Vacuum Insulated Pipelines VIP PN16 and PN40

Table of contents

I. STRUCTURE OF THE MANUAL / CLARIFICATION

The various aspects of this manual are clearly listed here. Points of attention are marked throughout the entire manual in the following way (the interpretation is also given):

Offers suggestions/advice to the operator in order to perform certain tasks more easily.

Points out possible problems to the operator.

Indicates damage to the system or directly linked equipment when the operator does not carefully adhere to the procedures.

Warns the operator of possible injuries if the procedures are not adhered to properly.

The life of the operator is directly threatened.

Demaco Holland bv considers the operator to be:
the one who operates the machine or equipment supplied by Demaco Holland bv.

The operator is responsible for the safety of any assisting employee. The operator must ensure, before starting the machine or application, that no dangerous situation can occur for the assisting employee.

II. SAFETY AND HEALTH CONCERNS

⚠ NOTE

This user manual must be read by the operator as soon as possible in order for him to become familiar with the operation of this equipment.

From the point of view of injuries to the operator, specific attention is given to the dangers that can occur when using liquid nitrogen. On Demaco Holland bv equipment, where the operator may come into contact with liquid nitrogen, you can find the label as shown below. It warns the operator of the presence of coldness and it is indicated that safety glasses and gloves with wrist protection should be worn.

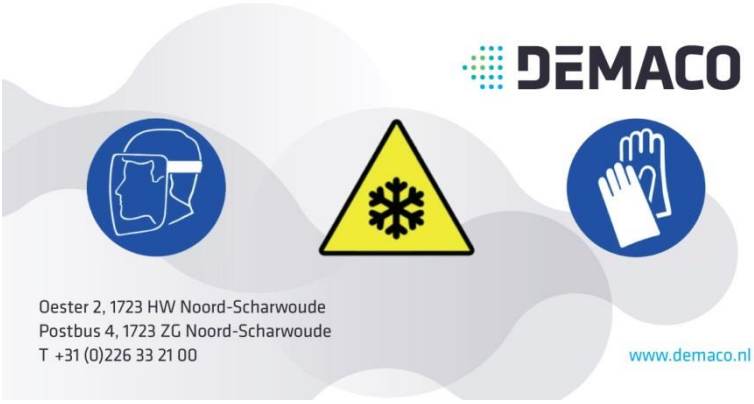

figure 1; ***Safety label***

This user manual should at least be available for consultation at the head of the department. We recommend that a copy be made of this manual inserted in plastic folders, or bound, and put on view at location with the control cabinet.

We also recommend to carefully read the Demaco safety instruction “Safety guidelines for working with cold media”. Extensive information is provided in this manual about working with cryogenic media. A copy of the “safety instruction” is shipped with this delivery. Should you require more copies of this instruction in order to create a save working environment for your operator(s), additional copies can be requested from Demaco Holland bv. Contact our sales department.

1 INTRODUCTION

NOTE

Inside Holland users of pressure equipment must perform an examination before bringing into use, dutch term; “Keuring Voor Ingebruikname” (KVI), the user must select which equipment must have this examination. The rules are according the dutch “Waren Wet Besluit Drukapparatuur” (WWBD).

1.1 Explaining the function and operation

These assembly instructions apply to vacuum insulated pipelines. Before you start with the installation, use and maintenance, you should read these instructions carefully.
Vacuum insulated pipelines are compounded from pipeline sections that are pre-manufactured, vacuum-packed and tested. Every section is provided with a static vacuum which is equipped with a chemical getter system to increase the standing time of the vacuum and a number of layers of glass and aluminium foil to keep heat radiation on the process tube as low as possible. Every section is also equipped with a pump valve. This valve has 2 functions, access as vacuum pump and as safety valve for the vacuum mantle. The pump valve is normally situated at the end of a section and must remain reachable for eventual re-vacuuming.

The sections are pre-manufactured and mutually connected using Johnston links, Welded links, Perlite links or Foam links. Johnston links require no welding activities during the installation of the pipeline work. Welding links on the other hand have to be welded and vacuumed during the installation of the pipeline work.
Perlite links and Foam links must only be welded and equipped with conventional isolation.

A vacuum insulated pipeline consists of a double-walled tube whereby the process medium runs through the inner tube. The outer mantle is necessary to create a vacuum isolation and to ward of external pressures. The thermal crimping as a result of the cryogenic process medium is absorbed by built-in compensators. This results in thermal contraction only as a result of environmental temperature changes. The outer mantle has very limited contact with the process tube so that standard support systems can be used. Here, only the thermal contraction of the outer mantle should be considered. Thermal contraction of the process tube is completely absorbed by the compensators built into the process tube.

WARNING

Support by means of welding is normally not possible to the vacuum insulated pipelines because leakages could then originate in the vacuum mantle. Welding for support systems or compounds for isolation mantles for conventional insulated pipelines can only be done on a special double equipped vacuum mantle.

Type and positions of support systems have to be determined from the standards and rules applicable to the location of use. Normal applicable support distances are:

- DN10 - DN25 2m
- 1” 2.5m
- 1.5” – 2.5” 3m
- 3” and 4” 3.5m
- 6” 4.5m
- 8” 6m

For distances between a support and a curve, valve, link or other components, a maximum of 1m must be used. Bends should be prevented on links between different sections.

1.2 Purpose of use and circumstances

Vacuum insulated pipelines are suitable for cryogenic gasses from -269°C to 80°C.
PN16 vacuum insulated pipelines are suitable for maximum 16 bar (g).
PN40 vacuum insulated pipelines are suitable for maximum 40 bar (g).
Expected lifespan depends on the number of cold/warm cycles of the compensators that are usually 1000.

2 ASSEMBLY INSTRUCTION

2.1 Receipt

Be careful with the unpacking of vacuum insulated pipelines and be on the lookout for visible damage. Visible damage should be reported to Demaco Holland bv or a Demaco representative.
Check the pipeline sections based on the isometric drawing. The project number, pipeline and the section number are applied by Demaco Holland bv on every section at the pump valve. The applied section numbers on the pipelines correspond with the section numbers on the isometric drawing. The pipeline and the section numbers can be read through the packaging. Only remove the packaging at the time of the definite assembly. Hereby dirt and moisture is prevented to enter the pipelines which could disrupt a correct assemblage.
Check if the pumps valve plugs are still present to be sure that the vacuum is still present.
In case of multiple pipelines, we recommend that you first sort the sections per pipeline number before starting with the assemblage.
If the installation activities are not performed immediately and the sections have to be stored, this has to take place in a safe manner to prevent damage.

2.2 Installation

Depending on the pipeline, a starting point can be selected for the assembly.
This does not have to be with section number 1.
Follow the steps below:

1. Install the first supports for the first sections.
2. Then place the first two selected sections loosely in the supports and remove the safety lids.
   Use safe lifting equipment if the weight of the section requires this to guarantee personal safety and to prevent damage of the pipelines.
3. Repeat the above steps until the entire pipeline is positioned.
4. Minor outline deviations may still be adjusted by changing the support.
5. Implement limited height variances to prevent gas blockages.

6. Use a slope of 1% so that gas bubbles can only escape in the flow direction.
7. When the pipeline is completely positioned according to above directives the supports can be fixed.
8. Finally, connect the pipeline to the tank and the users' end point.

For the assembly of specific links, refer to the manual of this specific link, i.e.:

- Johnston links
- Welding links
- Perlite links
- Foam links

⚠ WARNING

Check that a safety valve is installed between every two closures before the liquid medium is pumped into the pipeline. Closed in cryogenic fluids that warm up can create very high pressures, pressures above the allowable pressure of the pipeline. This can result in cracking of the pipeline.

A safety valve can blow of cold medium, this can result in danger for freezing.
This flow of cold gas may not be pointed on the VIP-jacket, because this can lead to condensation and ice on the jacket. Pump valves or Johnston couplings (that contain soft seals) that are placed in the jacket can get cold and they can leak because of this cold temperatures, this results in bad isolation values.

⚠ CAREFUL

Every section is vacuum packed in the factory.
Welding to the outer mantle of a section will result in the loss of the vacuum.

2.3 Testing

When you are convinced that you have assembled the entire pipeline correctly, the pipeline can be tested.
The following tests can be performed:

1. Pressure test:
    a. Perform according the regulations.
    b. Increase the pressure in small steps and check for any leakages.
2. Functional test:
    a. Open the valves on the user end which is the furthest removed from the stock tank and wait until liquid comes out before the valve can be closed.
    b. Repeat this step with all present valves so that the entire system is cooled.
    c. Check the vacuum insulated pipeline visually for condensation and ice. Under specific environmental conditions, condensation formation is possible on links, valves and other less properly insulated parts.
    d. Check if all present components are functioning properly.

When all of the above-mentioned tests have been performed with success the vacuum insulated pipeline system is suitable for use. When defects are established these have to be fixed followed by a repetition of the above tests or they have to be reported to Demaco Holland bv or Demaco representative.

2.4 Disassembly

If a vacuum insulated pipeline system has to be dismantled it is advisable to operate in the opposite sequence as the installation.

Before Johnston links can be dismantled, the pipeline has to be discharged of the internal pressure by closing the valves at the tank and opening the release valves.
The pipelines should also be warmed up to room temperature. This heating takes place unforced and under normal circumstances 20 hours. This heating process can be accelerated by purging the process pipeline with nitrogen gas at room temperature.

3 STORAGE OF THE VACUUM INSTULATED PIPELINES

Storage of the vacuum insulated pipelines should be dry and in packaging. Make sure that no water and pollution can enter the pipelines. The minimum storage temperature of the pipelines is 18°C.If it is stored at lower temperatures the process pipeline has to be blown with dry gas before use, so that no water or water condensation is present in the process pipeline with commencement of use. Special moisture free packaging is also usable for this.

Ensure that the packaging and protection of the ends of the pipeline sections remain undamaged during transport and storage.

4 MAINTENANCE AND USE

The maintenance of a vacuum insulated pipeline is subject to periodical visual inspection, once per month. Ice formation or heavy condensation on the outer mantle or on the flanges of the links can indicate:

- A reduction of the vacuum level in the vacuum space. This occurs with normal conditions after some years. With the reduction of the vacuum level the isolation value also decreases. Ice will thus possibly become visible. By vacuuming the pipeline again, the isolation is recovered. Demaco Holland bv has all the equipment and knowledge to perform this after vacuuming.
  For the proper implementation of the after vacuuming the pipeline should be empty and be brought to room temperature at least.

- Damage to the O-ring in the Johnston. We recommend replacement of the O-ring when visible damage has developed. Remove the O-ring and clean the O-ring groove cautiously.
  When an O-ring has to be replaced, the link must always be heated to room temperature/area temperature.

To temporarily prevent condensation of ice before after vacuuming can be performed, conventional foam isolation can be used to decrease or prevent condensation drops.

Vacuum insulated pipelines can be equipped with safety valves. Check whether the opening of the safety valves are free of any obstacles.

During re-evacuation (LNG pipes only) always use cold traps to avoid damaging the vacuum pump. Or use pumps that can deal with CH_4 molecules.

5 INTERVALS AND SCOPE OF INSPECTION OF SAFETY FACILITIES.

The vacuum insulated pipelines can be equipped with a safety relief valve which must undergo regular inspection in accordance with the local regulations.