recommendation a loss of more than 5% of the empty cylinder weight shall constitute a reject condition. The value of 5% comes from the 2001 version of SANS 10019.

The raw data record must include the Empty cylinder weight or the Tare weight (in accordance with ISO 13769) as stamped on the cylinder, together with the respective recorded weight from the scale used by the Gas Cylinder Inspection Body and any variation between the two weights.

2.5 Pressure Gauge Requirements Cylinder Proof Pressure Test Machine

PRESSURE GAUGES USED TO INDICATE THE PRESSURE ATTAINED INSIDE A GAS CYLINDER DURING THE HYDRAULIC TEST SHALL CONFORM TO THE REQUIREMENTS OF THE PERIODIC INSPECTION AND TEST STANDARD AS LISTED IN SANS 1825:2014 CLAUSE 4.1

For example SANS 6406 Gas cylinders – Seamless steel gas cylinders – Periodic inspection and testing.

The pressure gauges shall comply with clause 11.2.2.2 which states:

‘Pressure gauges shall be of Industrial Class 1 (± 1 % deviation from the end value) with a scale appropriate to the test pressure (e.g. EN 837-1 or EN 837-3).

They shall be checked for accuracy against a calibrated master gauge at regular intervals (at least once a month). The master gauge shall be calibrated in accordance with national requirements.

The pressure gauge shall be chosen so the test pressure is between approximately one-third and two-thirds of the value capable of being measured on the pressure gauge.

For example a gas cylinder with a test pressure 300 bar would require a pressure gauge with a minimum upper pressure 450 bar and preferably 600 bar.

ALSO

SANS 1825:2014 TABLE 3 Note ‘I’ stipulates the requirement for the pressure gauge to be a minimum 120 mm diameter. This will be changed in the next addition to 100 mm minimum diameter. DoL currently accepts the use of 100 mm or larger diameter pressure gauges.

General

As a recommendation the increments on the pressure gauge scale face should be in max 5 bar increments. This allows the operator of the hydraulic test machine (typically a Haskel pump) to best read and attain the required test pressure during the cylinder testing phase.

The pressure gauge should be located at a height and location that allows the operator to look directly at the pressure gauge at eye level, it is important to eliminate the parallax effect when reading the gauge. The allowable over pressure is small at 3% or 10 bar whichever is lower. As a result it is critical that the pressure gauge is large enough in physical size with the pressure increments sufficiently small to permit the operator to stop the Haskel pump at the required test pressure.

The use of more than one active pressure gauge while the cylinder is being hydraulically tested should be carefully assessed. No two pressure gauges will give the same exact reading.

(continued on page 6)

(continued from page 5)

2.6 Over Pressure Protection Devices

ALL THE CYLINDER INSPECTION AND TEST STANDARDS IN USE IN SOUTH AFRICA CONTAIN A REQUIREMENT THAT A SYSTEM CONTROL DEVICE MUST BE INSTALLED IN THE HYDRO TEST SYSTEM TO PREVENT CYLINDERS FROM BEING SUBJECTED TO A TEST PRESSURE IN EXCESS OF THE STAMPED TEST PRESSURE ON THE CYLINDER.

In addition the same standards include a clause indicating the test pressure tolerances that the installed system control device must be capable of maintaining.

This is an important safety requirement and is not optional.

A key element of any installed system control device is that it must be capable of controlling the maximum test pressure that any cylinder under test may be subjected to within the specified tolerances.

Any such system installed must be capable of accommodating the full range of test pressures the system needs to operate at depending on the cylinders being tested.

As an example, if the range of cylinders being tested is 200 bar, 230 bar and 250 bar, the system control device must be able to be set to address each of those test pressures. It does not meet the requirements if the system control device is permanently set at the highest figure as to do so would mean that the cylinders requiring a lower test pressure would not be protected by the safety device and could be subjected to a test pressure in excess of the allowable tolerances specified in the inspection and test standards.

There are several methods or types of equipment that may be employed in order to meet the requirements. The standards do not prescribe which of these are to be installed and used.

It is up to each gas test station to decide which is most suitable for their operation.

The specific clause references are indicated below.

SANS 6406 – seamless steel cylinders
Requirement: 11.2.2.5 Tolerances: 11.2.3.3

SANS 10461 – seamless aluminium cylinders
Requirement: 11.2.2.5
Tolerances: 11.2.3.3

SANS 10460 – welded steel cylinders (excluding LPG)
Requirement: 11.2.5
Tolerances: 11.3.3

SANS 1285 – LPG cylinders
Requirement: D.1.4.3
Tolerances: D.1.4.4(d)

BS EN 14769 – pressure drums
Requirement: 11.3.1.2.5
Tolerances: 11.3.1.3.3

ISO 11623 – composite cylinders
Requirement: There is no specific requirement in clause 10 of the standard but there is a statement that for the hydro test, ISO 6406 or ISO 10461 shall be used as appropriate.

EXAMPLES

The examples below explain how to interpret the pressure test limits as detailed in SANS 6406. As indicated above, similar requirements and principles of application apply to the other listed inspection and test standards.

Clause 11.3.3 this stipulates the cylinder test pressure shall not exceed 3% or 10 bar whichever is the lowest.

Example 1: A cylinder with a 250 bar test pressure

100% = 250 bar and 3% = 7,5 bar thus the 3% shall be applied as it is less than 10 bar.

Example 2: A cylinder with a 450 bar test pressure

100% = 450 bar and 3% = 13,5 bar thus the option of 10 bar shall be applied.

CONTACT INFORMATION

SANAS website: www.sanas.co.za | **Main Switchboard No:** +27 (0) 12 394-3760 | **General Fax No:** +27 (0) 12 394-0526 | **Physical Addresses: the dti** Campus, Block G, Ground Floor |77 Meintjies Street, Sunnyside, Pretoria | **SANAS Knowledge Transfer Centre:** 121 Muckleneuck Street Nieuw Muckleneuk | Pretoria | 0002 | Private Bag X23 | Sunnyside | Pretoria | 0132