Cylinder Identification: Adding Up the Clues

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Session Code Tu-J3

Lots of Clues

- Product Labels
- Shoulder markings and DOT labels
- Cylinder shape & design
- CGA Valve numbers
- Connection design
- Pressure relief devices
- Info from facility operator or locals
- NOT COLOR

DISCLAIMER

- Clues are helpful in cylinder identification in a facility that has used them for its operations or for sale
- Clues may not apply in case of mad scientists and meth labs

Labels – the easy way

DOT Labels


TOXIC
GAS
2

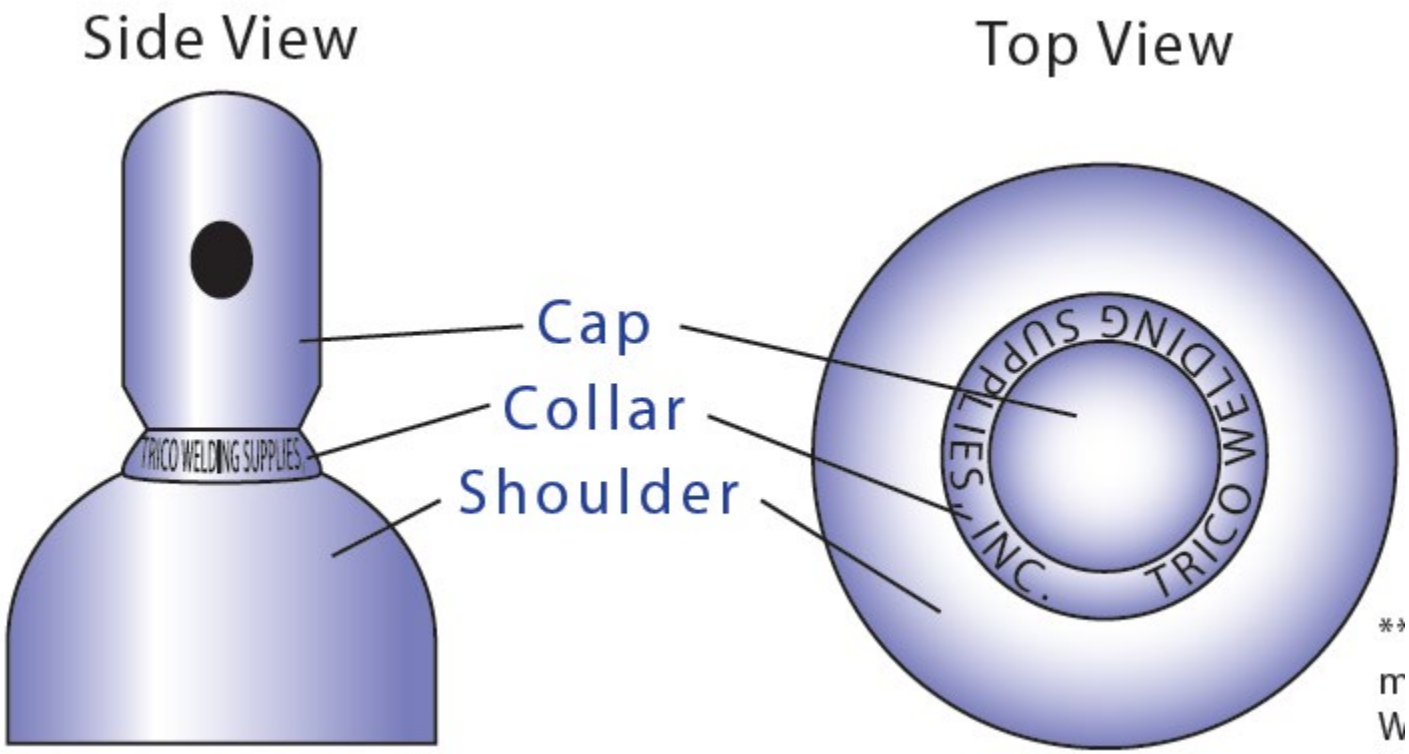

CORROSIVE
8


INHALATION
HAZARD
2

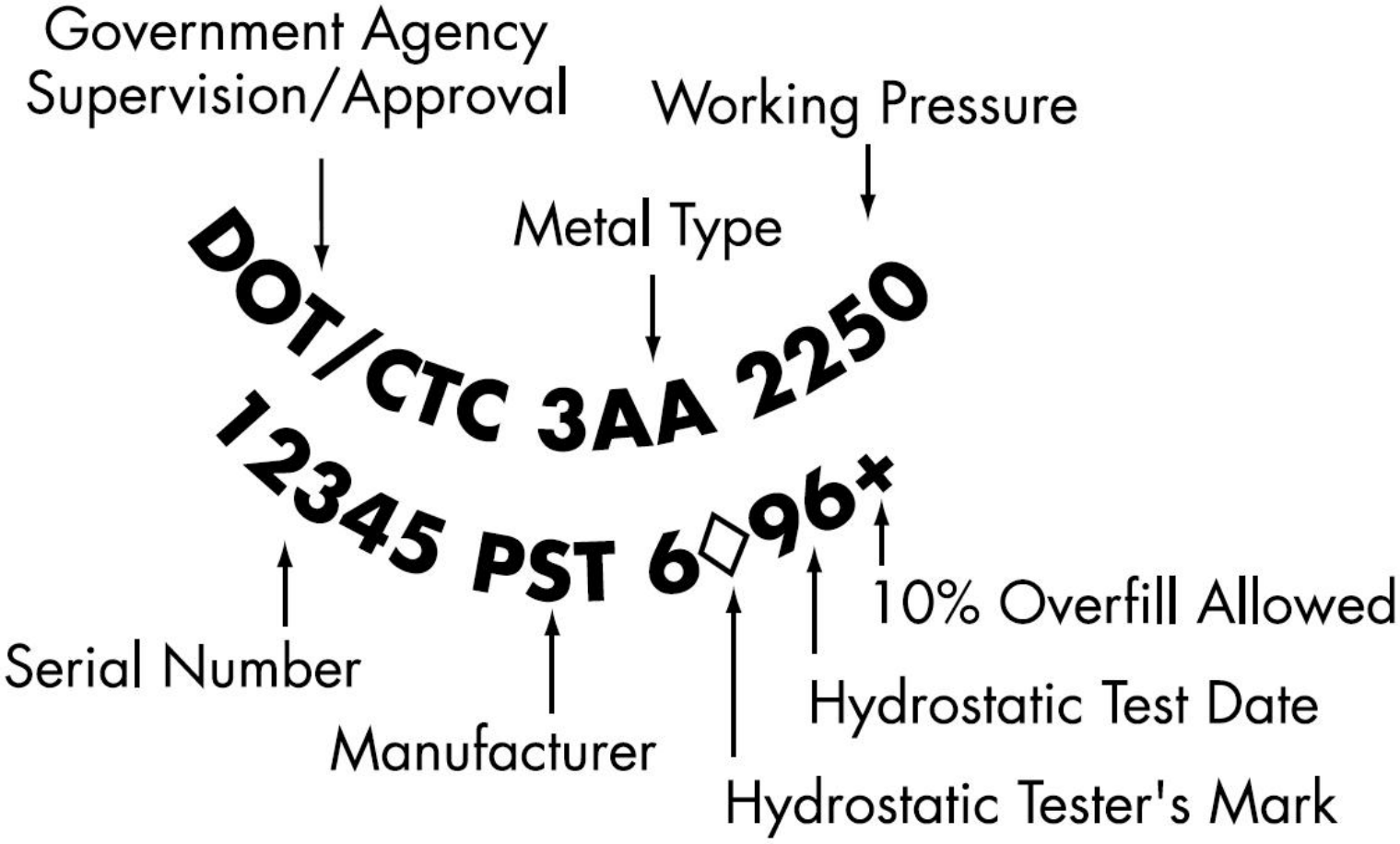

NON-FLAMMABLE
GAS
2


FLAMMABLE
GAS
2

Cylinder Features



Cylinder Shoulder Markings per 49 CFR 178



If you can read the markings…

Sometimes you can read them on an old, corroded cylinder…

and sometimes you just can't.

Cylinder Shape and Design - Low Pressure Cylinders

- Up to 500 psi
- Thin walled
- Welded seams
- Footrings
- Fatter and lighter than high pressure

Low Pressure Cylinders

Fat cylinders = low pressure

Footrings = low pressure

Cylinder Shape and Design – High Pressure Cylinders

- Up to 10,000 psi
- Seamless
- Tall and narrow
- Thick-walled – heavy even when empty
- Steel or aluminum

Cylinder Shape & Design – Cryogenic Containers

- 20-500 psi operating pressure
- Nitrogen, Oxygen, Argon, CO_2, Nitrous Oxide
- Relief valves vent pressure as temp increases

Cylinder Valves and Connections

- Compressed Gas Assocation (CGA) number on valve tells you a lot
- CGA plus 3 digits – e.g., CGA 540
- Number identifies shape and thread of inlet and outlet connections – where you attach to valve
- Indicates what gases might be inside
- Will sometimes tell you exact gas
- Will indicate characteristics: corrosive, flammable, inert, etc.

Handbook of Compressed Gases

- Produced by the Compressed Gas Association
- Very useful reference for cylinder work
- Info on valves, connections, pressure relief devices, cylinder markings, gas characteristics, individual gases, etc.
- Chapters on dozens of individual gases
- A bit expensive
- If you're doing a cylinder job, get one

Gases and Their CGA Numbers

Gas	CGA Valve Outlet & Conn. No. CGA/UHP CGA
Acetylene	510
Air, Breathing	346
Air, Industrial	590*
Allene	510**
Ammonia, Anhydrous	705**
Ammonia, Electronic	660/720
Argon	580*/718
Argon-3500 psig	680***
Argon-6000 psig	677
Arsine	350/632
Boron Trichloride	660**/634
Boron Trifluoride	330**/642

Link to Cylinder Resources

CGA Valve Examples

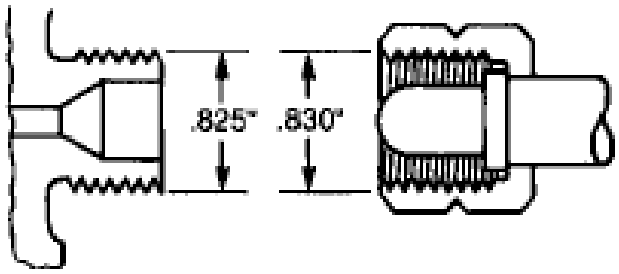
CGA 580, for inert gases only: nitrogen, helium, argon, etc.
Interior threading on outlet connector

CGA 350, for flammable gases: hydrogen, methane, silane, etc.
Exterior threading on outlet connector

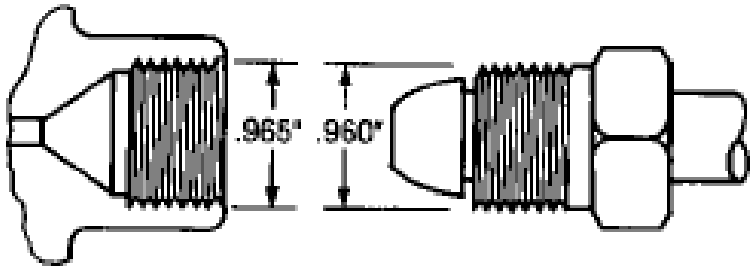
Outlet Connections

- Same valves as previous slide
- Flammable gas valve – 350 – top diagram
- Inert gas valve – 580 – bottom diagram

CGA 350
.825"-14 NGO-LH-EXT (ROUND NIPPLE)



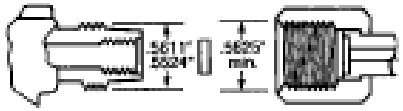
CGA 580
.965"-14 NGO-RH-INT



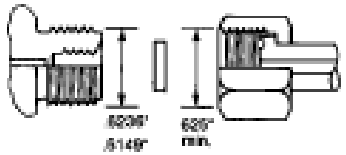
CGA 160
1/8"-27 NGT-RH-INT

CGA 165
.4375"-20 UNF-2A-EXT (7/16" SAE FLARE)

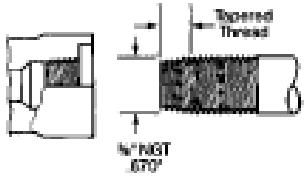
CGA 170
.5625"-18 UNF-2A-RH-EXT



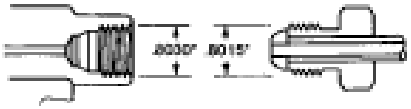
CGA 180
.625"-18 UNF-2A-RH-EXT



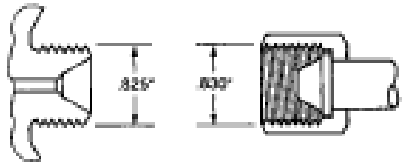
CGA 240
3/8"-18 NGT-RH-INT



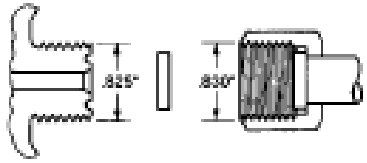
CGA 296
.803"-14 UNS-2B-RH-INT
(BULLET NIPPLE)



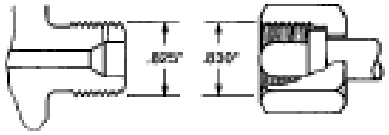
CGA 300
.825"-14 NGO-RH-EXT (CONICAL NIPPLE)



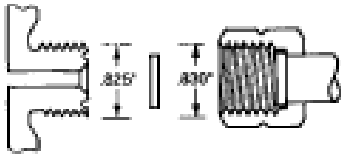
CGA 320
.825"-14 NGO-RH-EXT (FLAT NIPPLE)



CGA 326
.825"-14 NGO-RH-EXT
(SMALL ROUND NIPPLE)

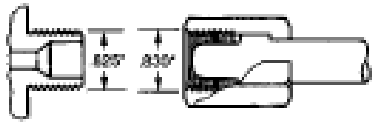


CGA 330
.825"-14 NGO-LH-EXT (FLAT NIPPLE)

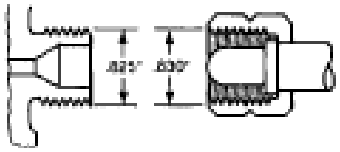


CGA 346
.825"-14 NGO-RH-EXT
(LARGE ROUND NIPPLE)

CGA 347
.825"-14 NGO-RH-EXT
(LONG ROUND NIPPLE)



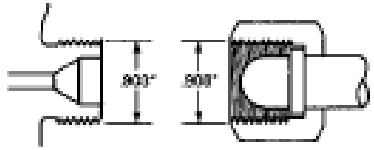
CGA 350
.825"-14 NGO-LH-EXT (ROUND NIPPLE)



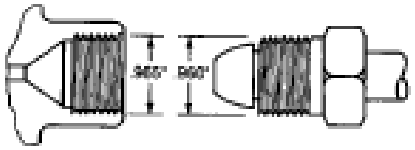
CGA 600
.885"-14 NGO-RH-INT (BULLET NIPPLE)

CGA 610
.885"-14 NGO-LH-INT

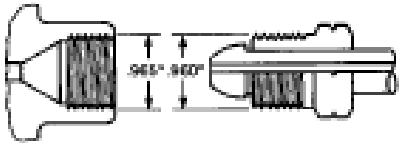
CGA 540
.903"-14 NGO-RH-EXT



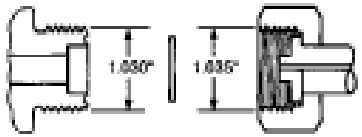
CGA 580
.965"-14 NGO-RH-INT



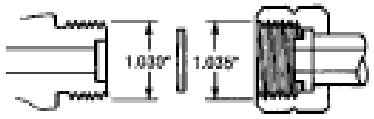
CGA 590
.965"-14 NGO-LH-INT



CGA 660
1.030"-14 NGO-RH-EXT
(FACE WASHER)



CGA 670
1.030"-14 NGO-LH-EXT
(FACE WASHER)



Pressure Relief Devices (PRDs)

- A little trickier to use as an identifier
- PRD types have CGA numbers too – e.g., CG-1
- Some PRDs are activated by pressure, some by heat, some by both
- Different gases have different requirements for pressure relief devices – per CGA
- CGA Table of PRDs as a reference to sort out what you might have

Pressure Relief Device Requirements

- Some gases must have a certain PRD – acetylene has to have a CG-3
- Some gases have a few options of what type to use – e.g., nitrogen, natural gas
- Some gases are prohibited from having PRDs – arsine, fluorine, hydrogen cyanide, others
- Some gases aren't required to have PRDs

TABLE 8-2–ALPHABETICAL LIST OF GASES AND DEVICES ASSIGNED (SEE NOTES)

Note 1: When more than one type of device is listed in Table 8-2 for a particular gas, only one type is required.

Note 2: The symbols used in Table 8-2 are defined at the end of the table. Interpretation of these symbols is necessary to determine the type of relief device to be used with the specific lading.

Note 3: Type CG-4 and type CG-5 devices are not acceptable for 110% fill; see 49 CFR 173.302(c).

Note 4: For certain gases, use of pressure relief devices is not permitted. For such gases the pressure relief device column is marked "Prohibited"; see 49 CFR 173.40.

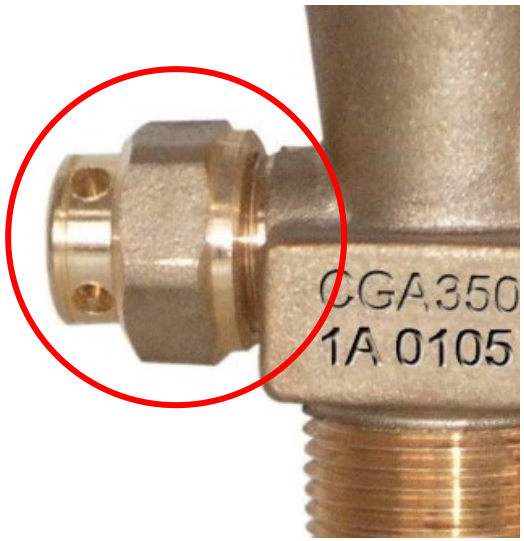
Note 5: "None required" does not remove the possibility that a pressure relief device may be used.

Note 6: When used in direct medical service, CG-1 devices for Carbon Dioxide, Carbon Dioxide/Nitrous Oxide Mixture (Liquid), Cyclopropane, Nitrous Oxide shall be of the projecting type.

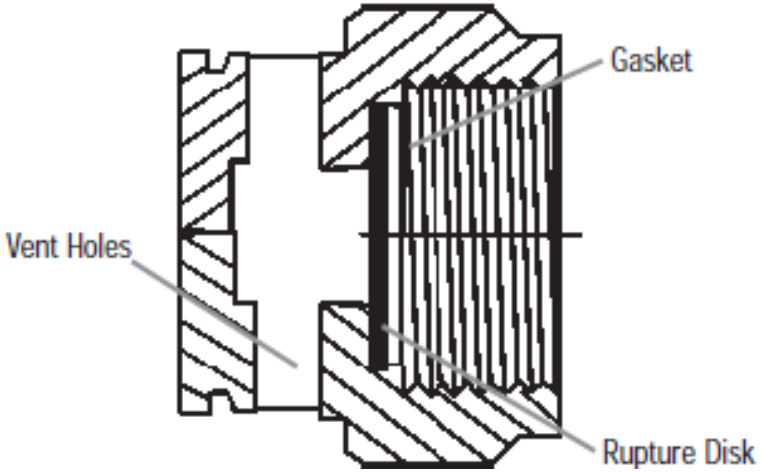
		GASES								
FTSC Code	LC_{50} PPM	Name of Gas	CG-1 Disk	CG-2 165 °F	CG-3 212 °F	CG-4 165 °F w/Disk	CG-5 212 °F w/Disk	CG-7 RV	CG-8 Disk/RV	CG-9 217 °F
5130		Acetylene			F					
1060		Air	A		KB	B	B	K		
2100		Allene		M				A		
		Allylene (See Methylacetylene)								
2102		Ammonia, Anhydrous (over 165lb) (None required if under 165lb)		E						
0303		Antimony Pentafluoride	PROHIBITED							
0160		Argon	A			B	B	K		
2300	20	Arsine	PROHIBITED							

Rupture Disk: CG-1

- Also called a burst disk
- Disk bursts when it reaches a set pressure
- Burst pressure stamped on cap

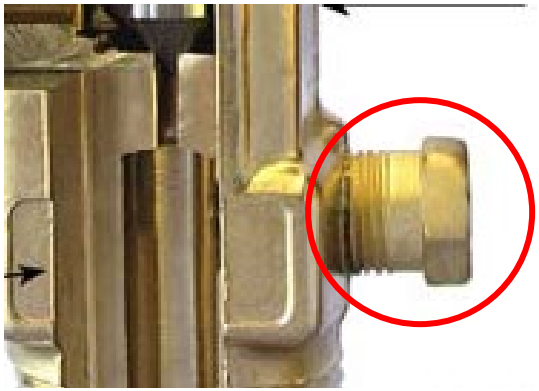


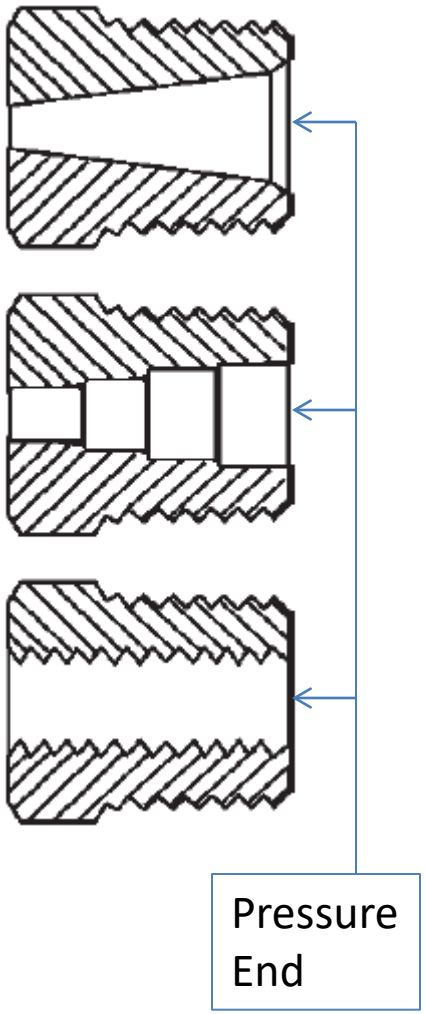
- Prevents cylinder rupture due to fire or overfilling
- Does not reclose – dumps entire cylinder



Fusible Plugs: CG-2, CG-3

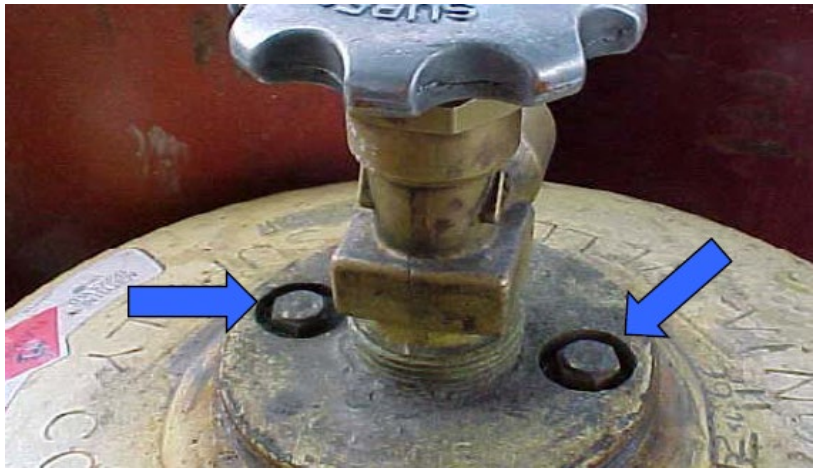
- Designed to melt at set temperatures
- 165° F for CG-2 – LPG
- 212° F for CG-3 – acetylene
- Pressure <500 psi
- Prevents overpressure due to fire
- Does not reclose





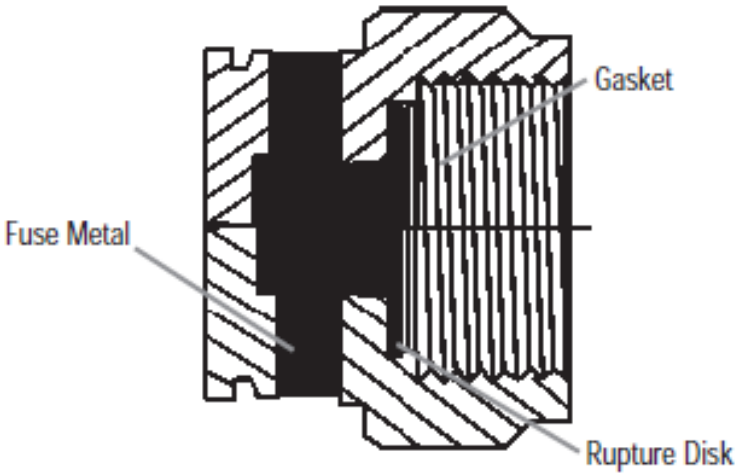
Fusible Plugs : CG-2, CG-3

- Plugs can be on the valve or body of the cylinder
- Acetylene cylinders usually have two fusible plugs on the collar



Combo: Burst Disk & Fusible Plug, CG-4, CG-5

- Burst disk backed by a fusible plug
- Plug has to melt first, then disk can burst with pressure increase



- CG-4 plug melts at 165 °
- CG-5 plug melts at 212 °
- Temp and pressure stamped on cap

Pressure-Relief Valve, CG-7

- Spring-loaded valve, opens at set pressure
- Relieves pressure on a cylinder, then closes

Quick Valve Clue

- Wrench-operated valve (no handwheel)
- Generally used for corrosives – chlorine, ammonia, fluorine, etc.
- Often have a screw-on cap on the outlet
- Immediate sign to be cautious with contents

So this is a bit worrisome…

Info from Facility, Employees & Locals

- Can be helpful
- Not always totally reliable
- Not a bad idea to verify what you hear using other clues from cylinders
- Facility type can provide context – guides your thinking

Color is NOT a useful indicator

A Rainbow of Ammonia Cylinders

Pop Quiz – Let's Make a Cheat Sheet

- What does a wrench-operated valve mean?
- What's in an 8A cylinder?
- What kind of gas takes a left-handed thread?
- What does a welded seam on a cylinder tell you?
- A cylinder has two fusible plugs on its collar – what's in it?
- What's in a green cylinder?

Liquefied vs Non-Liquefied Gases

- At cylinder pressures, some gases are compressed into liquid phase: ammonia, propane, carbon dioxide
- Other gases stay in gas phase even at high pressure: air, oxygen, nitrogen
- Some are liquid, but because of low temp, not pressure – cryogenic liquids: oxygen, nitrogen

Using the Clues – Going From This

To This

Using the Clues

- Adding up the clues can provide lots of identifying info
- Not like hazcat – doesn't have to go in a particular order
- More like building the clues to solve a mystery

Using the Clues in American Samoa

- Started with 700+ cylinders
- Sorted them by hazard, based on:
  - Cylinder shape and design
  - CGA valve numbers
  - Color (all rust-colored)
- Sorted them into:
  - Corrosives (ammonia, chlorine)
  - Flammables (acetylene, propane)
  - High-pressure inerts (oxygen, $CO_{2,}$ nitrogen, etc.)

Identification Practice

Things we can observe:

- Type of cylinder
- CGA #
- Valve features
- Pressure relief device
- Outlet thread
- Context – water treatment plant

- Type of cylinder = high-pressure
- CGA # = none
- Valve features
  - Wrench-operated
  - Vapor-tight cap
- PRD = 165 ° fusible plug
- Outlet thread = external, RH thread
- Context = water treatment plant

- Type of cylinder
- CGA #
- Valve control
- Manufacturer’s name
- Pressure relief device
- Outlet thread
- Context – outside old storage unit

- Type of cylinder = low pressure
- CGA # = none
- Valve control = handwheel
- Manufacturer's name = Rego
- Pressure relief device = relief valve
- Outlet = internal LH thread, cone nipple
- Context = unused bldg

- Type of cylinder
- CGA #
- Pressure relief device
- Outlet thread
- Shoulder markings

- Type of cylinder = low pressure
- CGA # = 510 or 540
- Pressure relief device = fusible plugs on collar, no PRD on valve
- Outlet thread = internal LH thread
- Shoulder markings = DOT 8 250

- Type of cylinder
- DOT label
- CGA #
- Valve features
- Pressure relief device
- Outlet thread

- Type of cylinder = high pressure
- DOT label = Non-flammable gas
- CGA # = none
- Valve features = “Helium of U.S.”
- Pressure relief device = burst disk
- Outlet thread = internal RH thread

- Type of cylinder
- CGA #
- Pressure relief device
- Outlet thread
- Context = wreckage of a house

- Type of cylinder = high pressure
- CGA # = 540
- Pressure relief device = burst disk
- Outlet thread = external RH
- Context = in wreck of house

- Type of cylinder
- CGA #
- Valve features
- Pressure relief device
- Outlet thread

- Type of cylinder = high pressure
- CGA # = 320
- Valve features = handwheel
- Pressure relief device = burst disk & fusible plug at 165°
- Outlet thread = external RH threat, flat face connection

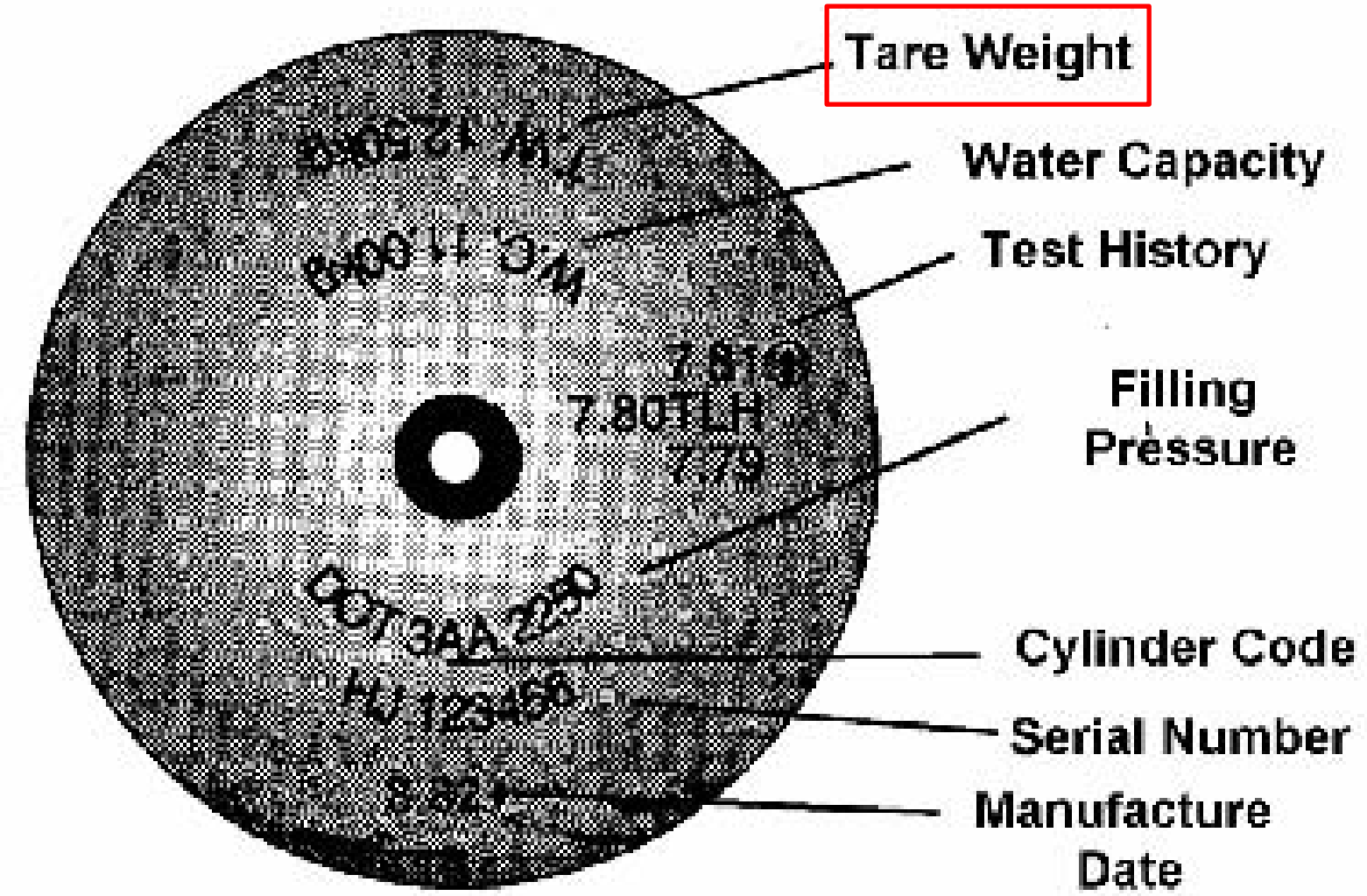
- Type of cylinder
- CGA #
- Pressure relief device
- Outlet thread
- Context = found during hazmat sweep after natural disaster

- Type of cylinder = high pressure
- CGA # = 580
- Pressure relief device = burst disk
- Outlet thread = internal RH thread
- Context = head down in a manhole

Does it have anything in it?

- How to tell if a cylinder is empty
  - Weight
  - The ‘Kiss’ (and safe kissing)
  - Wire probe
  - Valve under pressure? Give it a tap

Cylinder Markings



Tare Wt. vs Actual Wt.

“Kissing” inert gas cylinder valves to confirm empty

One form of safe kissing

Probing the valve

- Can you get anything through the valve into the cylinder?
- If you can get a piece of wire or similar inside the cylinder – it's empty

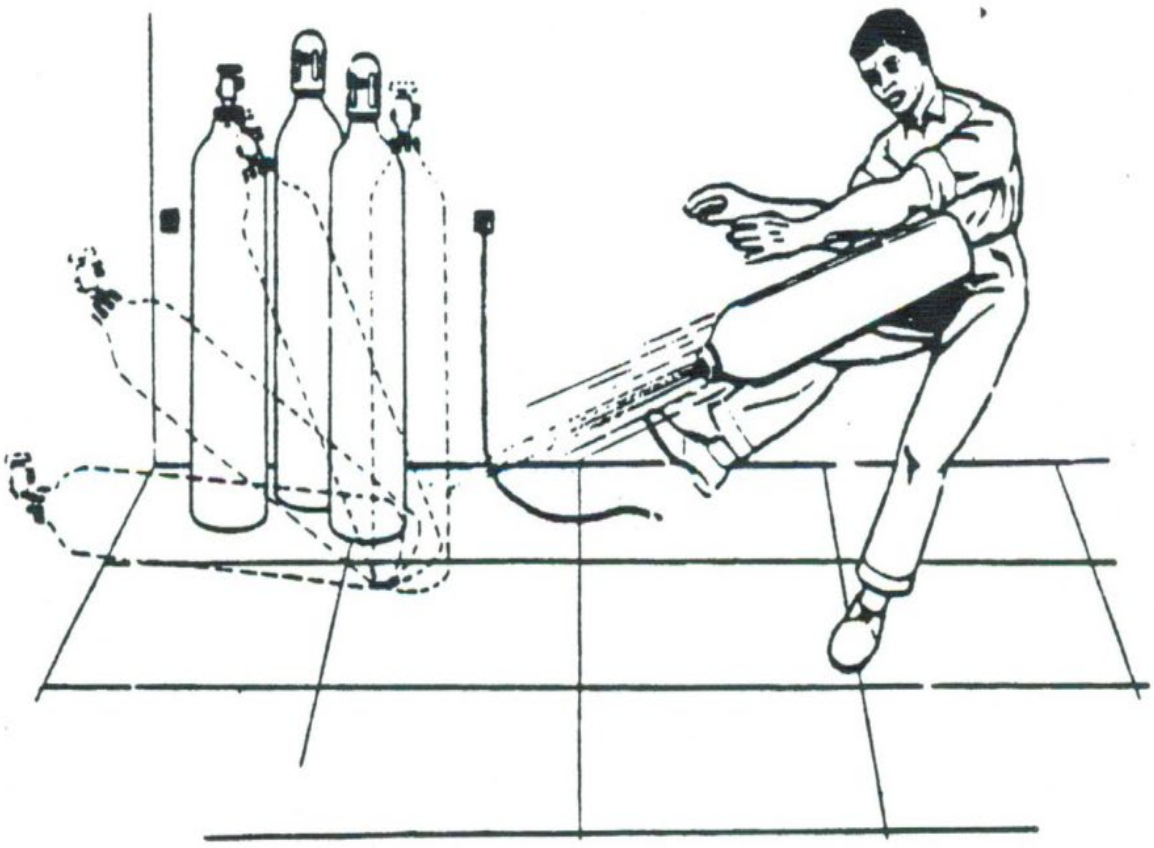
Valve under pressure?

- If the valve moves easily in the neck of the cylinder, it’s not under pressure
- Even a low-pressure gas will put hundreds of PSI on the valve, making it hard or impossible to turn

A few other cylinder tidbits

- Cylinders are made to be tough
- Valves are hard to get off, even on purpose

Common Perception of Cylinders



It’s hard to bust off a cylinder valve

Demo of Cylinder Disposal Method

Questions?

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