Linearity Checks and CGAs-Automation and Active Audit Stations

USERS' GROUP MEETING 2018

Bob Salerno

cisco

Linearities and CGAs

➢ What are these tests?

> ➢ Quarterly Audits to challenge each Analyzer at low and mid concentration ranges.

> ➢ Purpose is to verify that the analyzer is linear in the mid range.

Analyzer Test Gas Cylinder Ranges for Daily and Quarterly Quality Assurance
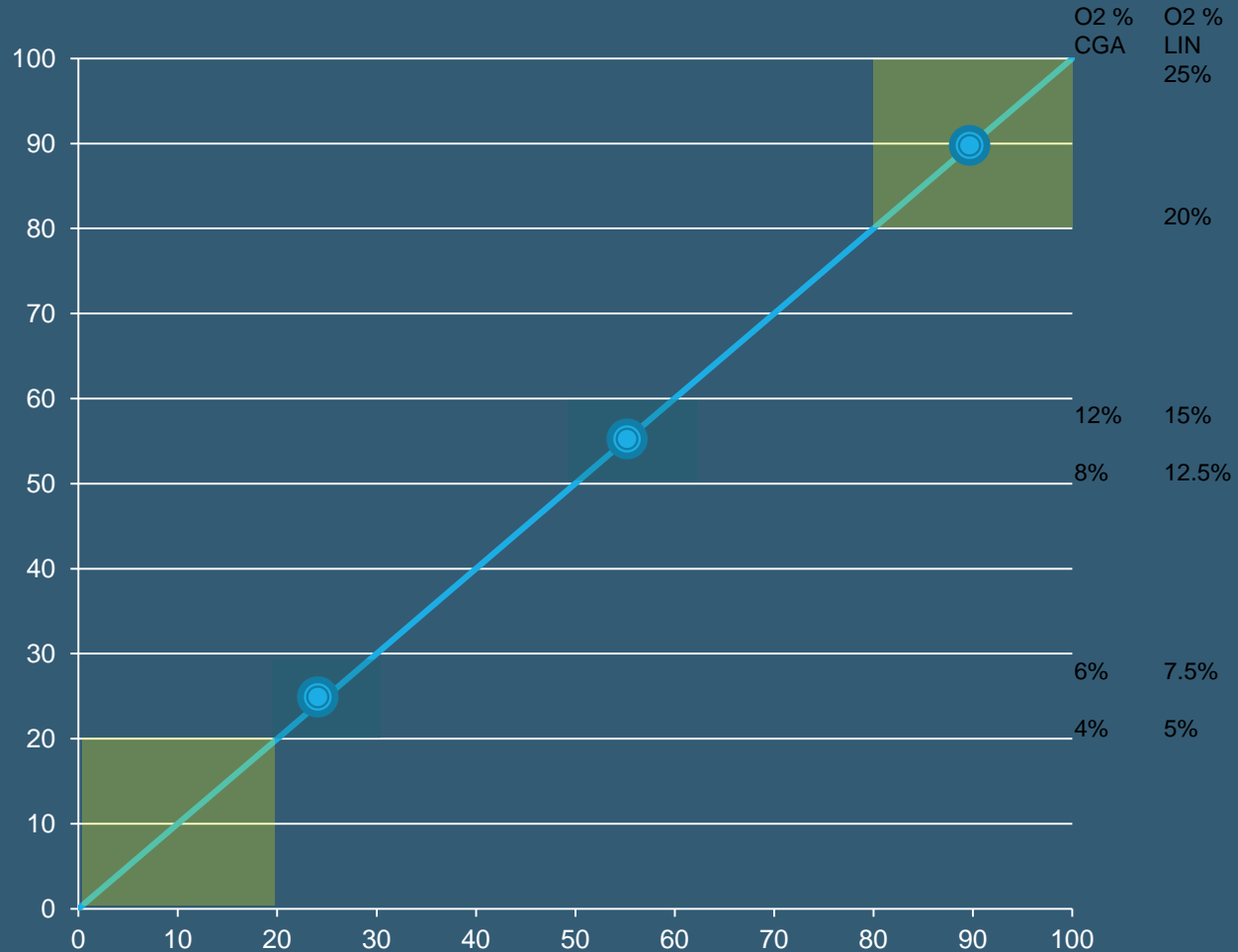
Basics about Audit Tests

- CGA
  - Cylinder Gas Audit.
  - Part 60 Requirement.
  - Uses Low and Mid Values of 20-30% and 50-60%.
- Linearity
  - Part 75 Requirement.
  - Uses the same Low and Mid as the CGA, but adds the High range as 80-100%.
- For simplification we call these tests "Audit Tests" and the gasses used as "Audit Gasses".

Use of Blended Cylinders

➢ CiSCO recommends using blended cylinders to kill two Audits with one Button.

  ➢ Examples: NOx/L & CO/L; NOx/H & CO/H, O2 & CO.

  ➢ Required to save space when using Automated Audit systems.

➢ CiSCO misled customers by listing Audit Concentrations separately for each type of gas in our O & M Manual. So customers purchased them separately. We then interpreted that as customers prefer to perform tests separately

Methods to Perform Linearity/CGA

➢ Use Daily Calibration Stations and adapt to the Audit Gasses

  ➢ Does not require much additional hardware just CGA adapters.

  ➢ Sequencing of Daily Cal Solenoids in certain orders.

  ➢ Operator must know where to connect Audit cylinders (after disconnecting daily cal gas cylinders).

  ➢ No place to safely locate and store Audit cylinders during the test.

  ➢ Not a desirable method, has not been used by CiSCO in many years.

CGA Adapters

A. Typical Linearity Test Gas Cylinder CGA Adapter Installation and Cross Reference Charts
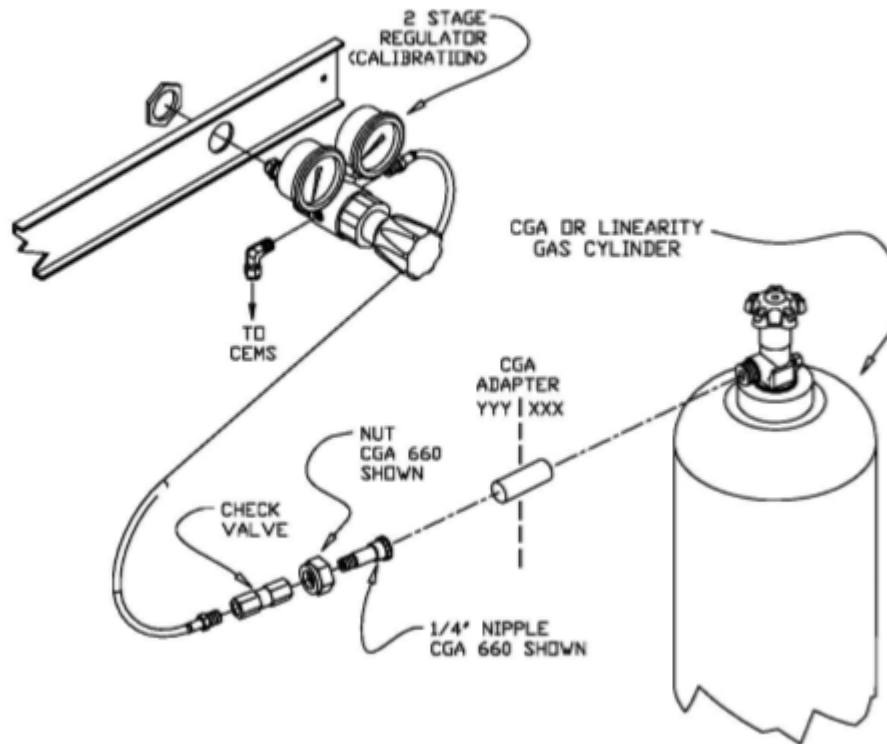
Position Audit Cylinders in correct Daily cylinder stations

LINEARITY / CGA REFERENCE TABLE				
ANALYZERS		**LOW RANGE (20-30%)**	**MID RANGE (50-60%)**	**HIGH RANGE (80-100%)**
NO_H (0-200 ppm), CO_H (0-1000 ppm) & $NH_3/_H$ (0-200 ppm)	*Adapters →*	-	-	660-590
	Range of Test Gas →	2.0-3.0 ppm NO & 2.0-3.0 ppm CO	5.0-6.0 ppm NO & 5.0-6.0 ppm CO	8.0-10.0 ppm NO & 8.0-10.0 ppm CO
	Position →	NO_L & O_2	$NO_x/_H$ & CO_H	O_2
NO_L (0-10 ppm), CO_L (0-10 ppm) & $NH_3/_L$ (0-10 ppm)	*Adapters →*	-	-	660-590
	Range of Test Gas →	40-60 ppm NO & 200-300 ppm CO	100-120 ppm NO & 500-600 ppm CO	160-200 ppm NO & 800-1000 ppm CO
	Position →	NO_L & CO_L	NO_H & CO_H	O_2
O_2 (0-20.9%)	*Adapters →*	590-660	590-660	-
	Range of Test Gas →	4.2-6.0%	10.5-12%	18%
	Position →	NO_L / CO_L	NO_H / CO_H	O_2

Methods to Perform Linearity/CGA

➢ Dedicated Audit Low and Audit Mid Ports

➢ Ports connect to calibration manifold and use dedicated solenoid valves automated by the PLC.

➢ High Span is same as Daily High Span gas for Linearities.

➢ Daily Cal gasses do not need to be disconnected with possible exceptions such as NH3(NOx) Linearity per PADEP requirements.

➢ Still need to get Audit Cylinders in place to perform tests, and cylinders are rotated in and out for each test.

➢ No place to safely locate and store Audit cylinders during the test.

Standard Automated Audit Blended Gas Configuration
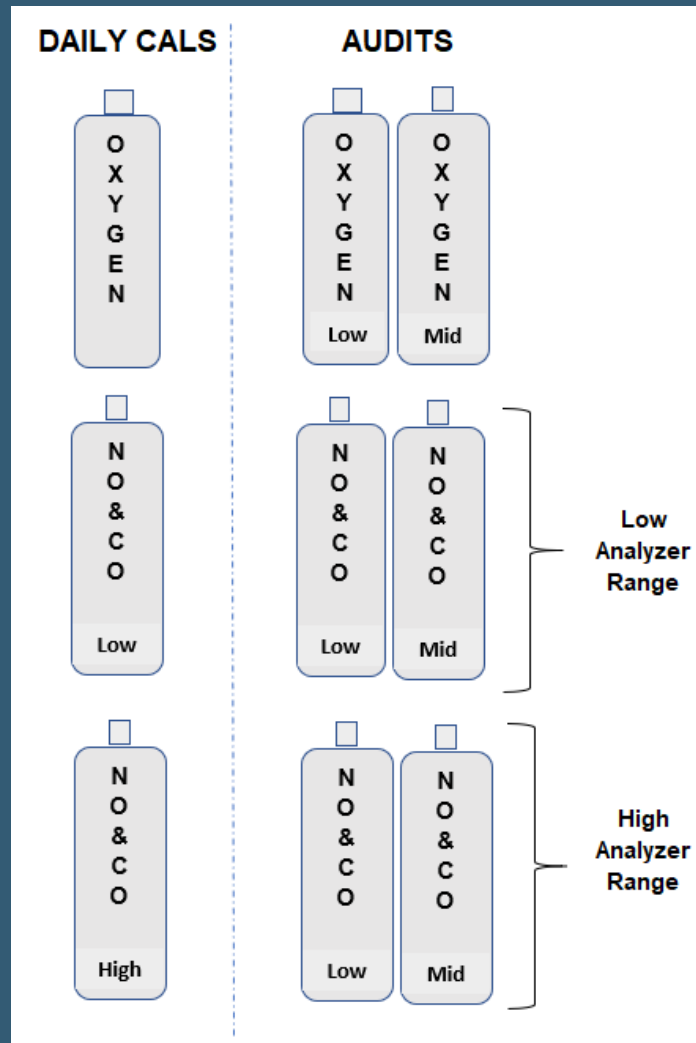
Methods to Perform Linearity/CGA

➢ Dedicated Audit Cylinder Station

  ➢ 6-position Cylinder Rack complete with 6 Regulators and Solenoid valves.

  ➢ Provides complete automation of all Audit Tests for typical Part 60/75 sites.

  ➢ Cylinders do not need to be moved around to perform tests. Cylinders may remain stationary for years.

  ➢ Can be Permanently mounted to shelter or as a stand alone rack close to the shelter.

Dedicated Audit Stations
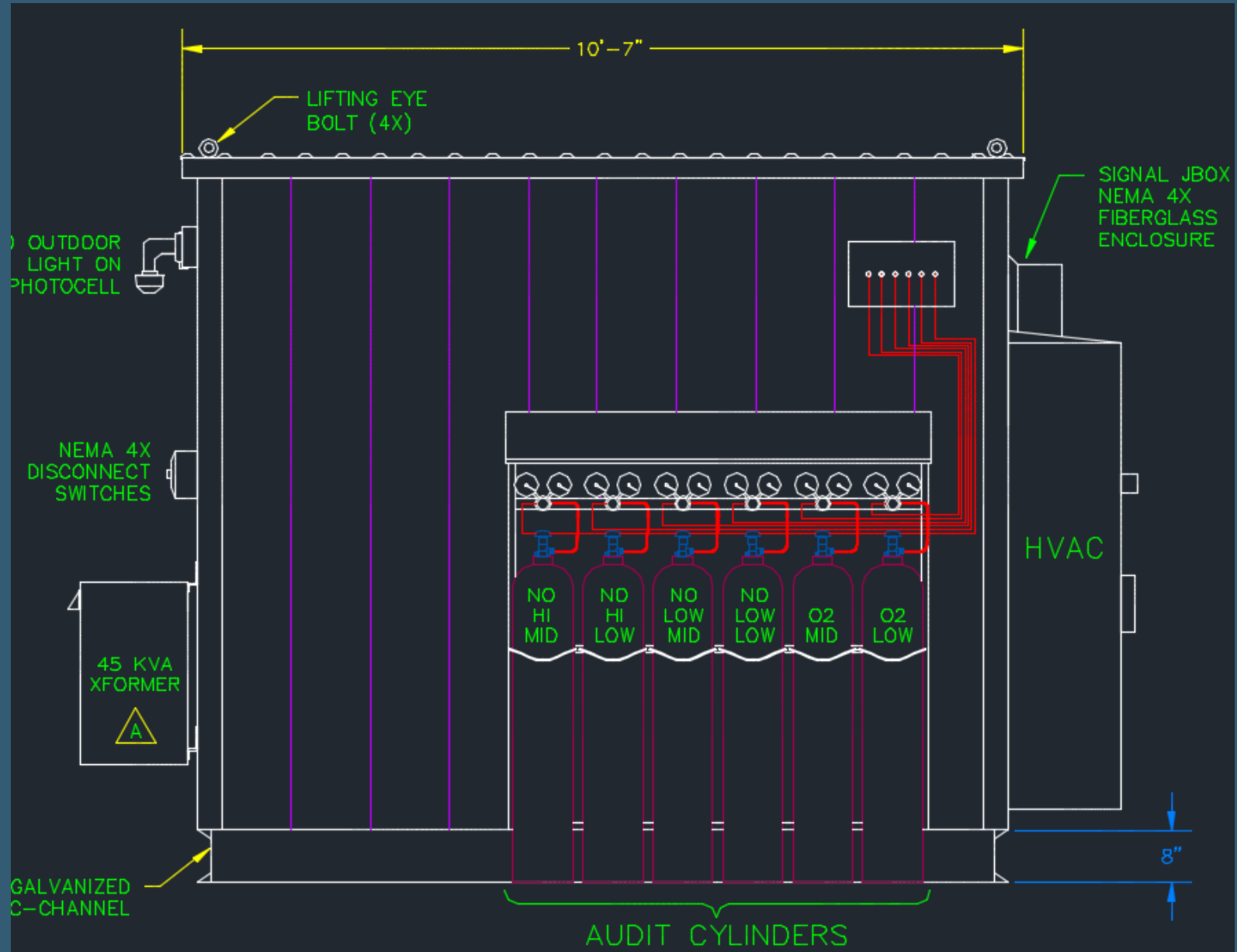
Field Modifications

➢ Rack may be mounted to an open side of shelter.

　　➢ Solenoids/tubing manifold are built into a control box mounted to rack.

　　➢ Only one tube required to feed back inside shelter.

　　➢ Control wires for solenoids need to be run to control box.

Requirements

➢ Space on Outside of Shelter if dedicated station is to be mounted.

➢ Typically 6 PLC outputs for Low and Mid for each test. The daily cal span used for the High.

➢ Blended Audit Cylinders to allow NOx & CO (for example) tests to be done at one time.

➢ Verification of the Number of Cylinder Stations required.   Depends on Gas Cylinder Blends and types of test.

Portable Rack Option

- Cylinder Rack with Fork Holes
  - Can be simple version where each gas set is connected manually for one test only.
  - Can be fully Automated for all tests.
- Only one set of Cylinders required.

Fully Automated Portable Rack

Solenoid Enclosure allows PLC to control gas flow for all cylinders. (capacity of eight shown)
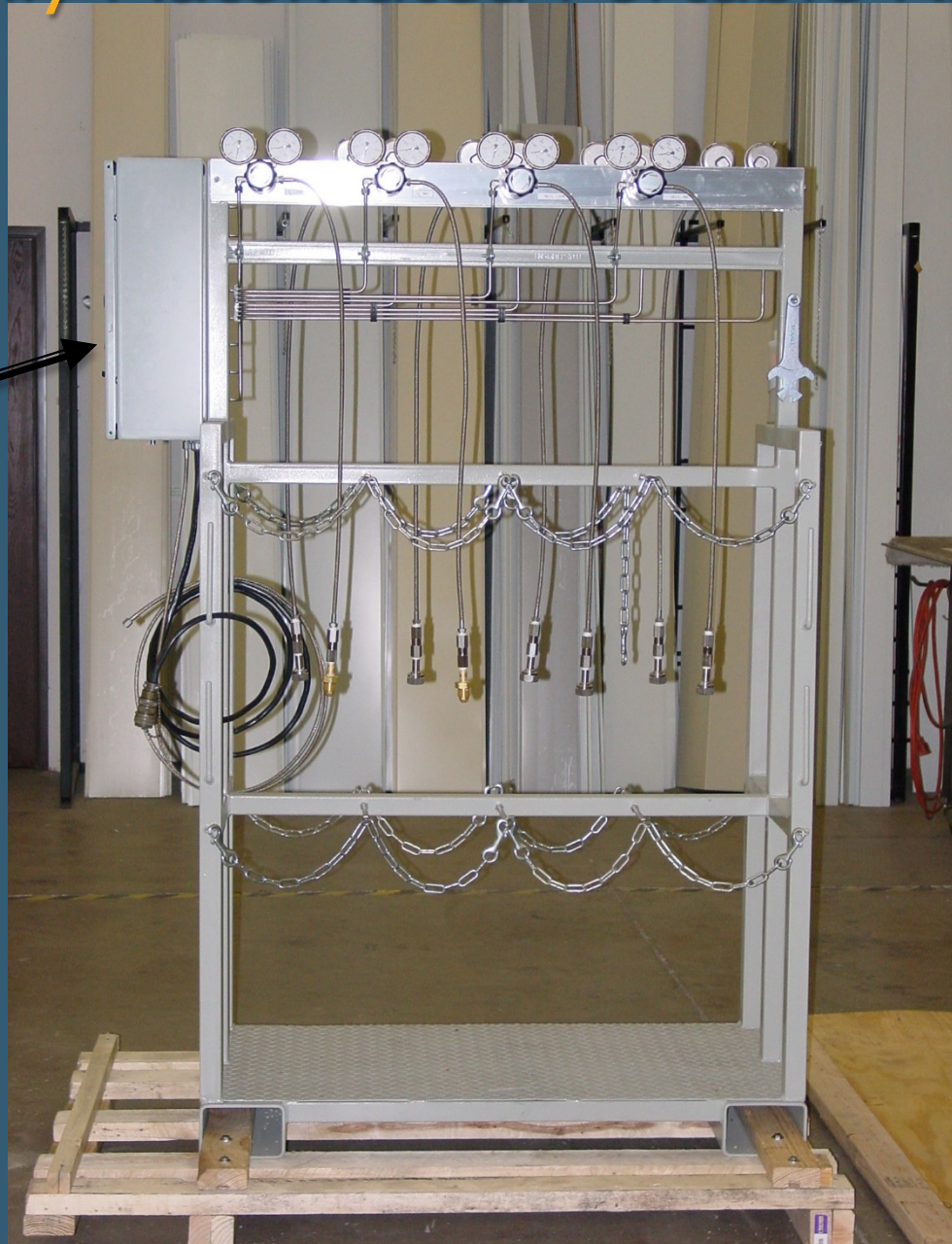
Two hose connections to CEMS Bulkhead

Solenoid control Connector attaches to each CEMS Bulkhead

Portable Lin/CGA Regulator Set

- Two Regulators and CGA Adapters
  - Inexpensive solution.
  - Requires Audit Cylinder to be transported to each shelter.
  - Can only connect one set for 1 Audit Test at a time.
  - Single Audit test may include Dual Analyzers when using Blended Cylinders.

Linearity/CGA Portable Regulator Set