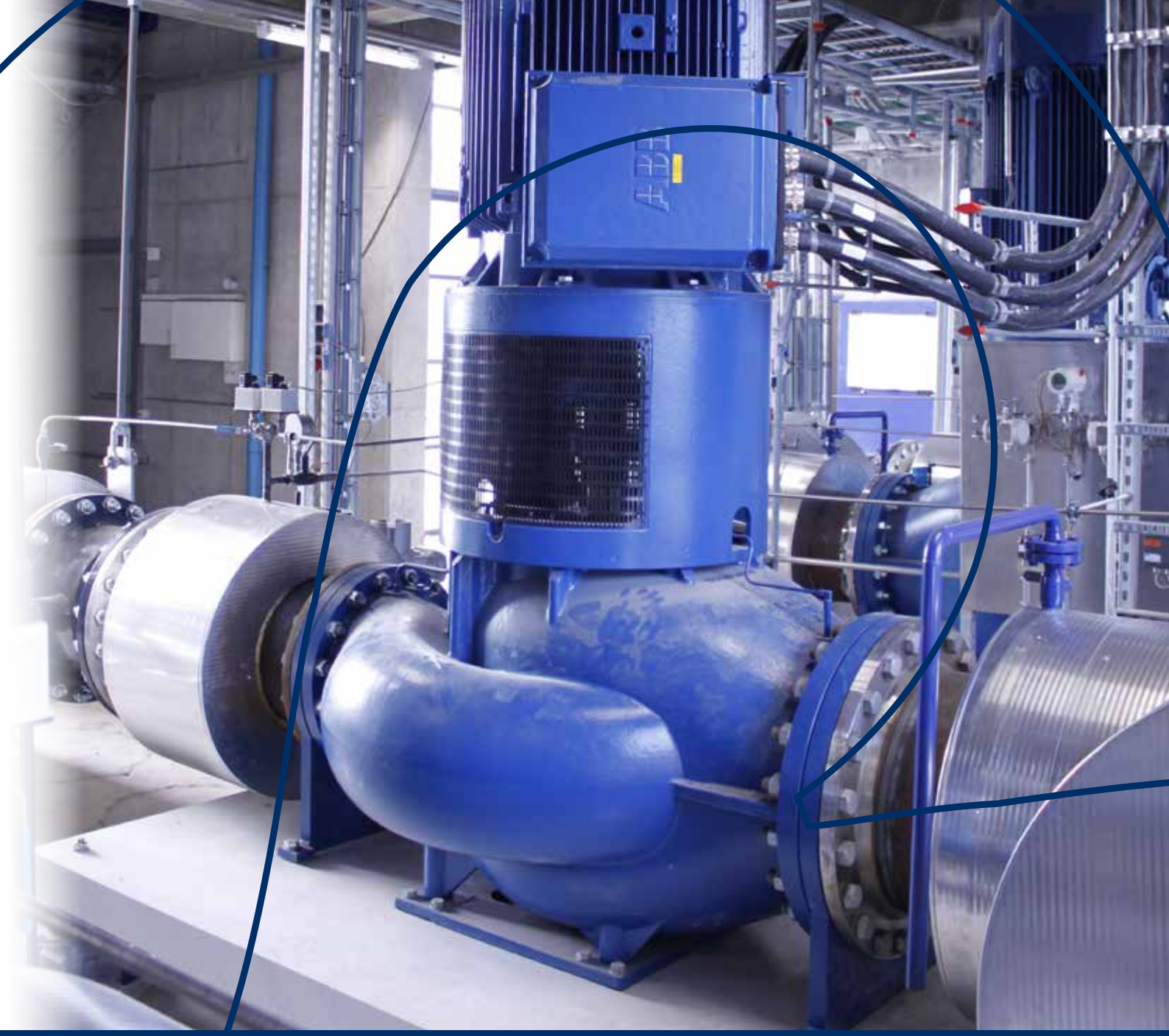


# DESMI Guidelines

## For pump installations

PROVEN TECHNOLOGY

DESMI

# Table of contents

*Congratulations on your new DESMI pump. We are proud that you chose us as your pump supplier, and will do our utmost to meet your expectations.*

*You are always welcome to contact us at desmi@desmi.com or +45 96 32 81 11 should you have any questions concerning your pump or anything else.*

*Remember that DESMI supplies pumps for installations of all sizes.*



*This brochure contains a number of recommendations for pump installation with DESMI centrifugal pumps concerning mechanical and electrical aspects.*

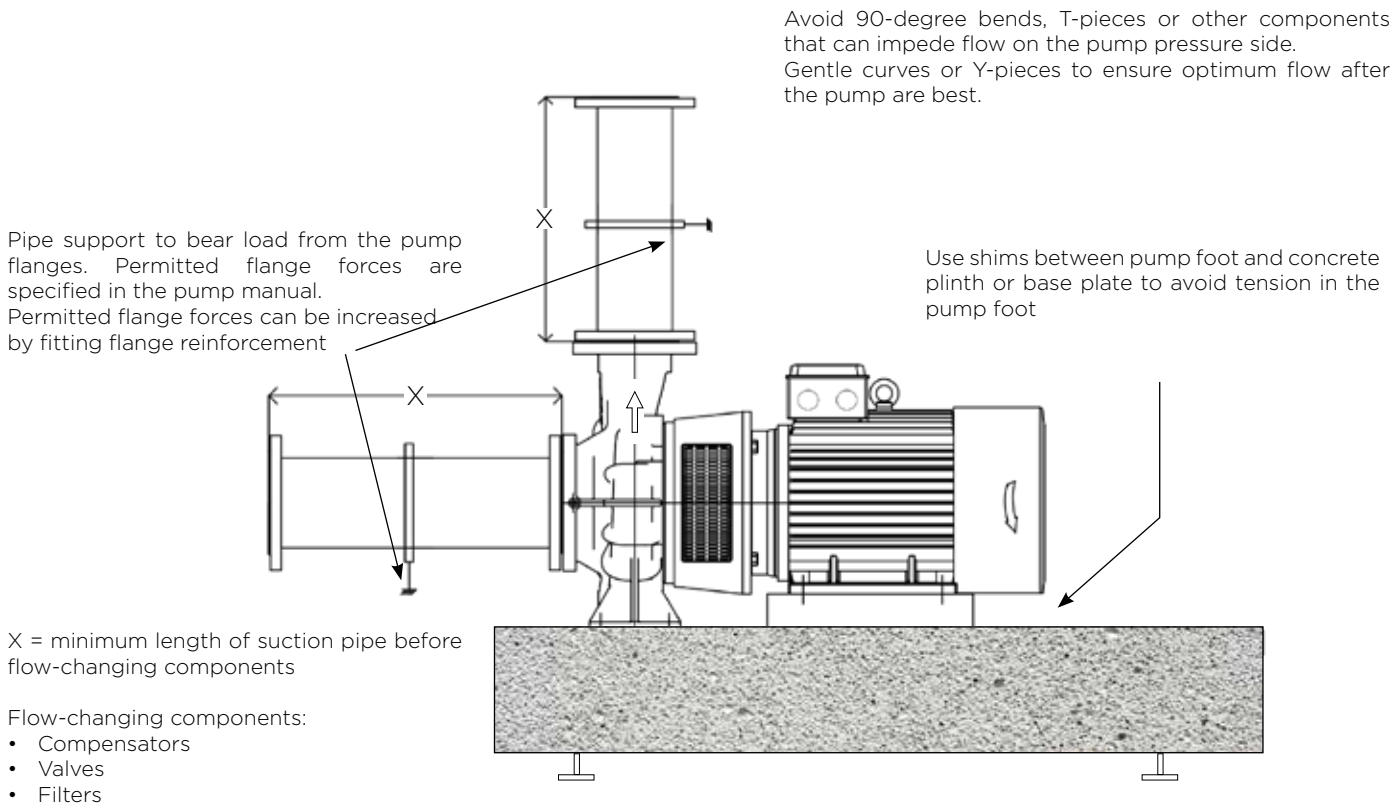
*For details on operation and maintenance, please refer to the pump manual for the relevant pump at www.desmi.com*

For final design and installation of pumps supplied by DESMI, use DS information DS/CEN/TR 13930 (recommendations for installing pipe systems) and 13932 (recommendations for installing pumps) as guidelines.

**Key elements of pump installation:**

- Base plate
- Pipe system
- Pipe support
- Ventilation for installation
- Service areas and lifting points for motor and pump
- Pump medium flow
- Optimum operating range
- Electrical connections (cables and screw assemblies)
- Electrical interference
- Using Common Mode filter for minimising bearing currents

Horizontal pump

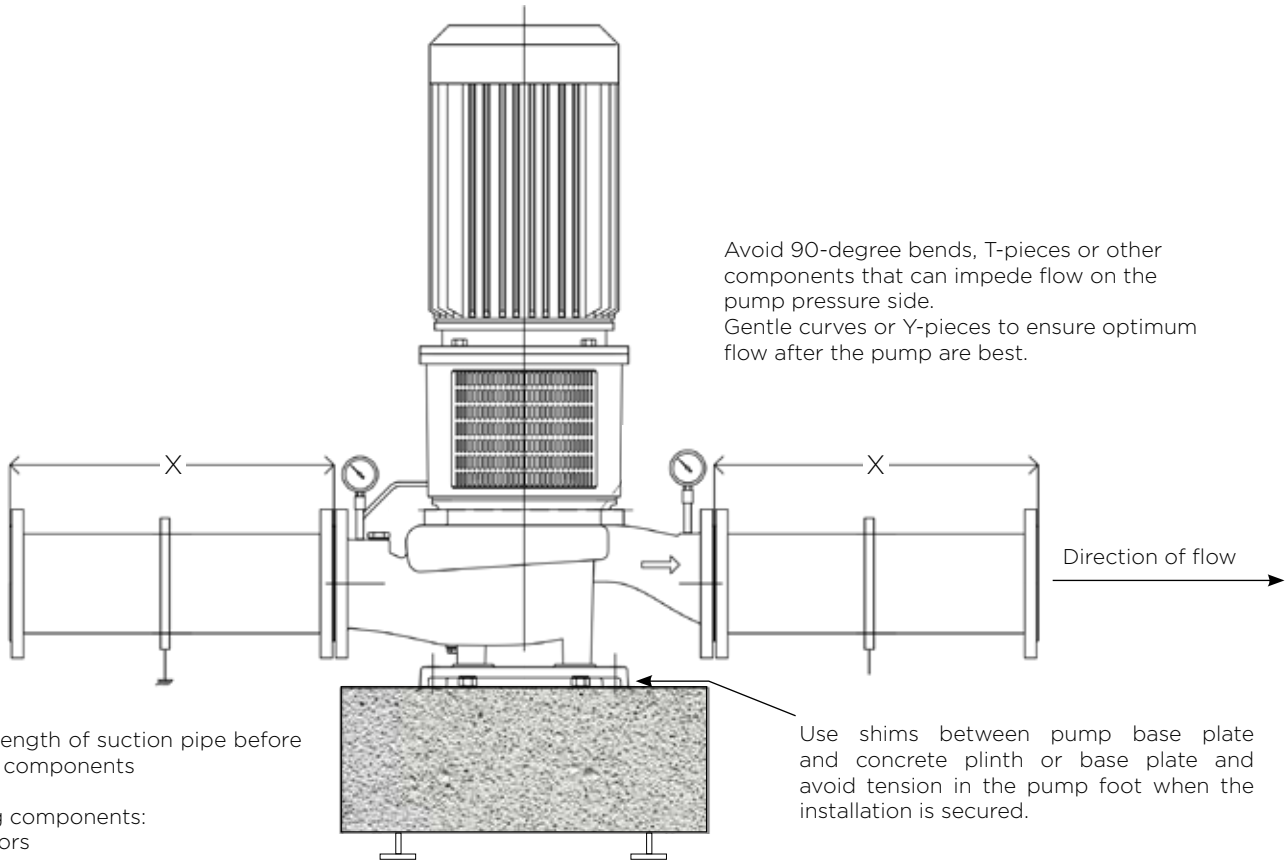



**Pipe system before pump**

DS13930/13932 recommends length of suction pipe "X" before the pump is around 5 x pipe diameter. For a DN100 pump, this will be equivalent to X= 500 mm. This rule of thumb ensures laminar flow before and after the pump that will give optimum operating conditions. But in practice, there are many good installations where this has not been fulfilled.

# Optimum pump installation

Vertical pump




Avoid 90-degree bends, T-pieces or other components that can impede flow on the pump pressure side.
Gentle curves or Y-pieces to ensure optimum flow after the pump are best.

X = minimum length of suction pipe before flow-changing components

Flow-changing components:
- Compensators
- Valves
- Filters
- Bends
- Orifice plate
- Etc.

Use shims between pump base plate and concrete plinth or base plate and avoid tension in the pump foot when the installation is secured.

A solid base plate will minimise vibrations and extend service intervals

# Before startup

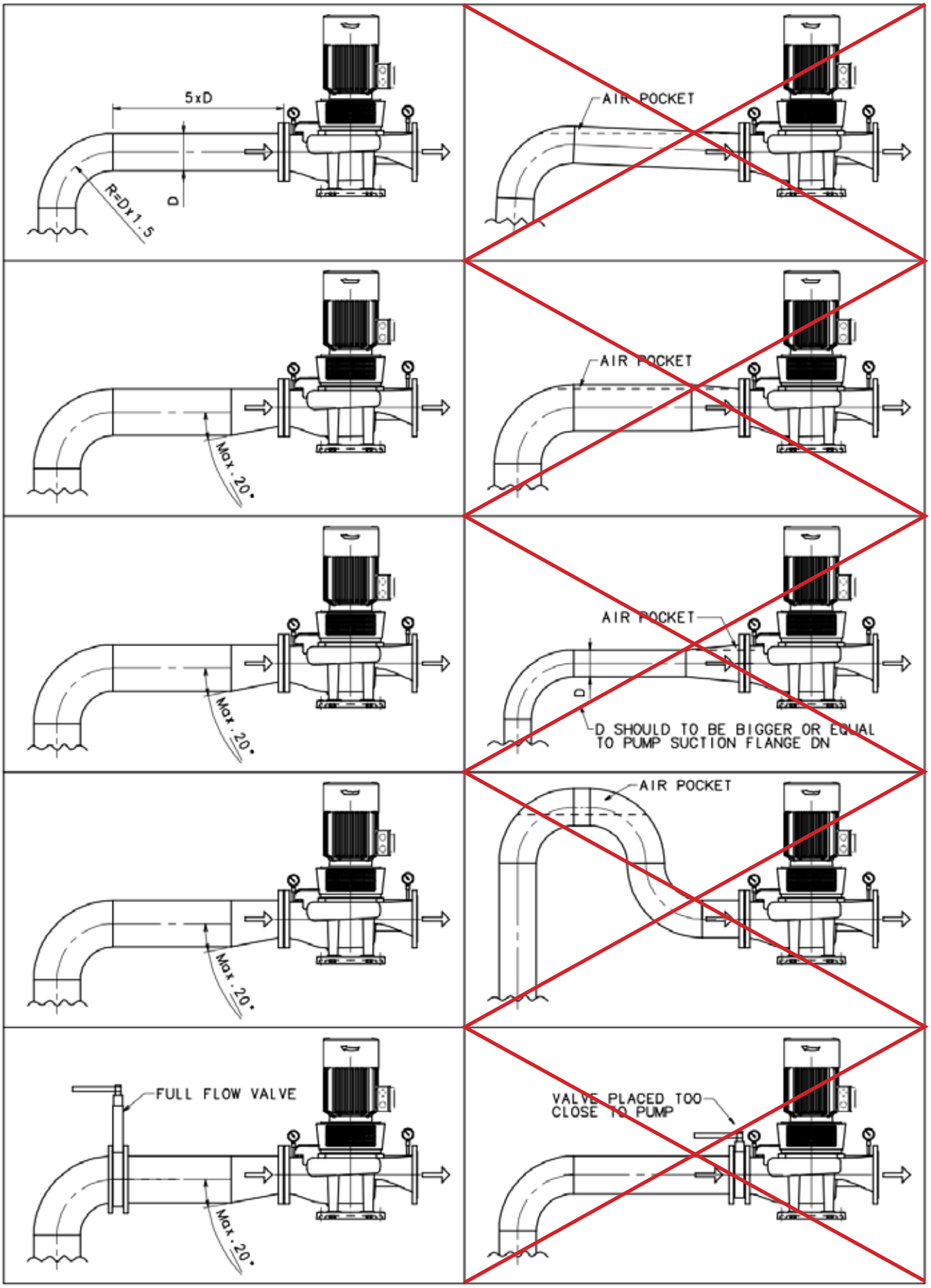
1. Check that the pump can rotate by turning it by hand
2. Check alignment of pipe system
3. Check bearings are lubricated before startup or no later than immediately afterwards
4. Check that the pump is filled with the correct medium and bled
5. Check that the pump rotates in the correct direction and has no abnormal noises or vibrations
6. Check differential pressure (discharge pressure - suction pressure) and compare with calculated operating point for the installation

If differential pressure is too high or too low, the pump may be damaged or have impeded efficiency. High flow must be reduced either by reducing RPM or constricting the discharge valve or installing an orifice plate on the discharge side. Alternatively, change the pump hole diameter - contact DESMI.

# Recommended design of pipes on suction side

Good installation

Poor installation



# Instruction for installing pumps with flange support(s)

(also applies to horizontal pumps)

1. Fasten the pump to the underlying structure (= foundation / concrete plinth / floor) and check that the pump is level.
2. Check that the pump shaft can be rotated freely - i.e. by hand without noise and abnormal resistance.
3. Place flange support(s) at the pump's flange(s) and check that the bolt holes are aligned and that the gasket surfaces are parallel.
4. If the underlying structure is not level (plane), it may be necessary to shim under either the pump footplate or under the flange support(s).
5. Insert gasket(s) between pump and flange support(s) and hold together and parallel with 4 temporary bolts 90° offset in each flange.
6. Check that the flange support(s) have full contact with the underlying structure (if there is more than a 0.5 mm air gap under the feet, shims must be placed underneath)
7. Bolt flange support(s) to underlying structure.
8. Remove the 4 temporary bolts and mount the pipe system flange(s) and gasket(s) against the flange support(s).
9. Check that the bolt holes are aligned and that the gasket surfaces are parallel.
10. Bolt the piping system flange(s) together with the pump and flange support(s).
11. Check that the pump shaft still can be rotated freely (sound and resistance must not have changed according to point 2).
12. If the temperature of the pipe system changes significantly (up or down) after commissioning the pump and consequent thermal stresses / movements in the pipe system, if any, can be transferred to the pump, it should be checked again that the pump shaft still can rotate freely at actual upper/lower temperature limits.
13. If the pump cannot rotate freely under all operating conditions, the pipe system must be better supported - alternatively, compensator(s) must be installed between the pump and pipe system.

# Allowable vibration levels on DESMI centrifugal pumps and motors

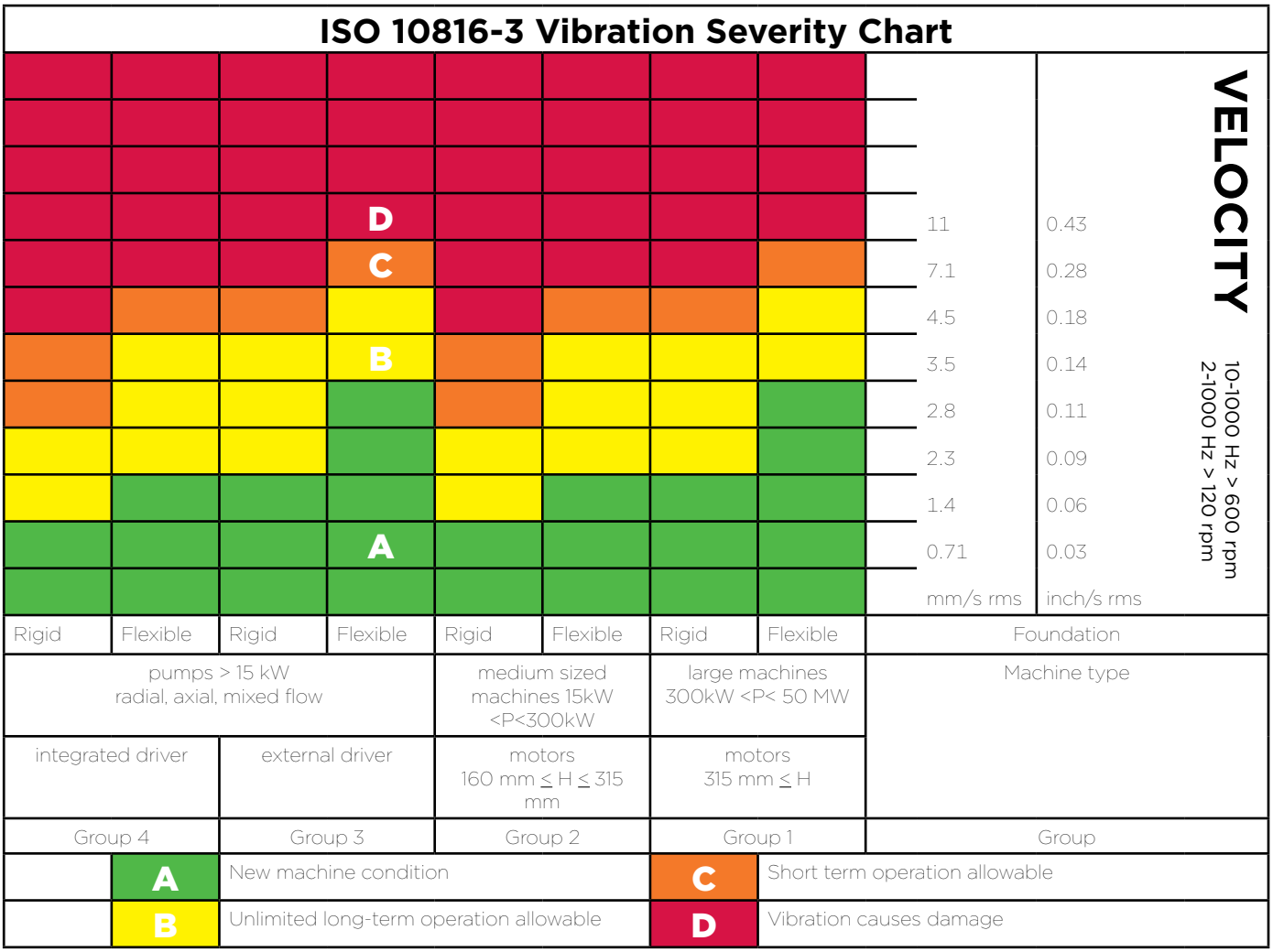
As standard DESMI centrifugal pumps with electric motor generate less than 2.8 mm/s vibration velocity (measured in 3 directions at motor flange level on vertical pumps) during a factory test.

The pump and electric motor industry generally agrees that vibration levels above 7 mm/s are damaging – i.e. this will result in shorter lifetimes of e.g. bearings and/or shaft seals in pumps (and bearings in motors) than normally expected. This agrees with the recommendations in the international standard ISO 10816-3.

But in pump installations on ships external excited vibrations from main engine and/or auxiliary machinery are transferred from ship hull to the pump often resulting in much higher vibration velocities than 7 mm/s.

DESMI recommends the following values for protective settings:

| Location | Vibration alarm level (mm/s) | Vibration trip level (mm/s) |
|---|---|---|
| Pump | >7 | >10 |
| Motor (drive end) | >7 | >10 |
| Motor (non drive end) | >10 | >15 |

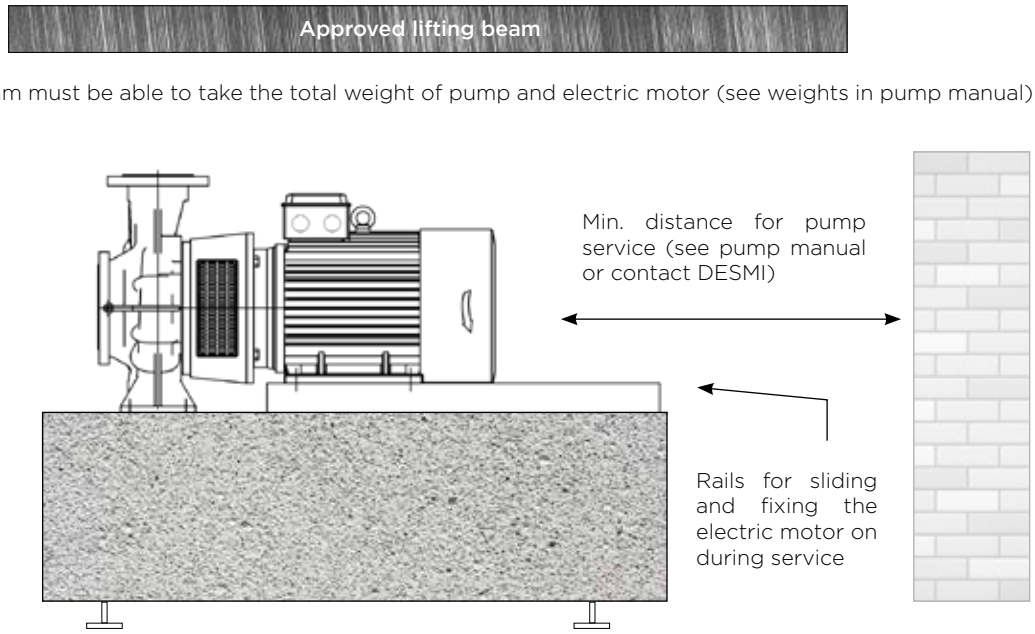


# Service areas for horizontal and vertical pumps

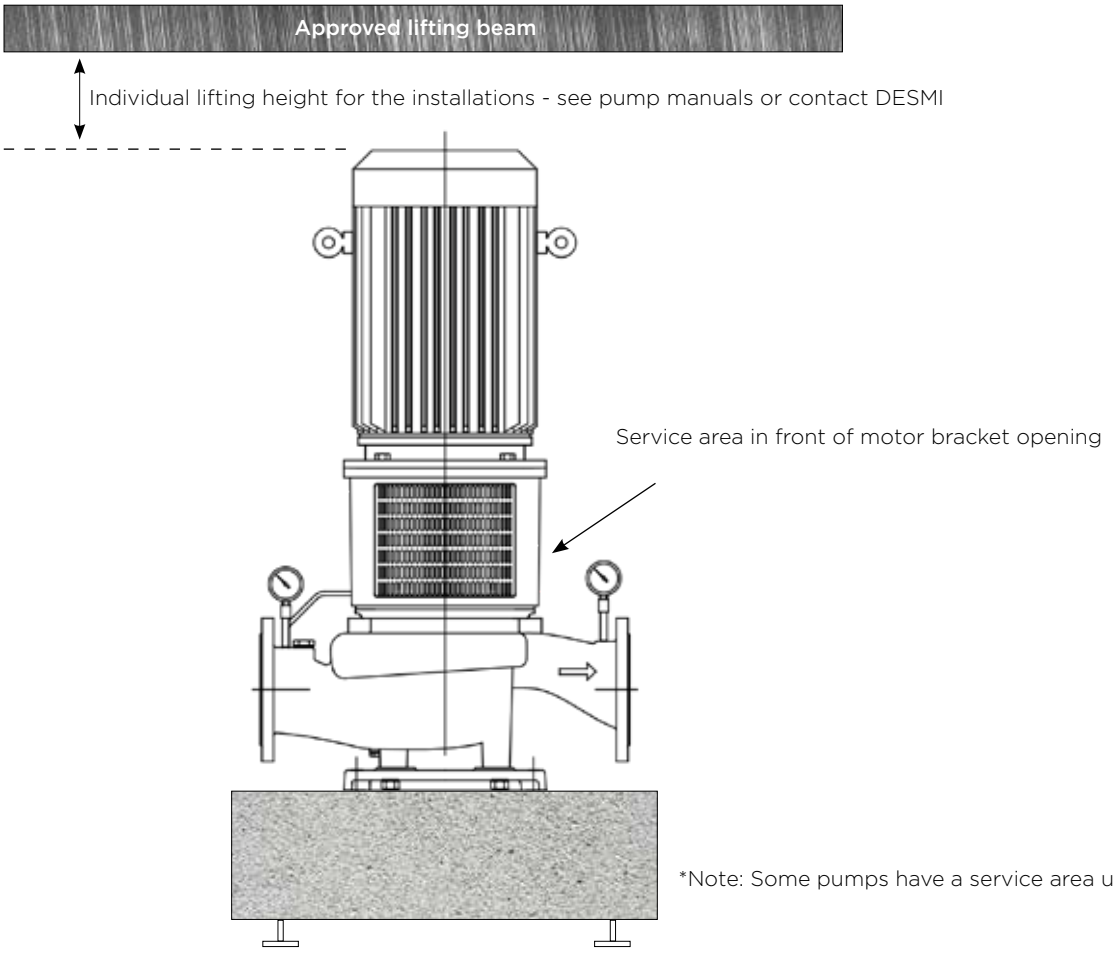
To facilitate future servicing of pump and electric motor, lifting gear should be installed, such as access for cranes, lifting points, ceiling beams or other approved equipment for the purpose.

Carefully consider where the pump installation will be placed, as transportable approved lifting gear often needs considerable space.

* If there is no permanently-installed lifting gear, an approved lifting beam is required.




The beam must be able to take the total weight of pump and electric motor (see weights in pump manual)

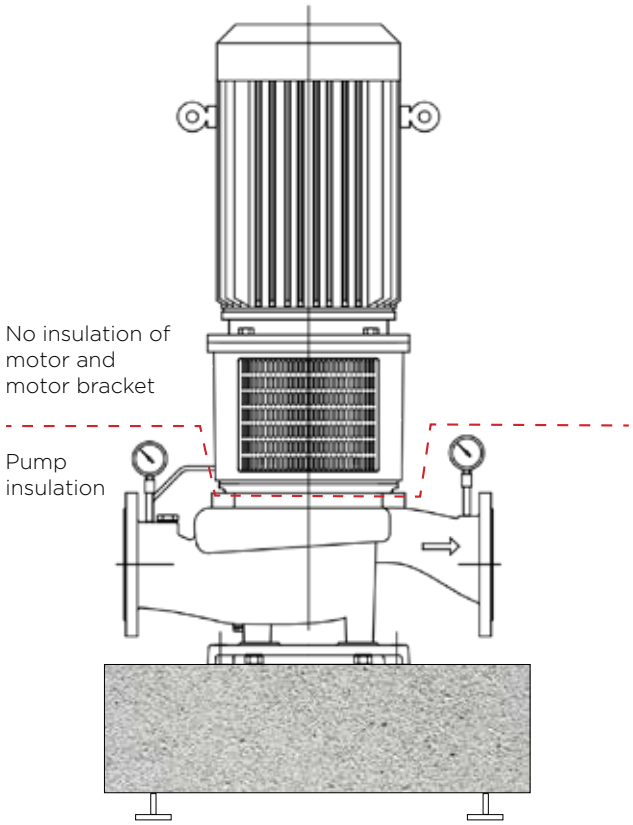


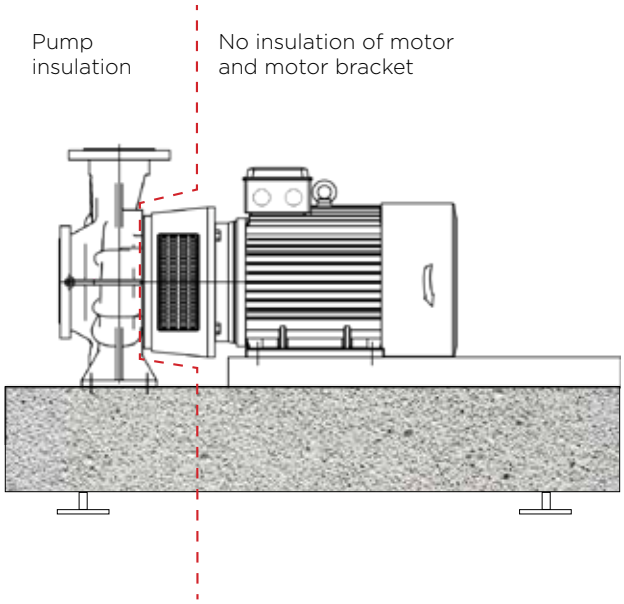

*Note: Some pumps have a service area underneath

Pumps supplied by DESMI cannot generally be insulated for heat except at the top of the pump housing – i.e. up to the base flange on the motor bracket as shown on the diagram below. No holes or screen openings on the motor bracket can be covered by insulation.

An electric motor will become hotter if mounted on a fully insulated pump. The ball bearings and/or coils in the motor can overheat if a pump is insulated all the way up to the motor flange.

Unrestricted ventilation of the motor bracket is therefore necessary to provide sufficient cooling of pump and motor bearings – in pumps with bearings (A02 version) and without (A12 version).




# Running pumps with a frequency converter

When a pump installation includes a frequency converter with the primary purpose of being able to regulate electric motor and thus pump RPM, the frequency converter can tend to generate very high current peaks. Failure to take this into account when designing the overall installation can cause damage, including bearing currents that can damage the motor's bearings very quickly. To avoid such problems and damage, DESMI has a number of recommendations that can minimise the risk of bearing currents and eliminate the destructive effect of the same if they occur.

**Electric installation**
DESMI recommends using screened EMC cables and EMC screw assemblies to avoid electrical interferences, and the installation must be correctly potential equalised. It is important that any paint residue etc. on screw assemblies in terminal boxes on motor and frequency converter is removed to achieve good electrical connection.

Depending on motor size and IE classification, DESMI recommends installing a Common Mode filter, the function of which is to reduce common mode current peaks between the frequency converter and motor. The larger the motor and IE classification, the greater the risk of bearing currents damaging the motor bearings. Alternatively, if the person responsible for installation can confirm (via measurement) that no bearing currents occur, a Common Mode filter can be avoided.

The length of motor cables also influences filter size and type that should be used.

**Mechanical installation**
A Common Mode filter will reduce but cannot eliminate current peaking, and depending on how correctly electrical installation has been performed (Common Mode filter, screened cables, potential equalisation etc.) bearing currents can still occur. The destructive effect on the motor of such currents can be strongly reduced by using insulated bearings or hybrid (ceramic) bearings in the motor. DESMI's recommendations in relation to use of these are also given in the table. An electric motor with ceramic bearings is more expensive than the same motor type with standard or insulated bearings. The advantage of using ceramic bearings is that the insulating effect is greater than for standard insulated bearings and that the overall lifetime of ceramic bearings is significantly longer.






DESMI's recommendations concerning use of Common Mode filters and insulated bearings

| Motor size [M] | Motor IE class | | | | | |
|---|---|---|---|---|---|---|
| | IE2 | | IE3 | | IE4 | |
| | Insulated bearings | Common Mode filter | Insulated bearings | Common Mode filter | Insulated bearings | Common Mode filter |
| M ≤ 4 kW | No | No / Yes | No | No / Yes | No | Yes |
| 5,5 kW ≤ M ≤ 30 kW | No | Yes | No / Yes | Yes | No / Yes | Yes |
| 37 kW ≤ M ≤55 kW | No / Yes | Yes | No / Yes | Yes | Yes | Yes |
| 75 kW ≤ M | Yes | Yes | Yes | Yes | Yes | Yes |

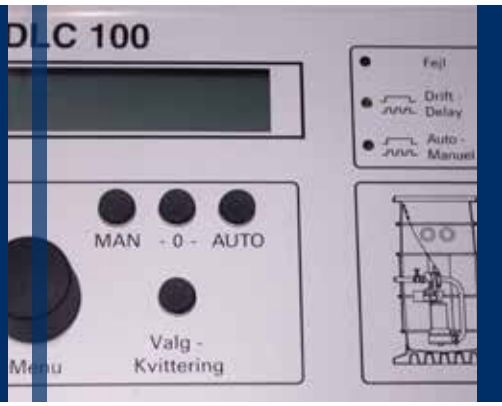
*(The recommendations in the table are based on experience and input from the various suppliers of electric motors and frequency converters)*

**DESMI as pump supplier (with electric motor) and frequency converter**
DESMI works closely with most manufacturers of electric motors and frequency converters, and therefore recommends the full package. In such situations, DESMI will provide consultancy to ensure all aspects concerning bearing currents etc. are taken into account. If the order also includes starting the pump, the installation will also be checked and approved.

**DESMI as pump supplier (with electric motor)**
In other situations, DESMI will only supply the pump with a motor, and our customers provide frequency converter and electrical installation. In such situations, we have less influence on installation as a whole and advise that our recommendations are followed. We naturally provide consultancy to the extent a customer requires it.

For more information on Common Mode filters and other anti-interference filters, such as Sinus and dU/dt filters, DESMI is happy to provide general input and consultancy. For more detailed information on the various products, we refer to our suppliers of frequency converters.

**"Interference" passed to the grid from frequency converters.**
Apart from generating interference for motors and pump installations, frequency converters are also known to generate interference towards the electricity grid - and depending on converter size, the electricity provider can specify that such interference is limited. DESMI Automation can measure and provide solutions for such situations.



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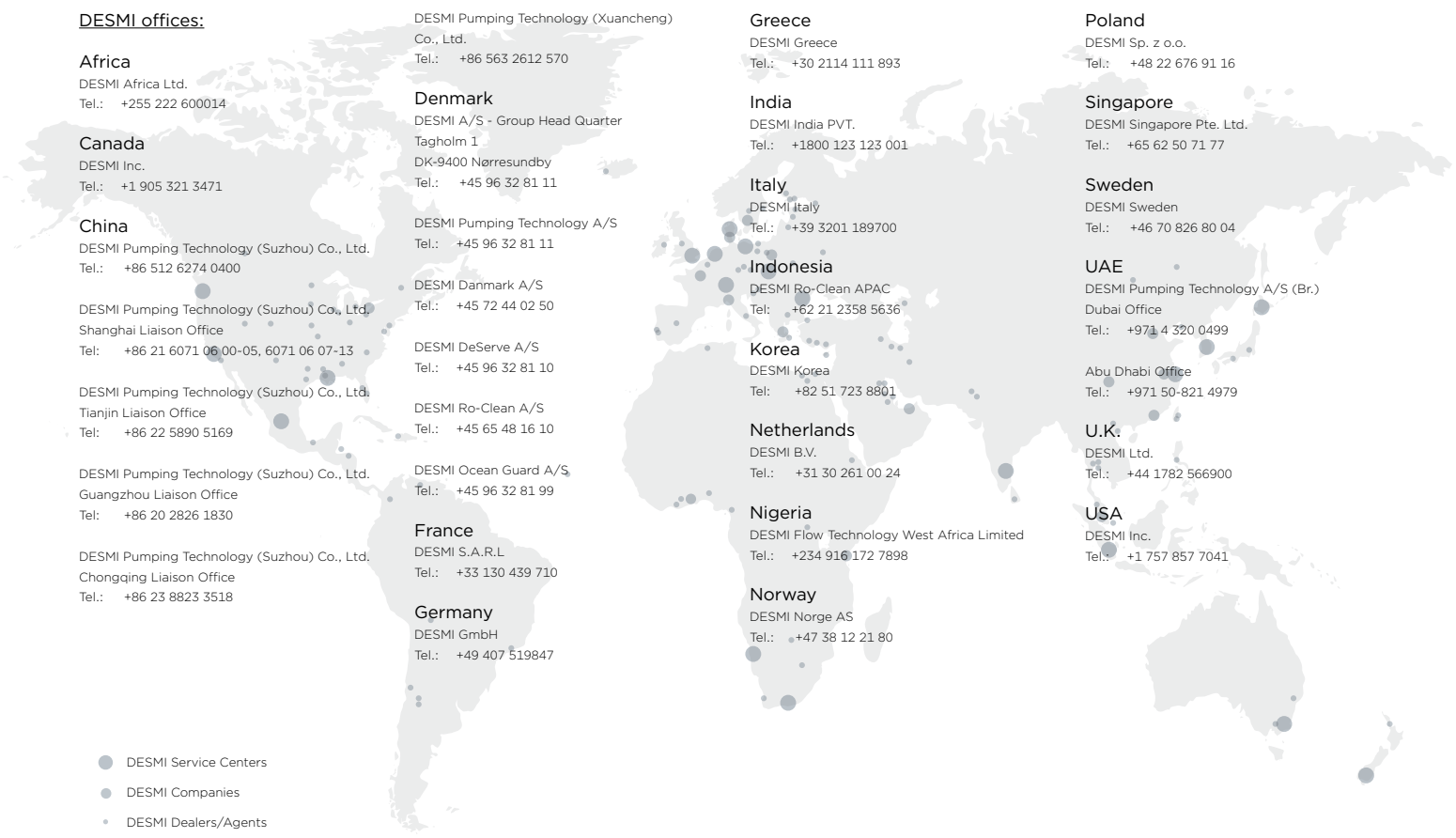

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