Training Package
TP 11/12

Safe use and handling of portable liquid cylinders (PLCs)

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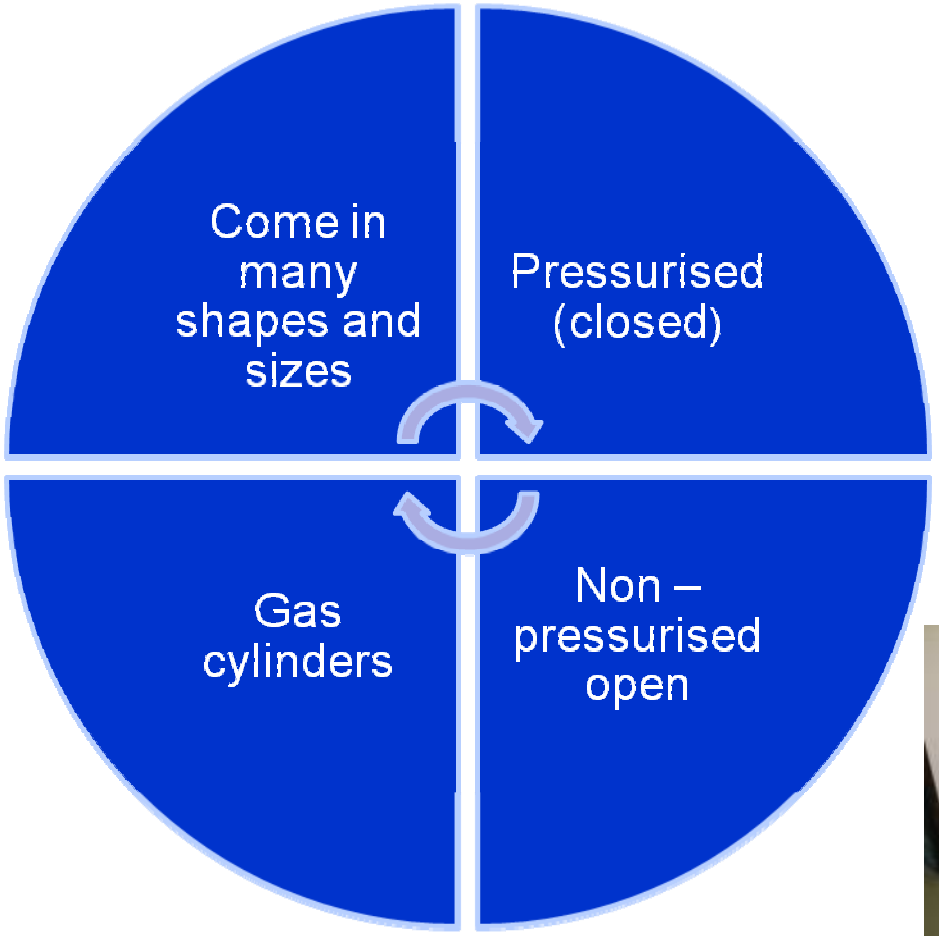
Cryogenic containers



Non-cryogenic cylinders

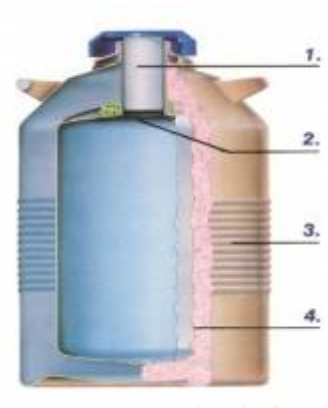
Cryogenic containers & equipment

Must be designed to store/handle cryogenic products

Pressurised PLC'S fitted with suitable safety devices (x2)

Manufactured to international standards

Material embrittlement can occur if incorrect equipment is used



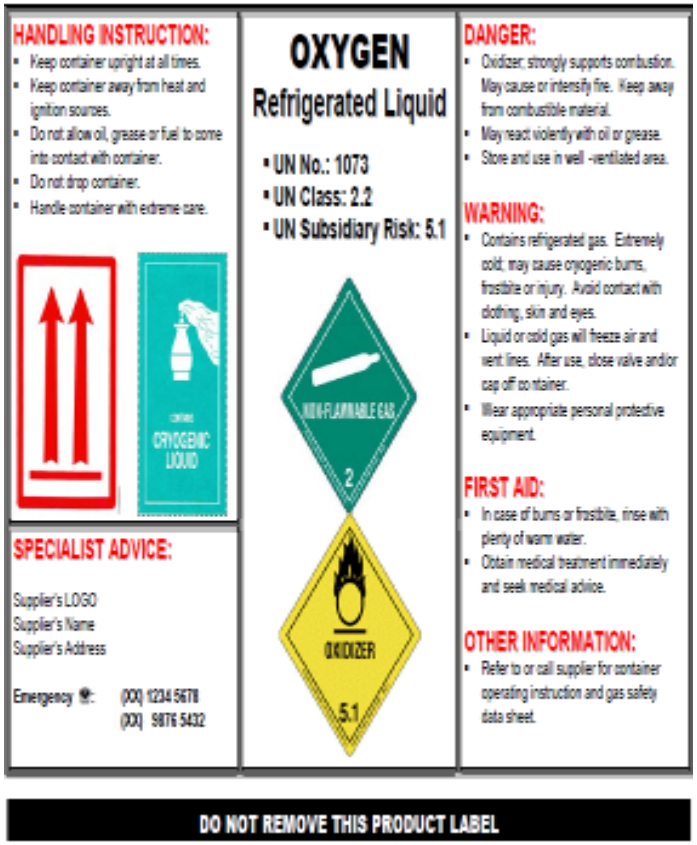
Product Supplier's Responsibilities

- Prior to filling and delivering, ensure that containers are correctly labeled and fitted with the appropriate connections.
- Connections should be visually inspected prior to filling, to verify that there is no damage and that they are suitable for the intended service.
- Ensure that the correct mating connections are in use at the customer's sites, avoiding the use of adaptors.
- Ensure that the pressure relief device installed is set at or below the design pressure of the PLC.
- Provide training and/or training materials as required.

Identification and Labeling

- Proper labeling of PLCs is critical for product identification.
  - Should meet the guidelines in AIGA 017/05 ‘Labeling of Gas Containers (including associated equipment)’

    OR
  - Meets Globally Harmonized System (GHS) of Classification and Labeling of Chemicals requirements.
- Identification tags should be affixed to the gas, liquid and vent outlet connections.
- A warning label “DO NOT TAMPER WITH CONNECTIONS” should be visible on the container.



Connections for PLCs

- There are clear standards for product outlet connections and other means of product identification.
- Failure to follow these standards can lead to high risk of the wrong product being introduced to the consumer's supply system resulting in loss of production, property damage and personal injury
- Liquid connection standards that are not discriminating between gases should be avoided (e.g. BSP standard that are currently used in some countries).
- Standardization of outlet connections for PLCs based on the AIGA 019/05 'Connections for Portable Liquid Cylinders' is recommended.

Primary Standard and guidance

- AIGA has adopted the Compressed Gas Association (CGA) connections as the primary standard for connections for PLCs due to:-
  - Regional commonality.
  - Compliance to selection of discriminated connections between gases
- Use of connection adapters is strictly prohibited.
- The liquid, gas and vent outlet connections should be silver brazed, welded or attached by other methods to the valve body to prevent customers from removing the connections.

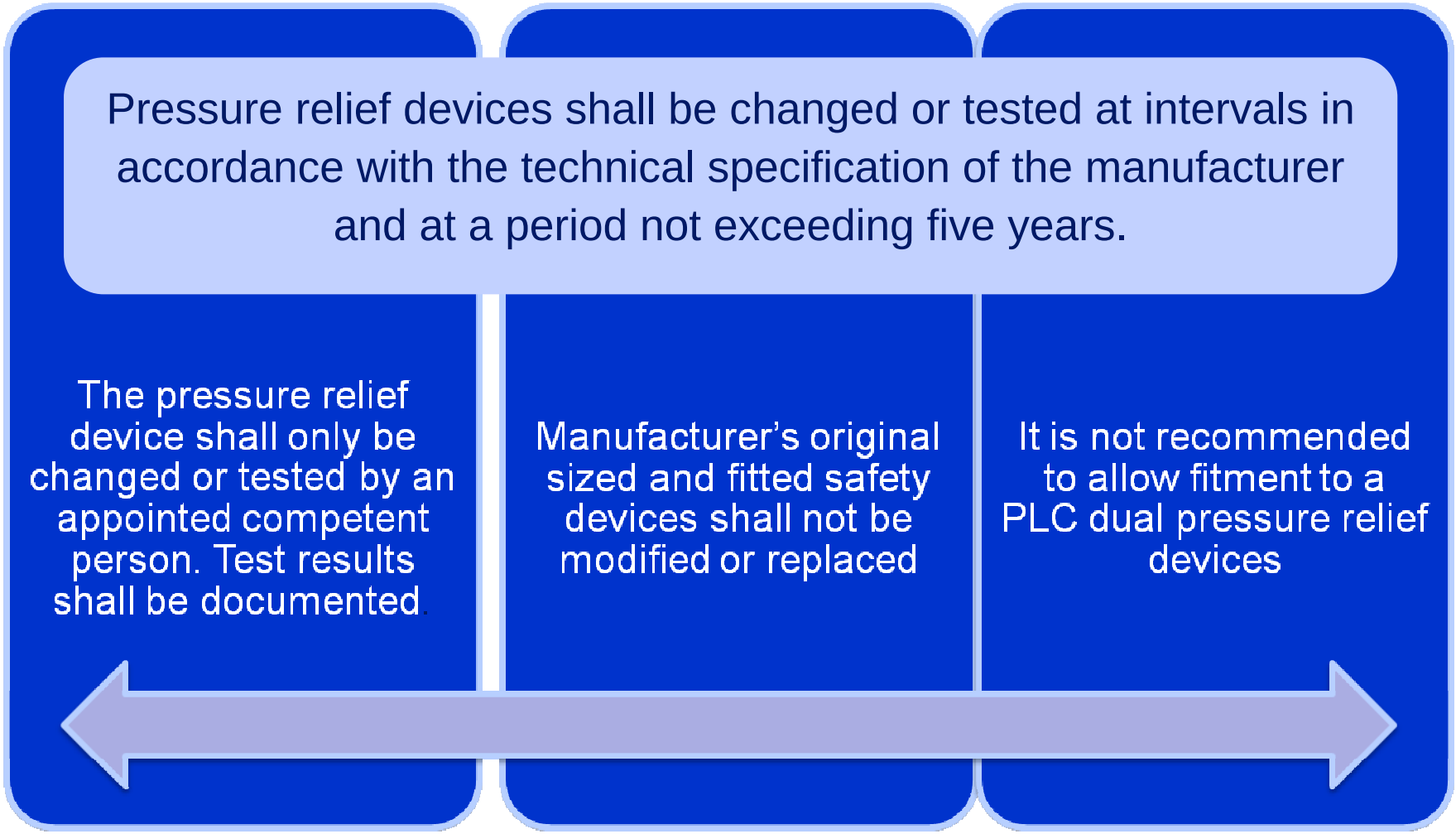
CGA Connections for PLCs

Product	Outlet connection	CGA connection number
Oxygen	Liquid	CGA 440
	Gas Use	CGA 540
	Vent	CGA 440
Nitrogen	Liquid	CGA 295
	Gas Use	CGA 580
	Vent	CGA 295
Argon	Liquid	CGA 295
	Gas Use	CGA 580
	Vent	CGA 295
Carbon Dioxide	Liquid	CGA 320
	Gas Use	CGA 320
	Vent	CGA 622
Nitrous Oxide	Liquid	CGA 326
	Gas Use	CGA 326
	Vent	CGA 624

Silver Brazed or Welded Joint to the Valve Body

Example of a device to deter removal of the fitting

Pressure relief devices



Connecting/Disconnecting

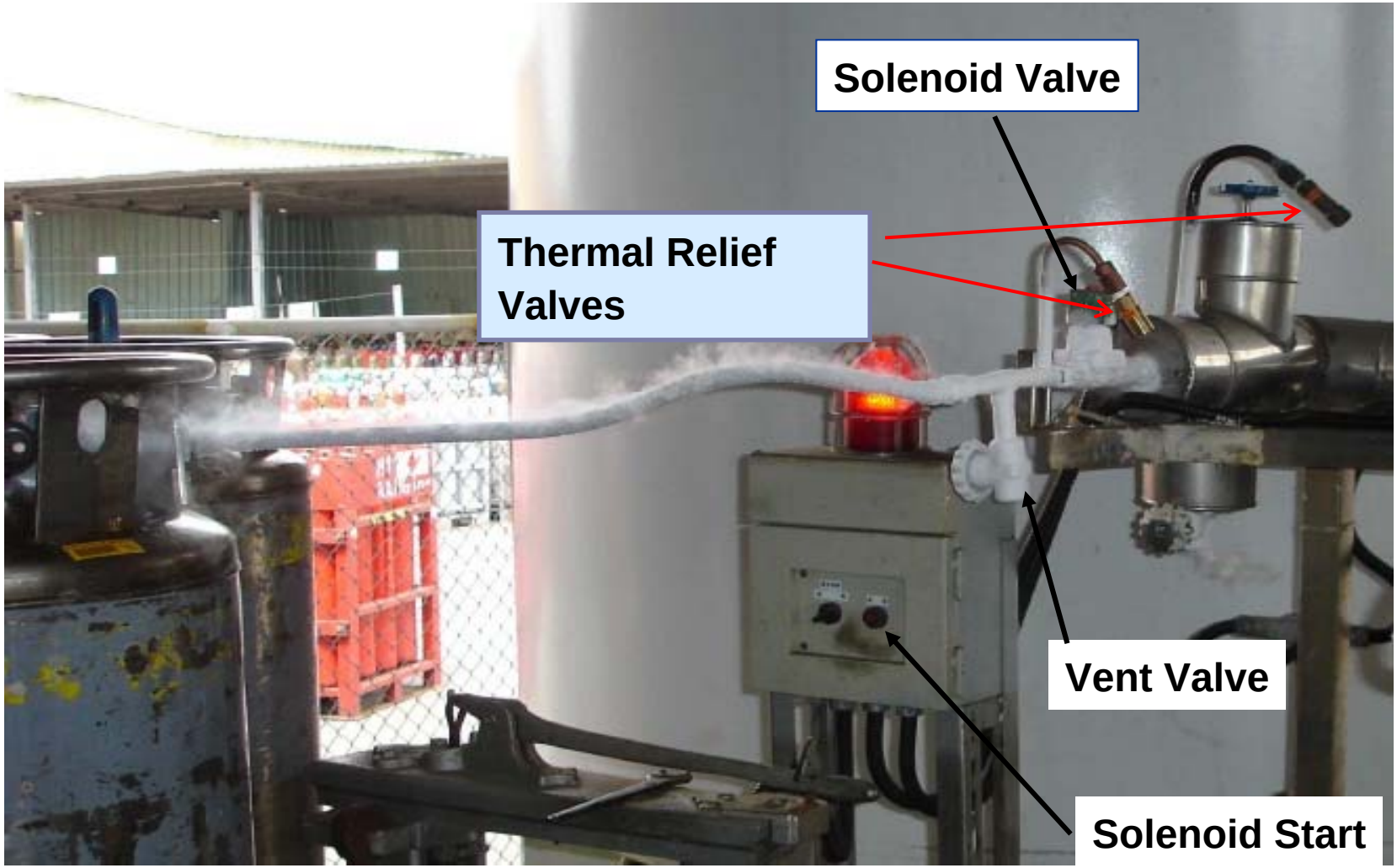
The user must counteract the torsion applied to the valve and tubing when the coupling is removed.

Provide training and/or training materials to prevent potential serious incidents.

Inspection and maintenance

- Inspection and maintenance is critical in safe operation of cryogenic containers.
- Tanks have systems for building up pressure.
- Built in systems for extra gas supply.
- Add on systems for excessive gas supply.
- Inspection, testing and maintenance needs to be performed at the specified periodic interval.
- All control and safety devices must be kept clean and free of any hydrocarbon substances, both PLC and fill systems.

Example Of Fill Piping System



Pre-Fill Checks

Pre Fill Inspections

Key part of the Operation

Ensure all who are involved with pre fill checks are trained and understand the importance of their job

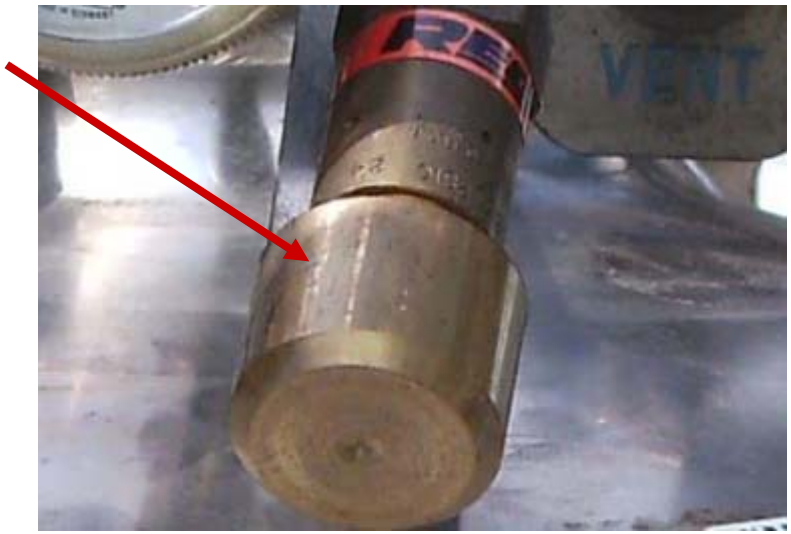
Our employees are on “the front line”.

They are the first to see problems

Capped relief valve – Near miss

Summary of Incident

- Customer blanked relief valve outlet on liquid nitrogen cryogenic container because it was lifting and making a noise.
- Potential for excess pressure and burst container.



Handling and Use

- All personnel must be adequately trained prior to handling or connecting PLCs.
- Training should include, but is not limited to:-
  - ✓ Personal protective equipment requirements.
  - ✓ Product safety.
  - ✓ Operation of equipment.
  - ✓ Emergency procedures.
  - ✓ Safe handling of the containers.

Handling equipment

- Full PLCs are heavy: Use pallets, carts or trolleys to safely move.
- Many types are available: choose the right type for your needs.

Loading and securing

- Use suitably rated loading ramps to load.
- Secure using suitably rated devices for use in load security: Nylon ropes, nylon webbing harnesses etc.

Manual handling of PLC's

- Train personnel to be aware of the work environment.
- Use the correct tools – Push, do not pull PLC's.

Transporting PLCs in Elevators

- Where possible, a freight elevator rather than a passenger elevator should be used.
- If the elevator is equipped with a floor lock device, it shall be used.
- Where possible, we must have sole and exclusive use of the elevator during the delivery.
- The Best Practice is to use two persons when transporting PLCs in the elevators. One will load the material at the origination floor and the other will receive and unload it at the destination floor.
- A fully charged, emergency escape, five minute air pack must be with personnel who accompany the transported PLC in the event of a product release.

What to avoid ……..

Safety hazards

- Contact & non Contact hazards
- Asphyxiation
- Cold Burns or Frostbite
- Can strongly support fire
  - ✓ Follow codes of practice
  - ✓ Ventilation
  - ✓ Access
  - ✓ Conduct risk assessments

Storage Requirements

- Containers should be stored outdoors or in well ventilated environments.
- Consider the need to include atmosphere monitoring equipment with alarms in areas such as laboratories. This equipment must be tested regularly to ensure it operates as intended.
- All customer employees need to be trained on the product hazards, safe connection of the PLCs, PPE use and responding to alarms.
- Do not store PLCs near elevators, stairs or exit routes
- Cryogenic liquid when spilled, can spread far and cause a hazardous environment. Atmospheres may not be suitable for sustaining life.

Best practices

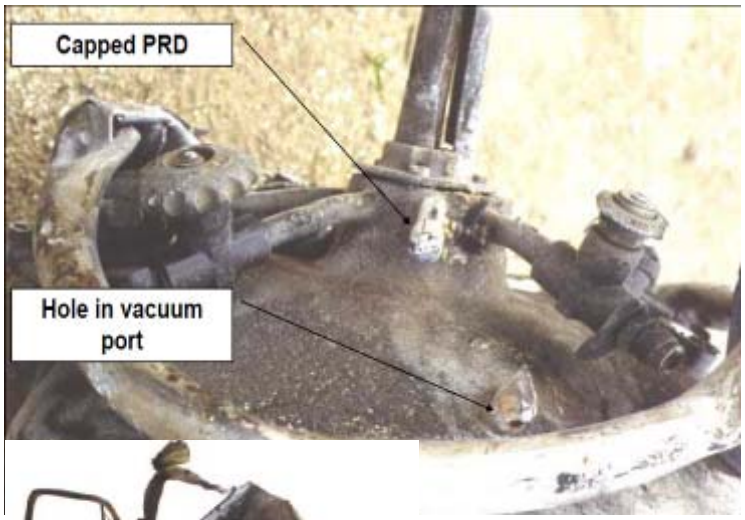
- All containers must be kept upright.
- Burst discs and relief valves to be turned away from face.
- Never drop cylinders, wherever possible PLCs should be retained to prevent them from falling.

PPE

- Personal protective equipment (PPE) requirements should be assessed for each activity and the correct type provided.
- This should not be restricted to employees but should be advised to customers.

Adoption of standards and guidance

Adopting and following the guidance issued by AIGA will avoid incidents and improve safety.



PLCs- Key Message

Equipment - Must be designed to store/handle cryogenic products

Connections - Follow AIGA guidance - AIGA 019/05

Testing Inspection and maintenance - Critical in safe operation of cryogenic containers

Training - All personnel must be adequately trained prior to handling or connecting PLCs

References

- AIGA 016/05 Safety Features of Portable Cryogenic Liquid Containers for Industrial and Medical Gases
- AIGA 017/05 Labeling of Gas Containers (including associated equipment)
- AIGA 019/05 Connections for Portable Liquid Cylinders
  http://www.asiaiga.org/publications.asp

- CGA: V1-2006 Compressed Gas Association: Standard for Compressed Gas Cylinder Valve Outlet and Inlet connections
- CGA: SB-26-2001 CGA Safety Bulletin: Cylinder Connections on Portable liquid Cryogenic Cylinders

- EIGA: IGC Doc 93/03/E Safety Features of Cryogenic Liquid Containers for Industrial and Medical Gases
  http://www.eiga.eu/index.php?id=181

- Chart Industries: CGA Fitting Restraints
  http://www.chart-ind.com/main/app_csd_packaged_gas_cga_fitting_restraints.aspx

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