Directive D-0801.3
Preservation Methods and Instructions for Storage after Delivery for Variable Speed Drives

Version 3, 2017-03-22
9163625-006714, Protection Class: 0: Offen (public)
Uncontrolled copy

Issued by: Berroth, Hannes
Date: 2017-03-22

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ID Number: 9163625-006714

Products: R-Coupling, S-Coupling, Vorecon, Torque Converter, Heat Exchanger, WinDrive, HyDrive

Departments: Sales, Design dept., Development, Quality Assurance, Projecting, Service

Subject areas: Preservation, packing, storage

Confidentiality: released for external use (customers / subsuppliers)
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1 Field of Application

This directive contains an overview of preservation methods, instructions for storage and inspections of machines and assemblies after delivery, as well as general instructions.

Note
The aim of all measures is to avoid the corrosive system!
It is imperative to prevent the corrosive system consisting of ferrous material + water + oxygen (water also in form of relative humidity). Aim is to achieve and maintain a relative air humidity of < 40% in the inside, as below this air humidity no corrosion occurs. Alternatively, the corrosive system is prevented by displacing the oxygen by means of flushing with technical nitrogen.
2 General instructions

Voith Turbo variable speed drives and their assemblies are technically sophisticated capital goods which sound conditions have to be maintained during installation and mounting works, longer periods of storage (without transport packing) as well as after installation, before, during or after flushing/test run or operational downtimes. The measures required during these phases as well as the necessary inspections are described in the following. All work performed has to be recorded in writing.

Note

Voith Turbo variable speed drives and their assemblies are technically sophisticated capital goods which sound conditions have to be maintained during installation and mounting works, longer periods of storage (without transport packing) as well as after installation, before, during or after flushing/test run or operational downtimes.

When carried out carefully, the storage and preservation methods described are suitable for maintaining the perfect condition of the goods supplied in the period from shipment from Voith, Crailsheim till commissioning and during operation.

It is imperative to prevent the corrosive system consisting of ferrous material + water + oxygen.
In addition to protecting the external, corrosion-prone surfaces by applying film-forming, water-repellent anticorrosive agents, the aim of the described measures is to create a dry or alternatively a dry (displacement of water) and oxygen-free climate (flushing with technical nitrogen) inside the variable speed drives.
Aim is to achieve and maintain a relative air humidity of < 40 % in the inside, as below this air humidity no corrosion occurs.
Alternatively, the corrosive system is prevented by displacing the oxygen by means of flushing with technical nitrogen.

Note

The aim is to achieve and maintain a relative air humidity of < 40 % inside the variable speed drive, as below this air humidity no corrosion occurs (by means of sorption air dehumidifier or dry compressed air / instrument air).
Alternatively, the corrosive system is prevented by displacing the oxygen by means of flushing with technical nitrogen.
The following can be used to create the non-corrosive atmosphere inside the variable speed drives:

- Sorption air dehumidifier (dehydration / relative humidity < 40%)
- Dry compressed air / instrument air (dehydration / relative humidity < 40%)
- Technical nitrogen (displacement of oxygen)

**DANGER**

Suffocation hazard
When nitrogen is used, work on the variable speed drives may only be performed by taking special preventive measures.

Suitable preservation measures have to be taken within 24 hours after receipt of variable speed drives without packing according to Voith Directive D-0800 (9163625-006212), Packing No. 1.

Assemblies, such as gear stages, are to be treated like external bright iron parts and are generally to be stored packed in accordance with Voith Directive D-0800 (9163625-006212), Packing No. 2/3 or in air-conditioned rooms (see Chapter 4), unless agreed otherwise, or delivered in special containers for long-term storage (for details, please see the instruction manual).
3 Installation of Variable Speed Drives into a System

Note
Special attention should be paid to the effectiveness of the preservation during the installation phase of variable speed drives into a system, as it is often subject to additional hazards due to water, accumulation of large amounts of dirt and physical damage.

Special attention should be paid to the effectiveness of the preservation, as it is frequently subject to additional hazards due to water, accumulation of large amounts of dirt and physical damage.

While installing into the drive train (includes mounting of variable speed drive on the foundation/skid, mechanical and electrical connecting work, piping, alignment), preparing for commissioning (flushing with oil), commissioning and making ready for operation, it is vital to check and document the effectiveness of the preservation in regular intervals.

- Installation should preferably be performed in buildings, at least, however, under a roof protected from the weather or in a tent.

- For mounting purposes, spray or coat bright external iron surfaces on the same day with a film-forming anticorrosive agent.

- Do not unpack cold variable speed drives in warm rooms (below dew point) but only after the temperature has equalized.

While flushing with dry air, dry compressed air / instrument air or technical nitrogen, ensure that there is an opening to prevent formation of an overpressure inside the Voith Turbo variable speed drive.

DANGER

Suffocation hazard
There is the risk of suffocation in case of permanent flushing with nitrogen in closed rooms. Ensure sufficient ventilation when flushing with nitrogen.

DANGER

Suffocation hazard
When nitrogen is used, work on the variable speed drives may only be performed by taking special preventive measures.
DANGER

Suffocation hazard
If nitrogen is used for preservation, it is vital to sufficiently ventilate the housing before beginning with any work inside the variable speed drive.

3.1 Installation in air-conditioned hall

The following measures apply to an air-conditioned hall which is defined as follows:

- Temperature range 18 to 26 °C
- Relative air humidity, permanently < 65%
- Low moment of air
- Temperature fluctuation within 24h < 3K

If one of the above conditions is not met, the measures defined under 3.2 for 'Non-air-conditioned halls' are to be applied.

Note
If the relative humidity < 40% and the temperature fluctuation is < 3K within 24 h, the measures shall be implemented only after completion of the work.

Spray bright iron parts with a film-forming, water-displacing anticorrosive agent. (Clean surfaces of variable speed drives, that were sprayed with preserving agents, before attaching or mounting parts, e.g. hubs, with a suitable cleaning agent, white spirit or petroleum.) After attaching or mounting parts, re-coat or spray remaining bright iron surfaces with anticorrosive agent, or coat with paint.

The following methods are recommended to protect the inside of the variable speed drives against corrosion during the installation phase:

a) Dehumidification of the air inside the variable speed drives using a sorption air humidifier.

- As long as no covers, flanges, etc. of the variable speed drives are opened, dry the air inside the machine in regular intervals (e.g. every 3 days) using a sorption air humidifier and document the same. Permissible relative residual humidity < 20%. Use a plastic foil or similar to close the vent filter and the input and output side shaft ends.

- The permanent supply of the variable speed drive inside with dehumidified air via a sorption air dehumidifier (control by means of hygrostat, if necessary) is permitted. Relative air humidity inside the variable speed drives shall be < 40%.

- Removed covers, flanges, etc. are to be remounted as quickly as possible, or be replaced by provisional covers to reduce the ingress of humidity to an unavoidable minimum.

- Then dry immediately the inside of the variable speed drive using a sorption air dehumidifier.
b) Supply of the variable speed drive inside with dry compressed air / instrument air. Volume flow rate approx. 5-10 l/min. The atmospheric dew point of the compressed air / instrument air must be 25K below the ambient temperature.

- As long as no covers, flanges, etc. of the variable speed drive are opened, fill the machine inside every 3 days with dry compressed air / instrument air. Perform the flushing with at least 5 times of the volume of the inside.

- The permanent supply of the variable speed drive inside with dry compressed air / instrument air is permitted.

- Removed covers, flanges, etc. are to be remounted as quickly as possible, or be replaced by provisional covers to reduce the ingress of humidity to an unavoidable minimum.

- Then dry immediately the inside of the variable speed drive using a sorption air dehumidifier.

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**DANGER**

Explosion hazard
Avoid overpressure in the system.

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3.2 Installation in non-air-conditioned hall

The following measures apply to a non-air-conditioned hall which is defined as follows:

- Temperature range 10 to 30 °C
- Relative air humidity range 35 to 70 %
- Moderate movement of air
- Temperature fluctuation within 24h < 10K

If one of the above conditions is not met, the measures defined under 3.3 for "In the open" are to be applied.

Spray bright iron parts with film-forming, water-displacing anticorrosive agent. (Clean surfaces of variable speed drives, that were sprayed with preserving agents, before attaching or mounting parts, e.g. hubs, with a suitable cleaning agent, white spirit or petroleum.) After attaching or mounting parts, re-coat or spray remaining bright iron surfaces with anticorrosive agent, or coat with paint.
The following methods are recommended to protect the inside of the variable speed drives against corrosion during the installation phase:

a) Dehumidification of the air inside the variable speed drives using a sorption air humidifier.

- As long as no covers, flanges, etc. of the variable speed drives are opened, dry the air inside the machine in every 3 days using a sorption air humidifier and document the same. Permissible relative residual humidity $\leq 15\%$. Use a plastic foil or similar to close the vent filter and the input and output side shaft ends.

- The permanent supply of the variable speed drive inside with dehumidified air via a sorption air dehumidifier (control by means of hygrostat, if necessary) is permitted. The relative air humidity inside of the machine must be $\leq 40\%$.

- Removed covers, flanges, etc. are to be replaced immediately by provisional covers to reduce the ingress of humidity to an unavoidable minimum.

- Then dry immediately the inside of the variable speed drive using a sorption air dehumidifier.

b) Supply of the variable speed drive inside with dry compressed air / instrument air. Volume flow rate approx. 10-15 l/min. The atmospheric dew point of the compressed air / instrument air must be 25K below the ambient temperature.

- As long as no covers, flanges, etc. of the variable speed drive are opened, fill the machine inside every 3 days with dry compressed air / instrument air. Use a plastic foil or similar to close the vent filter and the input and output side shaft ends. Perform the flushing with at least 5 times of the volume of the inside.

- The permanent supply of the variable speed drive inside with dry compressed air / instrument air is permitted (10-15 l/min).

- Removed covers, flanges, etc. are to be replaced immediately by provisional covers to reduce the ingress of humidity to an unavoidable minimum.

- Then dry immediately the inside of the variable speed drive using a sorption air dehumidifier.

3.3 Installation in the open/outdoors

Perform the installation of variable speed drives and work for which covers, flanges, etc. are unscrewed, under a roof or in a tent.

Spray bright iron parts with film-forming, water-displacing anticorrosive agent. (Clean surfaces of variable speed drives, that were sprayed with preserving agents, before attaching or mounting parts, e.g. hubs, with a suitable cleaning agent, white spirit or petroleum.) After attaching or mounting parts, re-coat or spray remaining bright iron surfaces with anticorrosive agent, or coat with paint.
The following methods are recommended to protect the inside of the variable speed drives against corrosion during the installation phase:

a) Permanent supply of the variable speed drive inside with dehumidified air using a sorption air dehumidifier. Removed covers, flanges, etc. are to be replaced immediately by provisional covers to reduce the ingress of humidity to an unavoidable minimum.

b) Permanent supply of the variable speed drive inside with dry compressed air / instrument air.
   - The atmospheric dew point of the compressed air / instrument air must be 25K below the ambient temperature
   - Volume flow rate approx. 10-15 l/min
   - Removed covers, flanges, etc. are to be replaced immediately by provisional covers to reduce the ingress of humidity to an unavoidable minimum.

c) Permanent supply of the variable speed drive inside with technical nitrogen
   - Dew point of nitrogen 25K below the ambient temperature
   - Volume flow rate approx. 10-15 l/min
   - Required pressure approx. 0.002 bar
   - Removed covers, flanges, etc. are to be replaced immediately by provisional covers to reduce the ingress of humidity to an unavoidable minimum.

DANGER

Suffocation hazard
When nitrogen is used, work on the variable speed drives may only be performed by taking special preventive measures.

Note
Technical nitrogen for preservation purposes during the installation work may be used only if the sorption air dehumidifier / dry compressed air / instrument air are not realizable.
4 General Information regarding Storage

Requirements to the storage of variable speed drives or systems in closed rooms:

- The storage room should be dry, with a low level of dust, moderately ventilated and free from vibration.

- Basic precondition for the storage is that no aggressive media, such as gases, vapors or aerosols of acids, alkaline or salts can come in contact with the machines.

- Ensure sufficient stability, also on sloped planes.

- All machines have to be easily accessible for inspection and maintenance work:
  - Reading off the moisture indicators
  - Inspection of the machines
  - Mending of the packaging

- Do not unpack cold machines in warm rooms (below dew point) but only after the temperature has equalized.

- It is not allowed to fill or permanently supply machines with nitrogen in rooms due to the risk of suffocation.

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**DANGER**

**Suffocation hazard**
It is not allowed to fill or permanently supply machines with nitrogen in rooms due to the risk of suffocation.

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Requirements to the storage in the open/outdoors:

- Machines that were unpacked may be stored in the open only if they are provided for outdoor installation.

- Storage temperature should be within 0 and 40°C.

- The storage place has to be free of vibration. It should preferably have a stable ground, e.g. concrete base, it has to be at least safe against flooding and fixed in such a way that the machines and components cannot sink into mud even during longer periods of rain. Prevent the formation of puddles and stagnant water. Position machines on squared timbers.

- Avoid direct sunlight as, apart from the detrimental effect of UV radiation, it results in high temperature fluctuations.
• Secure tarpaulins to resist storms. Ensure that precipitation cannot collect and air circulation is still possible under the tarpaulins.

• Check the condition of the tarpaulins and packings in regular intervals for damages caused by weather, animals and rot. Eliminate immediately any defects.

Note
For a storage period exceeding 12 months, Voith Turbo recommends monitoring the relative humidity and temperature inside the variable speed drive by means of Voith HTDL (Humidity Temperature Data Logger, for description, see Chapter 9).

4.1 Storage in air-conditioned storage room

The following measures apply to an air-conditioned hall which is defined as follows:

• Temperature range 18 to 26°C

• Relative air humidity, permanently in the range < 40%

• Low movement of air

• Temperature fluctuation within 24h < 3K

It is vital to check and document the compliance with the storage conditions in regular intervals (by means of Voith HTDL, if necessary).

If one of the above conditions is not met, the measures defined under 4.2 for "Storage in non-air-conditioned storage space" are to be applied.

Perform the following measures during the storage period:

• Spray outer bright iron parts with a film-forming, water-displacing anticorrosive agent every two years or as required. (Clean sprayed surfaces before installing the machines using white spirit or petroleum.)

• Turn the shafts of variable speed drives supported by antifriction bearings by about a quarter to a half turn in order to prevent standstill marks (false brinelling) in the antifriction bearings every two years at the latest.

• Spray interior surfaces with solvent-free anticorrosive agent every two years.

• Should meanwhile a re-preservation become necessary, this needs to be performed even before the expiry of the 2 years.

For variable speed drives that are not packed, a storage with packing in accordance with Voith Directive D-0800 (9163626-006212), Packing No. 2 and/or 3 is permissible.
4.2 Storage in non-air-conditioned room

The following measures apply to a non-air-conditioned storage room which is defined as follows:

- Temperature range 10 to 30°C
- Relative air humidity range 35 to 70%
- Moderate movement of air
- Temperature fluctuation within 24h < 10K

If one of the above conditions is not met, the requirements defined under 4.3 Storage Outdoors are to be applied.

The following methods are recommended to protect the variable speed drives against corrosion:

a) Re-packing according to Voith Directive D-0800 (9163625-006212), Packing No. 4 (permissible max. 3 times).

- It is recommended regularly checking the effectiveness of the desiccant using humidity indicators; see the table below for check intervals (timetable) of humidity indicators as per TL 6685.

<table>
<thead>
<tr>
<th>Value indicated by the humidity indicators</th>
<th>Check intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>blue</td>
<td>every 8 weeks</td>
</tr>
<tr>
<td>30 % pink</td>
<td>every 2 weeks</td>
</tr>
<tr>
<td>40 % pink</td>
<td>weekly</td>
</tr>
<tr>
<td>50 % pink</td>
<td>Restore preservation properly</td>
</tr>
</tbody>
</table>

- Check the condition of the packing for damages by performing checks in regular intervals. Remedy any defects immediately.

- Re-new the aluminum compound foil after 2 years. (Aluminum compound foil is not resistant to ultraviolet rays.)

- On doing so, check the effectiveness of the preservation of bright iron parts. If necessary, mend the preservation using a film-forming, water-displacing anticorrosive agent.

- Turn the shafts of variable speed drives supported by antifriction bearings by about a quarter to a half turn in order to prevent standstill marks (false brinelling) in the antifriction bearings after two years at the latest.
b) Variable speed drives without packing

- Permanent supply of the interior of the variable speed drive via a sorption air dehumidifier.

- Alternatively to the sorption air dehumidifier, permanent supply of the variable speed drive inside with dry compressed air / instrument air. Volume flow rate approx. 10-15 l/min. The atmospheric dew point of the compressed air / instrument air must be 25K below the ambient temperature.

- After 1 year at the latest, check the effectiveness of the preservation on outer parts; re-preserve bright outer iron parts with a film-forming, water-displacing anticorrosive agent, if necessary.

- Every two years, turn the shafts of variable speed drives supported by antifriction bearings by about a quarter to a half turn in order to prevent standstill marks (false brinelling) in the antifriction bearings.

4.3 Storage in the open

The following methods are recommended to protect the variable speed drives against corrosion:

a) Re-packing according to Voith Directive D-0800 (9163625-006212), Packing No. 4 (permissible max. 3 times).

- It is recommended checking the effectiveness of the desiccant using humidity indicators; see the table below for check intervals (timetable) of humidity indicators as per TL 6685.

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<td>40 % pink</td>
<td>weekly</td>
</tr>
<tr>
<td>50 % pink</td>
<td>Restore preservation properly</td>
</tr>
</tbody>
</table>

- After 1 year, check the effectiveness of the preservation on the bright outer iron parts. Mend the preservation, if necessary. (Clean sprayed surfaces before installing the machines using white spirit or petroleum.)

- Every two years, turn the shafts of variable speed drives supported by antifriction bearings by about a quarter to a half turn in order to prevent standstill marks (false brinelling) in the antifriction bearings.

- Renew the aluminum compound foil after 2 years. (Aluminum compound foil is not resistant to ultraviolet rays.)
b) Variable speed drives without packing:

- Provide a rain protection (roofing, tent, tarpaulin, etc.)
- Spray bright iron parts with a film-forming, water-displacing anticorrosive agent

The following can be used to preserve the inside of variable speed drives:

a) Permanent supply of the variable speed drive inside via a sorption air dehumidifier

b) Permanent supply of the variable speed drive inside with dry compressed air / instrument air

- Volume flow rate approx. 10-15 l/min
- The atmospheric dew point of the compressed air / instrument air must be 25K below the ambient temperature.

c) Permanent supply of the machine inside with technical nitrogen

- Volume flow rate approx. 10-15 l/min
- Required pressure approx. 0.002 bar
- Dewpoint of nitrogen 25K below the ambient temperature.
5 Variable Speed Drives fixed to the Foundation

Note
The recommendations apply to variable speed drives set up and fixed to the foundation, which are not yet in operation or in case of a standstill (> 24h).

Special attention should be paid to the effectiveness of the preservation, as it is frequently subject to additional hazards due to water, accumulation of large amounts of dirt and physical damage.

Spray bright outer iron parts with film-forming water-displacing anticorrosive agent. Grease and move functional components, e.g. joints, once a month. Possibly fill the machines with operating oil; in this connection, see the instruction manual.

5.1 Fixed to the foundation in air-conditioned hall

The following methods are recommended to protect the inside of the variable speed drives against corrosion:

The following methods can be applied especially to machines not filled with oil regarding protection of the interior against corrosion:

- Dry the variable speed drive inside once a month. Permissible relative air humidity shall be at the lowest ambient temperature to be expected < 40 %.

- Supply of the variable speed drive inside with dry compressed air / instrument air. Volume flow rate approx. 10-15 l/min. The atmospheric dew point of the compressed air / instrument air must be 25K below the ambient temperature.

Additional measures, if necessary:

a) Machines ready for operation
Every 3 months, start and operate the machine only for a short time (about 5 minutes) to wet the inner parts and surfaces with oil.

b) Machines not ready for operation

- When the electric aux. lube oil pump is ready for operation, operate it every 3 months for about 5 minutes. (Do not run it warm!)
  
  In addition, take oil from the sump and spray it into the inside through openings in the housing.

- When the electric aux. lube oil pump is not ready for operation, take oil from the sump every 3 months, spray it into the inside through the openings in the housing, and circulate the oil through the pipes for about 5 months using a separate oil pump. Possibly rotate the machine shafts.
5.2 Fixed to the foundation in non-air-conditioned hall

The following methods are recommended to protect the inside of the variable speed drives against corrosion:

The following methods can be applied especially to machines not filled with oil regarding protection of the interior against corrosion:

Dry the variable speed drive inside once a month. Permissible relative air humidity shall be at the lowest ambient temperature to be expected < 40 %.
If this is not possible with a passage through the sorption air dehumidifier, the air needs to be dehumidified in a closed circuit.

Additional measures, if necessary:

a) Machines ready for operation

Start the machine every 2 months at the latest and operate it for a short time (about 5 minutes) to wet the inner parts and the surfaces with oil.

b) Machines not ready for operation

- When the electric aux. lube oil pump is ready for operation, operate it every 2 months for about 5 minutes. (Do not run it warm!)
  In addition, take oil from the sump and spray it into the inside through openings in the housing.

- When the electric aux. lube oil pump is not ready for operation, take oil from the sump every 2 months, spray it into the inside through the openings in the housing and circulate the oil through pipes for about 5 minutes using a separate oil pump. Possibly rotate the machine shafts.

In case of higher temperature fluctuations and/or higher air humidity, in addition, measure c) or d) (optionally) is necessary.

c) The permanent supply of the variable speed drive inside with dehumidified air via a sorption air dehumidifier is permitted.

d) Supply of the variable speed drive inside with dry compressed air / instrument air. Volume flow rate approx. 10-15 l/min. The atmospheric dew point of the compressed air / instrument air must be 25K below the ambient temperature.
5.3 Fixed to the foundation outdoors

The following methods are recommended to protect the inside of the variable speed drives against corrosion:

a) The permanent supply of the variable speed drive inside with dehumidified air via a sorption air dehumidifier (control by means of hygrostat, if necessary) is permitted. Relative air humidity inside the machine shall be < 40 %.
When the electric aux. lube oil pump is ready for operation it is recommended switching it on once a month for a short time (5 minutes).

b) Supply of the variable speed drive inside with dry compressed air / instrument air.
Volume flow rate approx. 10-15 l/min
The atmospheric dewpoint of the compressed air / instrument air must be 25K below the ambient temperature.
When the electric aux. lube oil pump is ready for operation it is recommended switching it on once a month for a short time (5 minutes).

c) Permanent supply of the variable speed drive inside with technical nitrogen.
Volume flow rate approx. 10-15 l/min
Pressure required approx. 0.002 bar. Dew point of the nitrogen to be 25K below the ambient temperature.
When the electric aux. lube oil pump is ready for operation it is recommended switching it on once a month for a short time (5 minutes).

⚠️ DANGER

Suffocation hazard
When nitrogen is used, work on the variable speed drives may only be performed by taking special preventive measures.
6 Preservation of Spare Parts Shipping Containers

The spare parts are preserved and stored in the spare parts shipping container with technical nitrogen.

**DANGER**

**Suffocation hazard**
There is a risk of suffocation when handling nitrogen in closed areas. Ventilate areas well and release nitrogen into the atmosphere via appropriate ductwork.

### 6.1 How to get preservation state

1) Connect to the nitrogen charging port. It is useful to have a pressure reduction (pressure reducer) arranged before.

2) Open the vent valve.

3) Fill the container with nitrogen.

   - When filling for the first time:
     To achieve a reliable preservation, technical nitrogen has to be flushed through the spare parts shipping container (8 to 10 times of the container volume). In this connection, please also see Directive D-0800.

   - Filling after shipment:
     Re-establish the preservation pressure.

4) Close the vent valve and allow the pressure in the container to rise to 0.1 bar.

5) Remove the connection from the nitrogen charging port.

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**Note**

If the parts are preserved and stored in a closed container without nitrogen filling, relative humidity and temperature inside the spare parts transport container has to be monitored by means of Voith HTDL (Humidity Temperature Data Logger, for description see Chapter 0). It is vital to perform a regular readout every 3 months.
6.2 Intervals to check the preservation

Every one to four weeks:

- Check the reading on the pressure gauge. Nominal value 0.1 bar.
- If the reading on the pressure gauge has dropped to 0 bar, re-establish the preservation pressure of 0.1 bar.

**Note**

On account of temperature fluctuations, the pressure inside the container changes. It has to be ensured that no underpressure may occur inside during periods with low temperature (e.g. during the night). If necessary, provide a permanent nitrogen supply through a pressure reducing valve.

- Inspect the spare parts shipping container for external damage and corrosion, mend the painting, if necessary.

Once a year:

- Remove the cover and inspect the stored parts for corrosion.
- Inspect the sealing surfaces of the container and cover, sealing surfaces must have a bright metallic appearance.
- Reseal by applying fresh sealing compound (Hylomar) and Teflon cord, and bolt the cover down securely.
- Re-establish the preservation pressure of 0.1 bar.
7 Connection for a Sorption Air Dehumidifier

Corrosion protection with dehumidified air is based on the fact that no corrosion occurs below a relative humidity of 40%. Relative air humidity is dependent on the temperature. The permissible, absolute water vapor content has to be determined according to the minimum ambient temperature to be expected. At this temperature, it shall be < 40%.

The relative permissible air humidity to which the air inside the variable speed drives needs to be dried, is determined by means of the hx-diagram for humid air (see example).

7.1 Example hx-diagram

a) Assumptions:

- Ambient condition: temperature 30 °C, rel. air humidity 70%
- Lowest ambient temperature to be expected 18 °C, permissible relative air humidity < 40%.

b) Determination of the permissible relative air humidity to which the air has to be dried at 30 °C.

1) Determine the point of intersection of temperature 30 °C and relative air humidity 70% (state of air prior to drying).
2) Determine the point of intersection of temperature 18 °C and relative air humidity 40% (nominal state of air after drying).
3) Read of the respective absolute water vapor content for the nominal state of the air: 5.5g/kg air.
4) On the line for the water vapor content vertically upwards, at about 2 to 4 °C above the initial temperature (30 °C), selected 34 °C, read off the intersection point with the curve of the relative air humidity: 15%.

c) Result of the example:
The air for the lowest ambient temperature to be expected, 18 °C, has to be dried to a relative humidity of 15% at 34 °C.
Fig. 1: hx Mollier Diagram
7.2 Connection principle

Tube cross sections depend on the equipment and need to be agreed together with the manufacturer of the sorption air dehumidifier.

![Diagram of sorption air dehumidifier connection principle](image)

**Fig. 2: Connection principle of sorption air dehumidifier in a closed circuit**

Open labyrinths or flanges should be closed (by means of metal covers or foil) when a sorption air dehumidifier is used.
8 Connection Principle for Technical Nitrogen

Fig. 3: Connection principle for technical nitrogen
9 Voith Humidity Temperature Data Logger (HTDL)

DANGER
Explosion hazard
HTDL is not approved for explosive atmospheres.

The Voith Humidity Temperature Data Logger (HTDL) can be used optionally to monitor the relative humidity inside of systems/machines or spare parts shipping containers. HTDL serves to record the relative humidity and temperature prevailing inside of variable speed drives during the transport and storage period. A time-dependent opening for checking / inspection purposes and for represervation is no longer required and necessary only when displayed on the HTDL.

**Note**
For a longer storage time > 12 months, Voith Turbo recommends monitoring the relative humidity and temperature inside of variable speed drives by means of Voith HTDL (Humidity Temperature Data Logger).

By means of a software it is possible to read out the HTDL. Prior to commissioning, the HTDL has to be removed.