



*- in Fluid Energy Management*

# **HEALTH & SAFETY**

## **OLAER RECOMMENDATION**

### **BEST PRACTISE**

### **WHEN WORKING WITH HYDRAULIC**

### **OR PNEUMATIC SYSTEMS**

**VERSION 01 DATED 09 / 2010**

Issue	Date	Effect on page	Reason for Revision
00	08/2010	all	First official Issue
01	09/2010	all	Appendix added : H&S checklist

Please note that this document is issued in good faith as a GUIDE for working safely on and around hydraulic and pneumatic systems. It is the responsibility of each Olaer local management to ensure that any action undertaken by operators on such systems is fully compliant with all national and/or local regulations. It is recommended that a risk assessment should be carried out before carrying out any work on hydraulic or pneumatic systems and that all appropriate safeguards be taken to minimise the risk of accident or injury.

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## PART ONE: INTRODUCTION: COMMON ELEMENTS

*REMINDER ON UNITS:*

PRESSURE:

➤ Bar or Pascal (Pa)

➤ One Bar ≈ The pressure of the atmosphere

➤ One Bar = 0,1MPa

WHAT IS PRESSURE?

$$PRESSURE = \frac{FORCE}{SURFACE AREA}$$



**200 BAR = ONE ELEPHANT ON A CREDIT CARD**

## **ANY EXISTING PRESSURE IS POTENTIALLY DANGEROUS**

Hydraulic or Pneumatic systems use as an energy source a **liquid** or a **gas** which can create very high mechanical forces or torques within the system.

### **Risks more specifically related to Hydraulic systems:**



Leaks under pressure can be very dangerous, fluid projections in a continuous stream shape (up to a distance of about **five metres**), then dispersing to a spray or vaporising.

**Do not attempt to stop the stream with your hand or any other part of your body**



Hydraulic circuits often use mineral oils. A stream with vaporisation is extremely inflammable when in contact with a heating source (flame or incandescent parts)

**Avoid any welding, grinding ... close to hydraulic circuits under pressure**



**A burst or a break of a flexible hose will lead to uncontrolled and random movements of wide amplitude. (Lashing)**

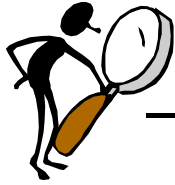
### **Risks more specifically related to Pneumatic systems:**



The failure or crack of a component is very dangerous due to the high quantity of energy stored in the gas. If detached part of the component or the component itself can become **powerful projectiles** which can kill.



**As with hydraulic systems, bursting or breaking of flexible hoses will involve lashing, but will be more violent and will last for a longer time**



## **PART TWO: PREVENTION**

**Note:** each business unit should implement with its respective QMS, a set up, operating instructions and training program.

**BEFORE ANY OPERATION** is carried out on a Hydraulic or Pneumatic system; every person **MUST** take care and responsibility for:

- Respecting the general safety rules that exist in each Olaer premises
- Respecting the specific rules within the specific working area
- Using suitable protective safety equipment :
- When working on hydraulic or pneumatic systems under pressure protective glasses are mandatory.
- Reading all of the appropriate Instructions, if there is any confusion the individual should ask for appropriate guidance before doing anything

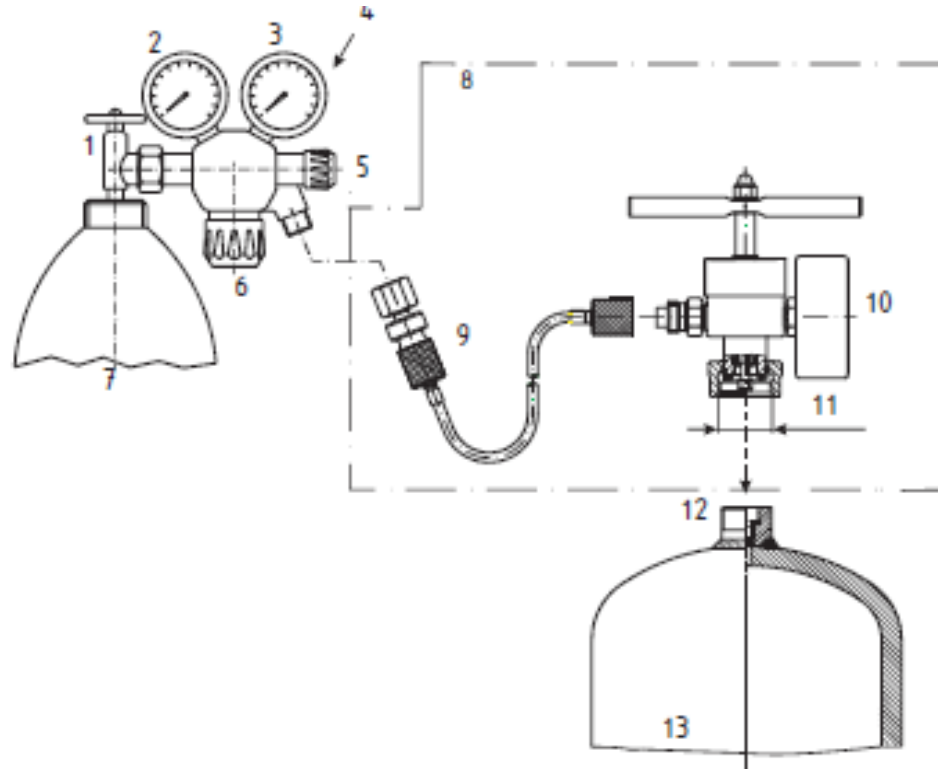


## **PART THREE: BEST PRACTISE WHEN WORKING WITH PNEUMATIC OR HYDRAULIC SYSTEMS**

The example of a gas-pre-charging operation of an Olaer accumulator with charging equipment is a good support for reviewing the best practises when manipulating systems under pressure. What follows is also valid when manipulating hydraulic systems.

Operations, described step by step in the instruction manual, require knowledge and **best practise** to be applied on the following parts:

- Gas bottles
- Flexible hoses
- Adaptors
- ...



1 : shut-off device	2 : high pressure gauge
3 : low pressure gauge	4 : pressure reducing device
5 : shut-off valve	6 : low pressure adjustment
7 : gas bottle	8 : gas filling device
9 : connecting hose	10 : gauge for pre-charge pressure
11: fastening thread	12 : gas port with gas filling screw
13 : accumulator gas chamber	

## Gas bottles

When using gas bottles **the following rules have to be applied:**

- If any protective device is fitted, this should never be removed
- Any handle must never be manipulated with a wrench or other tool, only by hand

- A coloured plastic washer, if existing (depending on country) indicates the year when the bottle must be checked.
- Handle the bottles with correct movement : raise or lay down

## Adaptors

When using an adaptor **the following rules must be applied:**

### Connection to gas bottles or systems

- Always verify that the pressure rating of the adaptor is greater than the pressure intended for the system
- Always use an adaptor which corresponds to the bottle or the system to which it will be fitted (**same thread dimensions**)
- Never fit an intermediate or an unknown adaptor
- Do not use any grease or oil with an adaptor
- Apply the recommended torque value by the manufacturer

### Adaptors Used Regularly

- Improper use of adaptors can lead to serious and dangerous failures as illustrated hereafter :



- In order to minimise any risk with an adaptor which is used repeatedly, the following best practise must be applied :

- Systematically and regularly check the following points :
  - Cleanliness of the adaptor (pay particular attention to the threads)
  - Wear of threads
  - Detection of any crack in material

If any anomaly or problem is detected the operator **MUST** immediately scrap the adaptor concerned and replace it with a new one even if this is only a doubt it is imperative to use a cautious approach.

In case of doubt or difficulty in applying a periodical check of each adaptor in usage, one can adopt a systematic replacement of all adaptors every determined number of years:

- **5** years or less for high frequency usage
- **10** years for low frequency usage

## Seals

For seals in systems under pressure **the following rules have to be applied:**

- Always verify that the maximum pressure rating of the sealing systems in use is greater than the pressure intended
- Always use the correct seal as defined in the sealing system design
- Before mounting, grease or lubricate as recommended by the supplier
- When seals are reused, check the following points :
  - Cleanliness of the seals
  - Check there is no excessive hardening (ensure there are no cracks when bending or manipulating the seal)
  - Detection of any crack in material

If any obvious anomaly is detected the operator **MUST** immediately scrap and replace the concerned seal with a new one.

In case of doubt or difficulty in applying a periodical check of each adaptor in usage, one can adopt a systematic replacement of all seals every determined number of years. **5** years can be considered as a maximum for rubber seals.

# Flexible hoses

Flexible hoses fitted in systems are permanently stressed by:

- their own movement
- friction on part of the system
- pressure amplitudes and shocks (water-hammering)
- change in temperature

It explains why failures of hoses or its clamping system can never be completely avoided.

**In order to minimise limit the risk at maximum the following rules have to be applied:**

- Verify the marking on hoses: at least **MUST** be mentioned year of manufacture and maximum allowable pressure permitted
  
- Always verify that the maximum allowable pressure permitted by the hose is greater than the pressure intended
  
- Always use a hose which is chemically compliant with the type of fluid circulating.  
**Note !** The resistance of the lining and cover of a hose are designed for the media to which the hose comes into contact : air, oil, water, chemicals, and/or external influences : ozone, UV light and weathering. Consequently never use the same hose for different media.
  
- Always check a proper mounting, without excessive bending or torsion  
See hereafter best practises for mounting:



Incorrect



Correct



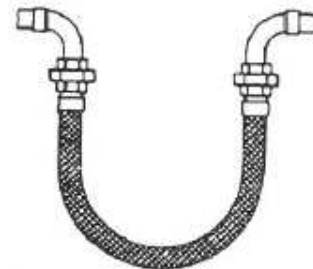
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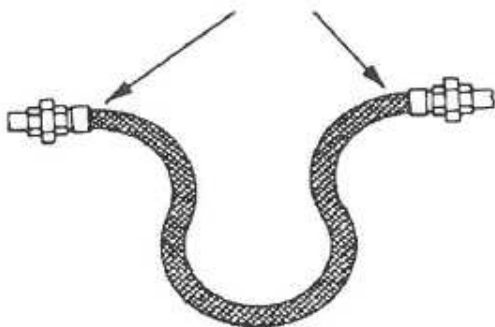
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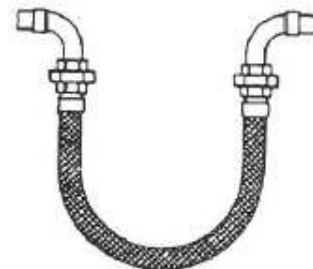
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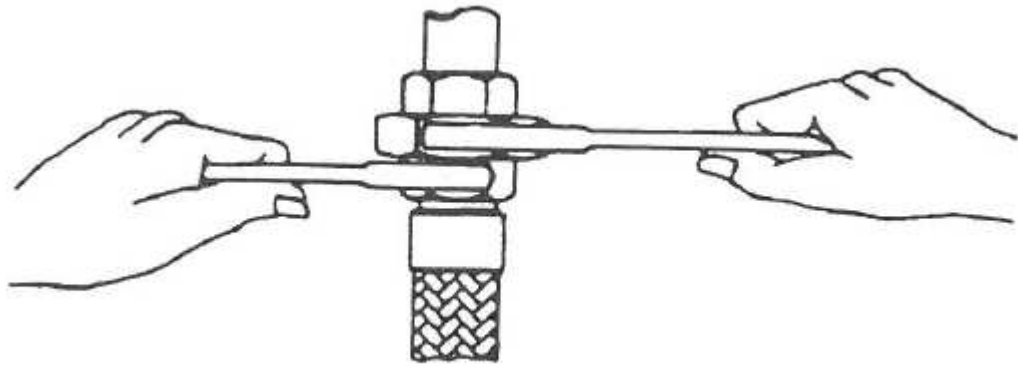
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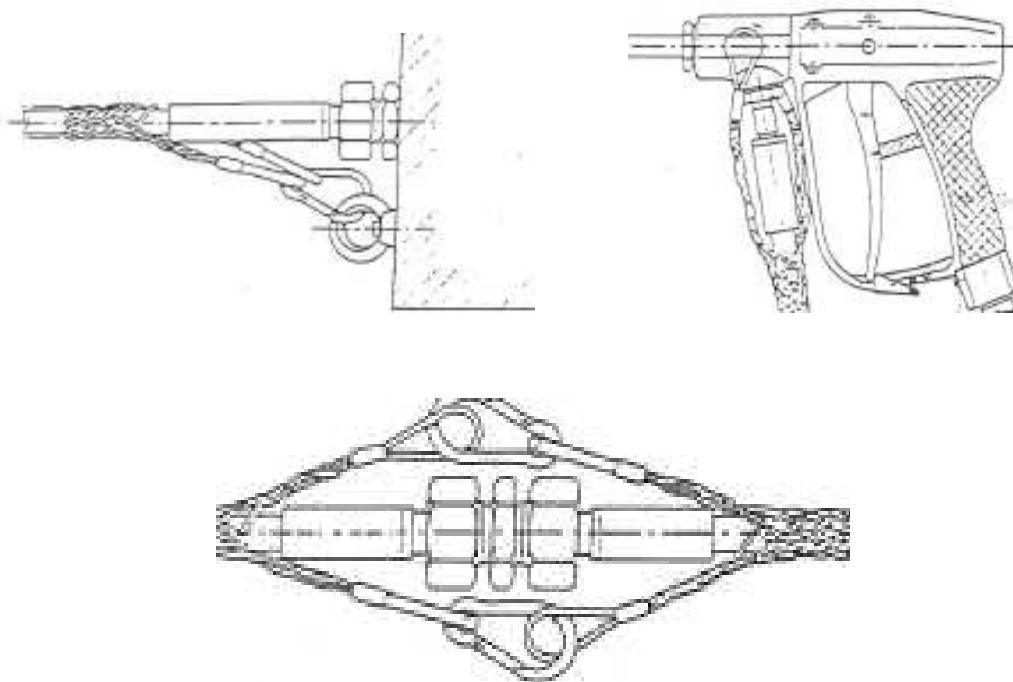


CORRECT



CORRECT

- Above pressure of **10 bar** or for hoses whose lengths are above 50 cm, attach the hoses. See hereafter best practises for attaching hoses:



- For Nitrogen gas pre-charging control operation the mounting of a Flow Reduction Valve is recommended  
Use the Olaer FRV 1/4-350 or other model if required in case of too high closing sensitivity, higher pressure range or other gas than Nitrogen.

## **Flexible hoses regularly used**

- Proceed with periodical checking of each of the points :
  - Cleanliness of flexible hoses (external and internal)
  - Wear or chemical degradation
  - Check for cracks in the hose or the clamping

If any anomalies are detected the operator **MUST** scrap the concerned flexible hose and replace it with a new one.

In case of doubt or difficulty in applying a periodical check of each flexible hose in usage, one can adopt a systematic replacement of all hoses every determined number of years. 5 years can be considered as a maximum.

**PLEASE NOTE THAT ALL BUSINESS UNITS SHOULD HAVE A SAFE WORKING ENVIRONMENT WITH CLEAR AND DOCUMENTED INSTRUCTIONS COVERING INSPECTION OF EQUIPMENT, SET UP TEST, ONGOING TESTING AND CLOSE DOWN. THERE SHOULD ALSO BE A REACTION PLAN IN THE CASE SOMETHING GOES WRONG.**

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# **APPENDIX**

## **H&S CHECKLIST**

**THIS CHECKLIST MUST BE USED IN CONJUNCTION WITH THE  
OLAER BEST PRACTISE WHEN WORKING WITH HYDRAULIC OR  
PNEUMATIC SYSTEMS MANUAL**

**1. PREVENTION**

REQUIREMENT	OK	NOK	CHECKED BY	DATE
The general safety rules that exist and understood with in your work area.				
<b>Comments</b>				
Any relevant specific rules within your working area are clearly understood.				
<b>Comments</b>				
Suitable protective safety equipment is available and used.				
<b>Comments</b>				
Protective safety glasses are available and used.				
<b>Comments</b>				
Any appropriate instructions known, available and understood.				
<b>Comments</b>				

**REMEMBER: SAFETY FIRST AND IF IN DOUBT ASK YOUR MANAGER**



**GAS BOTTLES**

When using GAS BOTTLES the following rules **MUST** to be applied

Any protective devices are present and have not been removed.				
<b>Comments</b>				
<hr/>				
Any handle has not been manipulated with a wrench or other tool, only by hand.				
<b>Comments</b>				
<hr/>				
A coloured plastic washer, if existing (depending on country) indicates the year when the bottle must be checked – This has been checked and is with the specified date.				
<b>Comments</b>				
<hr/>				
The gas bottle must be attached to a solid fittings				
<b>Comments</b>				
<hr/>				

**REMEMBER: SAFETY FIRST AND IF IN DOUBT ASK YOUR MANAGER**

**ADAPTORS**  
**CONNECTION TO GAS BOTTLES OR SYSTEMS**

When using ADAPTORS the following rules **MUST** to be applied

The pressure rating of the adaptor has been checked and is greater than the pressure intended for the system.				
<b>Comments</b>				
The correct adaptor has been fitted to the bottle or the system (i.e. same thread size).				
<b>Comments</b>				
Grease or oil has not been applied to the adaptor				
<b>Comments</b>				
The manufacturer recommended torque value has been applied to the adaptor				
<b>Comments</b>				

**REMEMBER: SAFETY FIRST AND IF IN DOUBT ASK YOUR MANAGER**

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**ADAPTORS Continued**

When using gas bottles the following rules **MUST** to be applied

<b>ADAPTORS USED REGULARLY</b> I have checked the adaptors and confirmed the following No contamination to the adaptor threads. The adaptor threads are not worn. The adaptor has been visually inspected for cracks.				
<b>Comments</b>				

**REMEMBER: SAFETY FIRST AND IF IN DOUBT ASK YOUR MANAGER**

**SEALS**

When using SEALS the following rules **MUST** to be applied

The maximum pressure rating of the sealing systems in use is greater than the pressure intended				
<b>Comments</b>				
<hr/>				
The correct seal has been used as defined in the sealing system design.				
<b>Comments</b>				
<hr/>				
Before mounting the supplier recommended grease or lubricate has been used.				
<b>Comments</b>				
<hr/>				
<b>WHEN SEALS ARE REUSED, CHECK THE FOLLOWING POINTS</b> The seal are clean. There are no cracks evident when bending or manipulating the seal.				
<b>Comments</b>				
<hr/>				

**REMEMBER: SAFETY FIRST AND IF IN DOUBT ASK YOUR MANAGER**

**FLEXIBLE HOSES**

When using FLEXIBLE HOSES the following rules **MUST** to be applied

Ensure the marking on hoses details the year of manufacture and maximum allowable pressure permitted and the system is not greater than the hose requirement.				
<b>Comments</b>				
Ensure that the hose is chemically compliant with the type of fluid circulating. <i>Never use the same hose for different liquids, gases etc.</i>				
<b>Comments</b>				
The hose has been mounted correctly and there's no excessive bending or torsion.				
<b>Comments</b>				
Above pressure of 10 bar or for hoses whose lengths are above 50 cm, ensure that the hoses are in accordance with page 11 of the manual.				
<b>Comments</b>				

**REMEMBER: SAFETY FIRST AND IF IN DOUBT ASK YOUR MANAGER**

**FLEXIBLE HOSES Continued**

When using FLEXIBLE HOSES the following rules **MUST** to be applied

For Nitrogen gas pre-charging control operation the mounting of a Flow Reduction Valve is recommended. Please confirm if this has been used.				
<b>Comments</b>				
I have checked the hoses for Cleanliness Wear or chemical degradation Cracks in the hose or the clamping				
<b>Comments</b>				

**REMEMBER: SAFETY FIRST AND IF IN DOUBT ASK YOUR MANAGER**