GUIDANCE FOR MANUAL HANDLING IN DISTRIBUTION ACTIVITIES

Doc 248/24

EUROPEAN INDUSTRIAL GASES ASSOCIATION AISBL

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Prepared by AHG-S.7 of the Safety Advisory Council

Disclaimer

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1 Introduction

Manual handling is an important issue for the industrial gases sector (including areas such as medical, food etc.). Many activities of the industrial gases industry involve manual effort which have the potential to cause harm if not properly managed. Manual handling related injuries are a major cause of lost workdays and occupational illness.

National or local regulations shall be considered separately. Applicable national and local regulations shall be applied in conjunction with this document. They shall be followed as a minimum.

2 Scope and purpose

2.1 Scope

This publication covers the ergonomics and occupational health of activities in the liquid gas distribution sector. Included specifically are ergonomic principles that can be adopted to reduce likelihood of musculoskeletal issues.

The scope of this publication covers ergonomics in distribution activities, such as:

- Manual handling of filling hoses;
- use of hand tools;
- operation of tanks and tankers, including opening and closing of valves;
- other distribution related activities such as trailer vehicle connections, lifting and lowering of landing legs etc.;
- handling of cryogenic containers (pressurised and open);
- filling of cryogenic containers at customer's premises

The following activities / situations are not covered by this publication:

- Cylinder handling related activities – see EIGA Doc 229, *Guidance for Manual Handling Activities of Cylinders* [1].[1]
- Maintenance related activities on the tanks and tankers;
- Handling of dry ice containers

[1] References are shown by bracketed numbers and are listed in order of appearance in the reference section.

- Homecare deliveries such as medical cryogenic containers/concentrators, associated equipment.

The working environment (such as lighting, humidity, flooring, temperature etc.) is not specifically addressed in this publication however they can impact manual handling activities and should be considered in ergonomics risk assessment.

2.2 Purpose

The publication is intended to provide guidance and good ergonomic practices in the distribution sector and comply with minimum requirements of related EU directives.

Sections 1-7 provide information on ergonomic principles, the health effects from manual handling activities and manual handling risk assessment methodology including the hierarchy of control. Annex 1 provides guidance and good practices for manual handling tasks in distribution activities.

This publication is not intended to replace the requirement for conducting a task specific risk assessment.

This publication does not replace or supersede any regulatory requirements.

This publication also provides information that is useful for training of drivers.

3 Definitions

For the purpose of this publication the following definitions apply.

3.1 Publications terminology

3.1.1 Shall

Indicates that the procedure is mandatory. It is used wherever the criterion for conformance to specific recommendations allows no deviation.

3.1.2 Should

Indicates that a procedure is recommended.

3.1.3 May

Indicate that the procedure is optional.

3.1.4 Will

Is used only to indicate the future, not a degree of requirement.

3.1.5 Can

Indicates a possibility or ability.

3.2 Technical definitions

3.2.1 Competent person

Competence is the demonstrated ability to undertake responsibilities and to perform activities to a recognised standard. Competence is a combination of practical and thinking skills, experience and knowledge, see EIGA Info HF 02, *Individual – "Training and Competence"* [2].

3.2.2 Cryogenic container

Transportable thermally insulated pressure receptacle for refrigerated liquid gas of a capacity of not more than 1000 litres; these can either be pressurised or maintained at atmospheric pressure by continuous venting of the product.

NOTE Cryogenic containers may also be referred to as dewars.

3.2.3 Manual handling and ergonomics

Application of bodily force to manually move or support a load, including the lifting, putting down, pushing, pulling, carrying, or turning by hand, which, by reason of its characteristics (weight, size, shape), unfavourable ergonomic conditions or the physical capability of the individual person, has the potential to cause an injury.

NOTE This definition while based on international standards is aimed specifically at the European industrial and medical gases sector and may not be applicable or relevant to other industries. It does not attempt or claim to be suitable as a generic definition for manual handling.

Further information on manual handling can be found in ISO 11228, *Ergonomics – Manual Handling (parts 1-3)* [3].

3.2.4 Musculoskeletal disorders

Disorder of the muscles, nerves, tendons, ligaments, joints, cartilage, blood vessels, or spinal discs such as muscle strains and tears, ligament sprains, joint and tendon inflammation, pinched nerves, and spinal disc degeneration. Musculoskeletal disorders (MSD) affect body parts including the neck shoulder, elbow, forearm, wrist, hand, abdomen (hernia only), back, knee, ankle, and foot.

MSDs do not include injuries resulting from slips, trips, falls, vehicle accidents and similar accidents.

3.2.5 Risk assessment

Structured and systematic identification and analysis of workplace hazards to assess their potential risks to health and determine appropriate control measures to protect the health and wellbeing of workers.

3.2.6 Work related upper limb disorder

Disorder of the hand, fingers, upper arm, shoulder, or neck. An upper limb disorder (ULD) may be any pain, tension, or other injury to any part of the upper limb. When this condition is caused by, or exacerbated by, workplace conditions or job tasks, it is a work-related upper limb disorder (WRULD).

4 Ergonomic principles

There are important ergonomic principles that shall be understood to help individuals achieve correct posture and reduce the likelihood of injury when carrying out manual tasks. Biomechanics is the application of mechanical principles to how humans move. The principles aim to place joints and spine in optimal position ensuring that the muscles are balanced and reduce the forces that are placed on the body.

The basic ergonomic principles are given below which will form the basis of the guidance given in Annex 1:

- keep the load close to the body;
- joints in optimal position (neutral);
- use a wide stance (feet shoulder width apart) when possible;

- avoid bending forwards;
- avoid twisting the spine;
- alternate postures and movements;
- avoid sudden movements; and
- prevent muscle fatigue.

5 Health effects

Poor manual handling practises from distribution activities can cause disorders due to acute and cumulative deterioration of musculoskeletal system through the related continuous activities (for example carrying, lifting, pushing, repetitive movements) and can result in fatigue and lead to injury or occupational illness.

Typical injuries can include:

- Injuries due to sudden exertion, considering that the cumulative effects of repetitive actions prior to the event can increase occurrence and/or gravity of the pain or injury.
- Musculoskeletal disorders are damages to the musculoskeletal system, that can occur as a consequence of gradual and cumulative wear and tear as well as from awkward postures, affecting mainly:
    - upper limb disorders (WRULD): tennis elbow, shoulder rotator cuff pain, shoulder arm strain, wrist pain, etc; or
    - lower back pain and back injuries.

6 Risk assessment

The purpose of this section is to provide an objective approach in identifying, assessing and controlling (see Section 7) ergonomic risk factors associated with manual handling activities in the workplace. Due to the diversity of the tasks, a case-by-case approach is recommended.

A competent person should be involved in the risk assessment process.

A manual handling risk assessment should consider the following (see Annex 1 EC Directive 90/269/EEC *on Minimum Health and Safety Requirement for Manual Handling*) [4]:

- Task – requirements of the activity: For example, handling cryogenic containers, handling/attaching hoses, repetitive actions such opening/closing valves, use of hand tools etc.
- Individual – physical effort required: The capability of the person carrying out the task, physical and psychological, training and competence.
- Characteristics of the working environment: The work area, floor surface, temperature, humidity, cleanliness and housekeeping, cramped or confined areas.
- Characteristics of the load: The weight, size, shape and stability of the load. For example, cryogenic hoses, weight, size and movability of cryogenic containers s etc.

The tools in Table 1 can be used to help in assessing general manual handling tasks.

Table 1 Example Tools for assessing manual handling tasks

Methodology	*Weblink*
AFNOR NFX35-109 Oct 2011 "ergonomics – manual load handling for lifting, moving and pushing / pulling – Analysis methodology and threshold values – Ergonomy'	*https://www.afnor.org/en/*
Leitmerkmalmethode	*https://www.baua.de/DE/Themen/Arbeitsgestaltung-im-Betrieb/Physische-Belastung/Leitmerkmalmethode/Leitmerkmalmethode_node.html*
MAC	*http://www.hse.gov.uk/msd/mac/index.htm*
RAPP "push-pull risk assessment tool"	*http://www.hse.gov.uk/pubns/indg478.htm*
REBA "rapid entire body assessment"	*https://www.ergo-plus.com*
RULA "rapid upper limb assessment"	*https://www.ergo-plus.com*
Snook and Ciriello method	*http://calculadores.insht.es*
KIM Lichaamsbeweging	http://www.ergonomiesite.be/
INRS (French National Research and Safety Institute for the Prevention of Occupational Accidents and Diseases)	Méthode d'analyse de la charge physique de travail - Brochure – INRS Santé et sécurité au travail - INRS
NOTE The tools listed above are not exhaustive and provided for guidance, other local tools / resources / references may be available that are not listed here.	

7 Hierarchy of controls

Controlling and improving exposures to occupational hazards is the fundamental method of protecting workers. Traditionally, a hierarchy of controls has been used as a means of determining how to implement feasible and effective control solutions.

One representation of this hierarchy is shown in Figure 1 [5]:

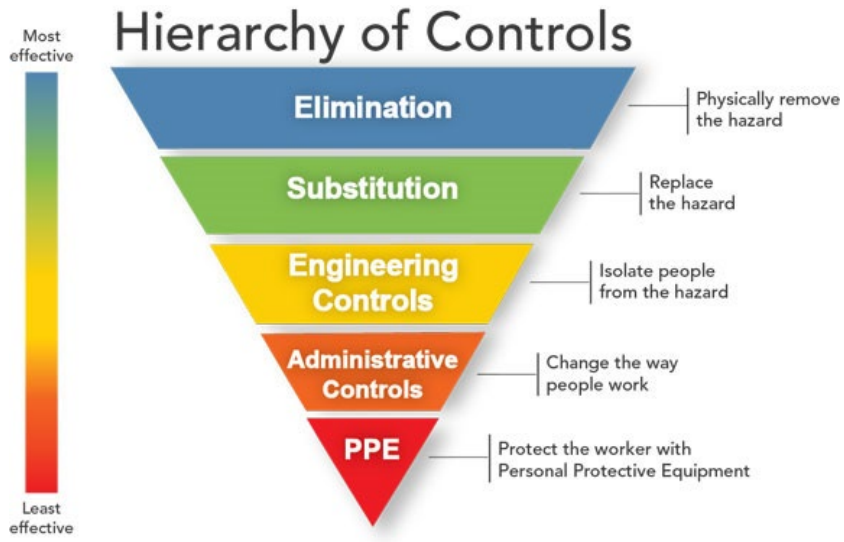


Figure 1 Hierarchy of controls

7.1 Elimination and substitution

To eliminate or substitute manual handling activities the following examples can be considered:

- automate/semi-automate loading and offloading product;
- mechanisation, for example introduction of a cryogenic container trolley, palletisation of cryogenic containers to allow movement by FLT. Introduction of mechanisation shall be assessed to ensure that any additional / new risks are controlled; and
- delivery of product, for example bulk tank, rather than cryogenic container.

7.2 Engineering controls

Examples of engineering controls include:

- mechanical assistance – fill hose suspension
- use of technical aids – hose handles, type of valve such as a globe valve vs ball valves, wheels and appropriately designed handles on cryogenic containers. All handling aids should be compatible with the rest of the work system, be effective, appropriately designed and easily operated.

7.3 Administrative controls

Examples of administrative controls include performing risk assessments, writing policies and procedures, periodic task safety observations, periodic medical assessments, and specific ergonomics training (see 7.5).

7.4 Personal protective equipment

Typical Personal Protective Equipment (PPE) includes foot protection, appropriate hand protection, and face and eye protection. For further guidance see EIGA Doc 136, *Selection of Personal Protective Equipment* [6].

7.5 Information, instruction and training

Manual handling information and training should include:

- how the body functions, possible injuries, illnesses;
- biomechanical principles, good lifting and handling techniques;
- PPE; and
- guidance on tools/equipment to improve manual handling (cryogenic container trolleys, hand tools, cryogenic container pallets, and valve opening tools) and reduce physical force.

  NOTE Consider the appropriate use of tools, for example the possibility of over torquing valves.

Manual handling should not be considered a one-off training. It should be refreshed at regular intervals.

8 References

Unless otherwise stated the latest edition shall apply.

[1] EIGA Doc 229, *Guidance for Manual Handling Activities of Cylinders,* www.eiga.eu.

[2] EIGA Safety Info HF 02, *Safety Information – Human Factors: Individual – "Training and Competence"*, www.eiga.eu.

[3] ISO 11228-1, *Ergonomics – Manual Handling – Part 1: Lifting and Carrying.* www.iso.org.

ISO 11228-2, *Ergonomics -- Manual handling – Part 2: Pushing and pulling*, www.iso.org.

ISO 11228-3, *Ergonomics -- Manual handling – Part 3: Handling of low loads at high frequency*, www.iso.org.

[4] EC Directive 90/269/EEC *on Minimum Health and Safety Requirement for Manual Handling*. www.europa.eu.

[5] Hierarchy of Controls, U.S. National Institute for Occupational Safety and Health https://www.cdc.gov/niosh/topics/hierarchy/default.html.

[6] EIGA Doc 136, *Selection of Personal Protective Equipment*, www.eiga.eu.

[7] EIGA Training Package TP 06, *EIGA Couplings Driver Training*

9 Additional references

HSE Manual Handling, *Manual Handling Operations Regulations*, UK Health and Safety Executive, www.hse.gov.uk.

HSE INDG398, *Making the best use of lifting and handling aids*, UK Health and Safety Executive, www.hse.gov.uk.

ANNEX 1 : Guidance and good practices for tasks when performing distribution activities

- Manual handling and connecting of filling and delivery hose
  - basic principles
  - hose handling/stowing
  - hose connection and disconnection
- Operation of tanks, opening and closing valves
  - Basic principles
  - Additional considerations for valves placed at high level
  - Additional considerations for valves placed at low level
- Opening and closing cabinets
  - Basic principles
  - Single cabinet door opening up or out
  - Roller shutter door
- Operation of tankers - opening and closing valves
  - Basic principles
- Other distribution related activities such as
  - trailer vehicle connections
  - lifting and lowering of landing legs
  - getting in/out the truck cabin and seat position
- Handling of liquid cryogenic containers (pressurised and open)
  - Basic principles
- Operation of liquid cryogenic containers
  - Basic principles
  - Additional considerations for valves placed at high level
  - Additional considerations for valves placed at low level
  - Filling of cryogenic containers at customer’s premises

Title: Manual handling and connecting of filling and delivery hose

Hazards: Operator capability, pressure, heavy loads, slips/trips/falls, low temperature (e.g. splashing of residual refrigerated product), striking objects (e.g. hose whipping, dry ice plugs ejection), fog and limited visibility, oxygen rich or depleted atmosphere

How to (in words):

Basic principles:

- Use a wide stance
- Keep body as close to the hose as possible
- Use a relaxed neutral wrist, elbow and shoulder position
- Back spine in neutral posture – avoid leaning and twisting
- Avoid overreaching
- Avoid over tightening and sudden movements

Hose handling / stowing:

- Due to tanker design, access to the delivery hose may require individuals to reach or work above shoulder height, ensure body posture is adjusted to minimise overreaching or stretching.
- Loading installations equipped with hose support devices reduce manual efforts when handling hoses
- Handle the hose with smooth movements
- If hose needs to be moved to/from the ground level, bend legs and use big muscle groups to generate force, maintain back in a neutral posture

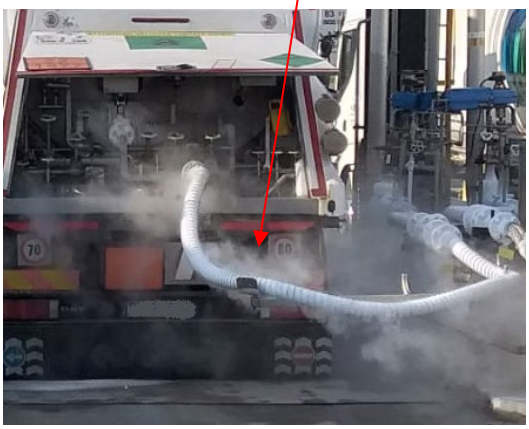
Hose connection and disconnection:

- When aligning and tightening the connection use small and smooth movements and apply appropriate tools; do not hit the “C” spanner with the palm of hand and do not apply excessive force. For further guidance see EIGA Training Package TP 06, *EIGA Couplings Driver Training* [7]

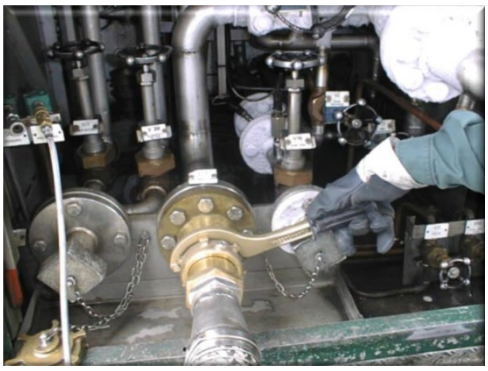
Pictures - Good practices

Hose handling

Suspending the hose or using stands can reduce ergonomic risk during hose handling



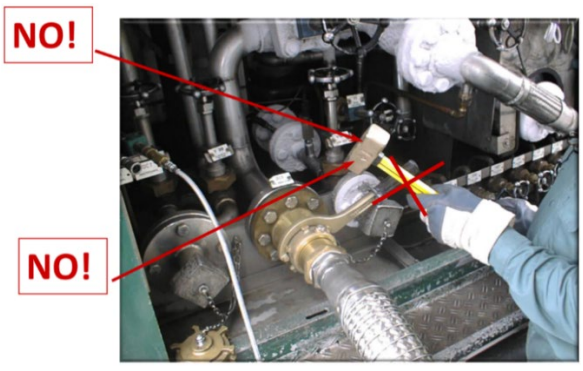
Hose connection



Pictures – Bad practices

Hose handling

Hose connection



Title: Operation of tanks, opening closing valves

Hazards: Operator capability, pressure, repetitive movements, slips/trips/falls, low temperature, noise exposure

How to (in words):

Basic principles:

- Adapt posture to work at waist height where possible
- Use a wide stance
- Use a relaxed neutral wrist, elbow and shoulder position
- Back spine in neutral posture – avoid leaning and twisting
- Keep shoulders relaxed
- Avoid overreaching
- Avoid over tightening and sudden movements

Additional consideration for valves placed at high level

- Work may be above shoulder height for some operators, adjust body posture to minimise overstretching and overreaching
- Using a suitable platform can help to keep shoulders and wrist in neutral relaxed positions

Additional consideration for valves placed at low level

- Work may be below waist height, bend legs to lower centre of gravity to maintain neutral posture

NOTE Valves that are stiff, difficult to operate or leaking should be reported for repair/review
NOTE Use of wheel keys/valve tools should be risk assessed, where they are used care shall be taken to avoid overtightening the valve

Pictures - Good practices

Pictures – Bad practices

Title: Opening closing cabinets

Hazards: Size and weight of cabinet doors, stretching and twisting, pinch points, striking objects

How to (in words):

Basic principles

- Move feet with a wide stance and use two hands when opening and closing cabinet doors
- Use relaxed neutral posture
- Avoid twisting
- Avoid sudden movements and stopping doors with excessive force

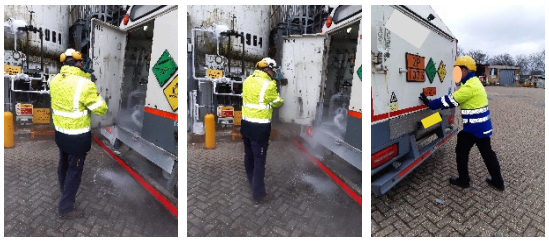
Single cabinet door opening up or out:

- Opening
  - Open the cabinet from in front of the door
  - Allow the door to open smoothly using both hands from force provided by the gas strut
  - Step backwards as the door opens to maintain neutral posture (and avoid twisting/arching back)
- Closing
  - When closing, lower the door from the side to help the operator to take a comfortable position
  - Start with one hand on the strap and the other to release gas strut, then use both hands on the door to control the closing

Roller shutter door:

- Use two hands shoulder width apart
- Open and close by pulling/pushing using big muscle groups to generate force
- Apply similar effort to both hands

Pictures - Good Practice



Opening & closing the cabinet door

Opening and closing single door cabinets

Roller shutter doors

Pictures - Poor Practice

Avoid twisting, avoid using one hand, avoid pushing the cabinet door away and avoid stretching

Avoid lowering single cabinet doors from the front


2T
2187


2T
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Title: Operation of tankers - opening closing valves

Hazards: Operator capability, pressure, repetitive movements, slips/trips/falls, low temperature, noise exposure

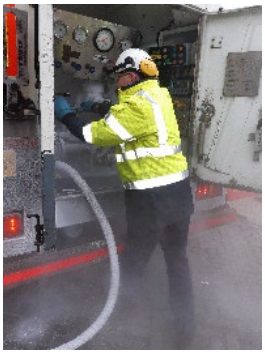
How to (in words):

Basic principles:

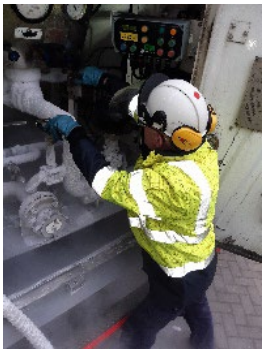
- Use a wide stance on the ground, do not climb on tanker structure
- Use a relaxed neutral wrist, elbow and shoulder position
- Back spine in neutral posture – avoid leaning and twisting
- Use two hands on larger valves, distributing the effort evenly
- Adjust body posture to minimise overstretching and overreaching
- Avoid over tightening and sudden movements
- When operating valves that require reaching, distribute the force of the action by bracing the other hand on another part of the cabinet

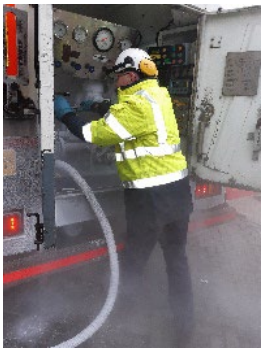
NOTE Valves that are stiff, difficult to operate or leaking should be reported for repair/review
NOTE Use of wheel keys/valve tools should be risk assessed, where they are used care shall be taken to avoid overtightening the valve

Pictures - Good Practice



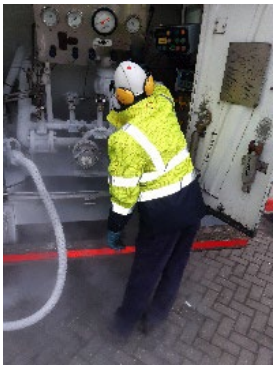
When operating valves face the valve square on and bend the knees with feet slightly apart.

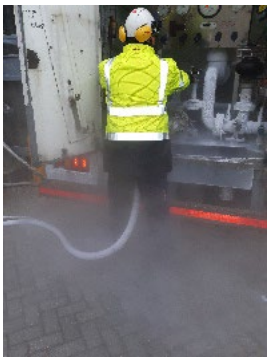




Use the other hand to distribute force when reaching out to operate valves at the rear of the cabinet by bracing it against another part of the cabinet.

Pictures - Poor Practice





Avoid stretching and twisting the body, additionally avoid working astride hoses.

Title: Other distribution activities (trailer vehicle connections, lifting and lowering of landing legs, seat position)

Hazards: biomechanical overload, overexertion, inadvertent trailer movement, inappropriate driving posture, fatigue, trip/fall

How to (in words):

Lifting and lowering of landing legs.

- When engaging/disengaging the lever and the leg movement mechanism: use a wide stance, maintain a neutral spine position, pull or push the lever with smooth action
- When rotating the lever: use relaxed neutral posture and avoid sudden movements; stand side-on using both arms to rotate the lever when the effort is increased.

Trailer-tractor connection/disconnection.

- When placing/removing wheel chocks: bend your legs and keep spine in neutral posture,
- When disengaging the locking device of the connection (after lowering trailer legs): use a wide stance with a neutral spine position and pull handle with smooth action
- When connecting/disconnecting the pneumatic and electric connections between truck and trailer: use wide stance, avoid bending from upper waist, keep shoulders relaxed; if possible, work from a frontal position.

NOTE: make sure trailer brakes are engaged and wheel chocks are in place.

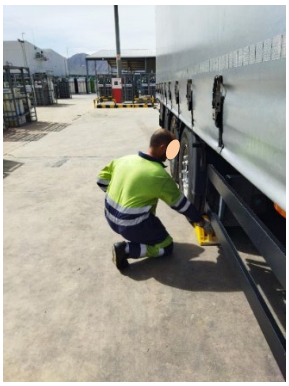
Getting in and out of the truck cabin and driving.

- Always face the cabin and use three points of contact, when getting in/out of the cabin
- Before driving, adjust seat to allow comfortable operations of steering wheel and pedals
- Adjust the back of the seat to allow comfortable posture of back and appropriate lumbar support; keep spine in neutral position, use a relaxed neutral wrist, elbow and shoulder position
- Complete preventative stretches when possible to counteract sedentary postures.

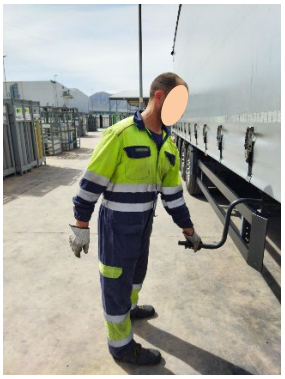
Pictures - Good Practice

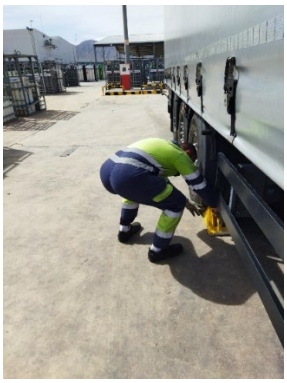
Lifting and lowering of landing legs

Handling wheel chocks

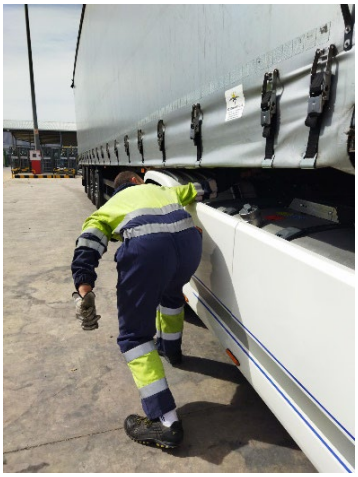


Pictures - Poor Practice



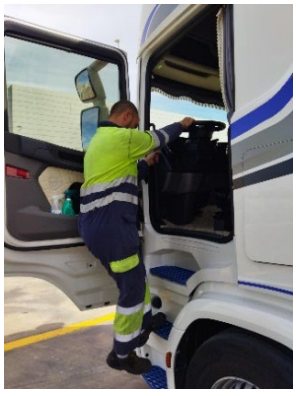


Trailer-tractor connection/disconnection



Connecting/disconnecting the pneumatic and electric connections

Getting in and out of the truck cabin and driving



Body is not balanced

Title: Handling liquid cryogenic containers (pressurized or open)

Hazards: Container size and weight, working environment (including slopes), operator capability, slips/trips/falls.

How to (in words):

NOTE: palletized cryogenic containers, when possible should be moved by fork-lift trucks or electric pallet truck, to reduce ergonomic risk factors. If a manual pallet truck is used, apply the basic principles below.

Basic principles

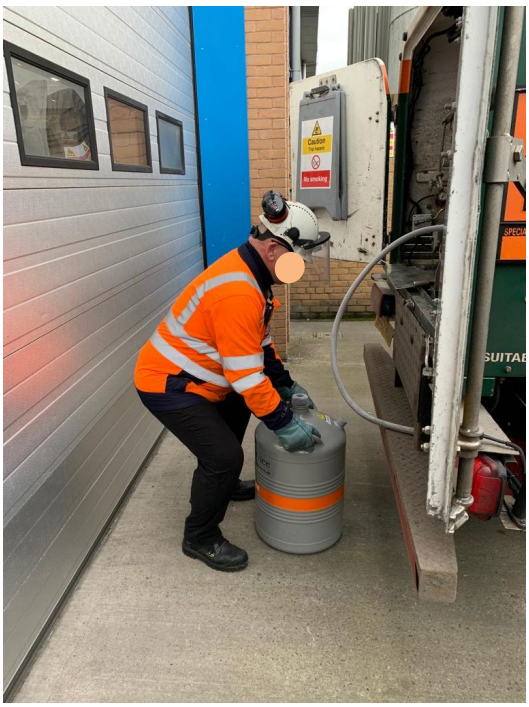
- Push where possible, pulling should be avoided
- Maintain a split stance and use big muscles to generate force
- Use two hands, distribute the force evenly, avoid jerking
- Size, shape, wheel positioning and availability of handle can influence body position
- Avoid pulling with one hand
- Consider your own physical capabilities, request help when necessary
- Important to consider the route, surface conditions, gradients, navigation around corners and through doorways, environmental factors
- When lifting small containers, do not bend at the waist, use leg muscles to generate force, consider mechanical aid to move open liquid cryogenic containers (e.g. trolley)

Pictures - Good Practice

Pushing a tank is the preferred method for moving tanks

Pictures - Poor Practice

Pulling a tank, other than repositioning slightly, is not the preferred method for moving tanks



Title: Operations of liquid cryogenic containers

Hazards: Operator capability, pressure, slips/trips/falls, low temperature (e.g. splashing of residual refrigerated product), striking objects (e.g. hose whipping), fog and limited visibility, oxygen rich or depleted atmosphere

How to (in words):

Basic principles:

- Use a wide stance
- Use a relaxed neutral wrist, elbow and shoulder position
- Back spine in neutral posture – avoid leaning and twisting
- Avoid overreaching
- Avoid over tightening and sudden movements
- If hose needs to be moved to/from the ground level, bend legs and use big muscle groups to generate force, maintain back in a neutral posture
- When aligning and tightening the connection use small and smooth movements and apply appropriate tools; do not hit tools with the palm of hand and do not apply excessive force

Additional consideration for valves and hose connections placed at high level

- Work may be above shoulder height for some operators, adjust body posture to minimise overstretching and overreaching

Additional consideration for valves and hose connections placed at low level

- Work may be below waist height, bend legs to lower centre of gravity to maintain neutral posture

NOTE Valves that are stiff, difficult to operate or leaking should be reported for repair/review
NOTE Use of wheel keys/valve tools should be risk assessed, where they are used care shall be taken to avoid overtightening the valve.

Pictures - Good Practice

Pictures - Poor Practice

Title: filling of cryogenic containers at customer's premises

Hazards: Operator capability, pressure, slips/trips/falls, low temperature (e.g. splashing of residual refrigerated product), striking objects (e.g. hose whipping), fog and limited visibility, oxygen rich or depleted atmosphere, environmental factors, working height differences

How to (in words):

Basic principles:

- Use a wide stance
- Use a relaxed neutral wrist, elbow and shoulder position
- Back spine in neutral posture – avoid leaning and twisting
- Avoid overreaching
- Avoid over tightening and sudden movements
- If hose needs to be moved to/from the ground level, bend legs and use big muscle groups to generate force, maintain back in a neutral posture
- When aligning and tightening the connection use small and smooth movements and apply appropriate tools; do not hit tools with the palm of hand and do not apply excessive force
- Avoid sudden movements when transitioning between different working heights

Additional consideration for activities at high level

- Work may be above shoulder height for some operators, adjust body posture to minimise overstretching and overreaching

Additional consideration for activities at low level

- Work may be below waist height, bend legs to lower centre of gravity to maintain neutral posture

NOTE Valves that are stiff, difficult to operate or leaking should be reported for repair/review

Pictures - Good Practice

Pictures - Poor Practice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Caution