Lockout Tagout

⚠CAUTION!

DETERMINING WHEN TO LOCKOUT

Having performed a hazard analysis on your company's equipment, you can now determine when machines must be locked out – i.e., when employees are exposed to injury from each (or any) of a machine's hazardous energy sources during servicing or maintenance activities. To do this, use your Hazard Analysis Checklist and the "Four Key Questions for Lockout Implementation."

---

i NOTE!

OSHA Requirements
OSHA rules state that equipment must be locked out during equipment servicing and maintenance whenever employees are exposed to injury from unintentional machine movement or startup. According to OSHA's regulations, servicing or maintenance procedures that require lockout include:

"Workplace activities such as construction, installing, setting up, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning, or un-jamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy."

In addition, lockout is required during any machine service or maintenance that requires an employee to:

- ► Remove or bypass a safety device; or
- ► Place any part of his or her body into a point of operation or similar danger zone during a machine's operating cycle.

---

i NOTE!

Routine, Repetitive Activities
Routing and repetitive servicing procedures that take place during normal production operations, such as minor tool changes and adjustments, do not require lockout tagout, as long as the work is performed using "alternative measures which provide effective protection."

These "alternative measures" include safeguarding methods approved by OSHA and ANSI (American Standards Institute) to protect operators, such as:

- ► Presence sensing devices
- ► Interlocking barrier guards

Remember, the factor that determines whether these or any other safeguarding methods eliminate the need for lockout tagout during routine, repetitive activities is whether the employee is protected from injury. If lockout is not required, you MUST have clearly written procedure that describe the alternative safeguarding measures used and the tasks that may be performed. Refer to OSHA and ANSI standards for approved safeguarding methods

This page is intentionally left blank.

Safety precautions

⚠WARNING!

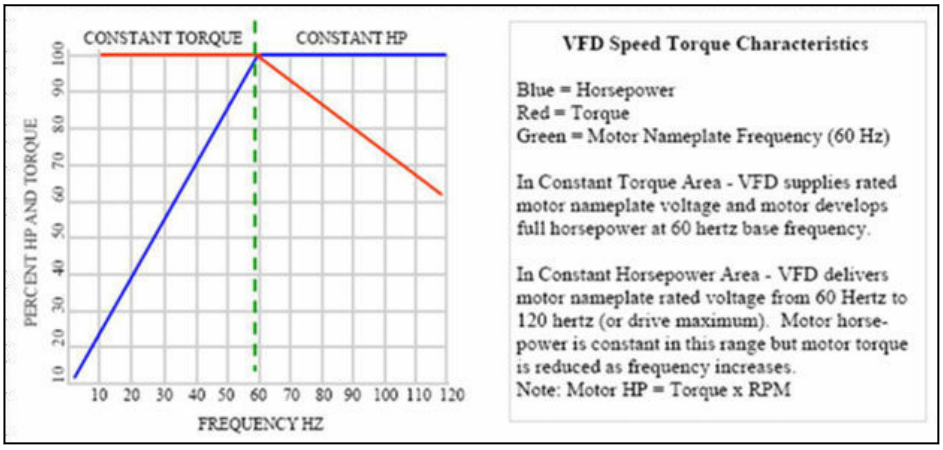
When Variable Frequency Drives (VFD's) are being used to vary the speed of the NETZSCH Progressing Cavity Pumps, then they MUST be CONSTANT TORQUE VFD's.

How the pump works

NETZSCH Progressing Cavity Pumps operate at a constant torque requirement for a specific operating pressure.
The speed of the pump does NOT affect the torque requirement.
For example: a pump running at 60psi output pressure at a speed of 200 revolutions per minute requires the same toque input as if it were running at 60psi output pressure at a speed of 600 revolutions per minute. The only exception to this rule is during pump startup; at the moment the pump starts the motor must provide more torque than the pump requires when it is running. This is due to the force of static friction that the motor must overcome in order to begin rotation. Although this is only a momentary force, enough torque has to be available to break the static load.

How the VFD works

Variable Frequency Drives work by taking the supplied power and modulating the supplied power frequency in linear proportion to the supplied voltage. This proportional modulation allows the motors speed to be altered without the motor drawing too many amps and burning out.
A VFD can be built to perform this modulation in one of two ways. The VFD can be set to modulate the frequency above the normal supplied 60HZ frequency allowing the output to provide a constant amount of power but the torque will drop off as speed is increased **(THIS IS A CONSTANT HP VFD)** or it can modulate the frequency below the normal supplied60HZ frequency allowing the output to provide constant Torque but the power will decrease as the speed is reduced **(THIS IS A CONSTANT TORQUE VFD)**. This relationship is shown in the detail below. The manufacturers of VFD's typically offer two service factors.
Normal Duty; which has an overload capacity of the VFD's full load ampere rating times 110% - 120% for one minute and Heavy Duty; which has an overload capacity of the VFD's full load ampere rating times 150% for one minute. Typically, constant Hp VFD's are sold with a Normal duty rating since the applications don't call for high starting torque which causes amp draw to spike. Constant torque VFD's are usually sold with heavy duty ratings so that they can supply elevated startup amp draws for high starting torque applications.



Application

Because while running a progressing cavity pump the torque value required by the pump is fixed; any reduction in supplied torque as a result of operational speed could cause the pump to fail. Also, depending on the running speed required, a constant HP VFD may not be capable of supplying the torque needed for pump startup. This is the reason a **Constant Torque** VFD **MUST** be used to operate a progressing cavity pump.

⚠CAUTION!

SAFETY PRECAUSIONS

Always bear in mind your safety during operation, maintainance and installation. Please adhere to the EC-Directive of machinerie including the national regulations and follow the US OSHA regulation #1910.219 & 1910.147 titled Mechanical Power transmission apperatus as well as the European Standard EN 292 with the accidents prevention rules laid down by the trade unions and other appropriate technical institutions.

1 INSTRUCCIONES DE SEGURIDAD

1 Instrucciones de seguridad

Este manual de instrucciones contiene aquellas indicaciones básicas que se deberán cumplir durante el montaje, funcionamiento y mantenimiento. Por consiguiente, es indispensable que, antes del montaje, tanto el montador como el personal técnico responsable/el jefe de la planta lean este manual de instrucciones y que éste esté disponible permanentemente junto a la máquina o instalación correspondiente.

Se tienen que cumplir o respetar no sólo las instrucciones de seguridad detalladas en este capítulo principal de “Seguridad”, sino también las medidas especiales, agregadas en otros capítulos principales, p.ej. las relativas al uso privado.

1.1 Símbolos utilizados

Las Imagenes de seguridad contenidas en este manual, cuyo incumplimiento puede acarrear un riesgo para las personas o para la máquina y su funcionamiento, vienen expresadas mediante los símbolos que se indican a continuación:

Peligro  para las personas en general

Peligro  por voltaje eléctrico

Peligro  de lesiones causadas por la máquina

Peligro  por cargas suspendidas

Peligro  para la máquina y su funcionamiento

Riesgo  de daño en los ojos; usar gafas de protección

1 INSTRUCCIONES DE SEGURIDAD

Las instrucciones pegadas o fijadas directamente sobre la máquina, p.e

- flecha indicadora del sentido de giro - símbolo indicador de las tomas de fluido tienen que respetarse incondicionalmente y deben mantenerse en un estado perfectamente legible.

1.2 Cualificación e instrucción del personal

El personal responsable del manejo, mantenimiento, inspección e instalación tiene que disponer de la calificaciones correspondiente a estos trabajos. El jefe de planta tiene que establecer con toda claridad el ámbito de responsabilidades, las competencias y la supervisión del personal. Si el personal no dispone de los conocimientos necesarios, será necesario entrenarlo debidamente.

SI el personal no tiene el conocimiento necesario debe recibir entrenamiento e instrucciones, Además, el usuario tiene que asegurarse que el personal haya comprendido perfectamente el contenido del manual de instrucciones.

Transportación
La persona responsable debe tener conocimiento sobre la prevención de accidentes y las regulaciones mediante cualquier equipo de elevación , instrucciones apropiadas deben ser dadas antes de dicha transportación ,poleas o cuerdas, deberán ser convenientemente instruida antes de ejecutar esta operación.

Montaje de equipo,

La persona responsable debe estar calificado , entrenado como técnico o mecánico.

instalaciones
debe estar calificado ,entrenado como técnico o mecánico Industrial .

Llevar a cabo trabajos de puesta en marcha, operación y mantenimiento

La persona responsable debe estar familiarizado con el diseño y Funcionamiento donde la bomba será instalada ,deben de entender la operación principal del a maquinaria y deben haber leído el manual y las instrucciones de seguridad antes de comenzar dicha labor .

Hacer reparaciones
debe estar entrenada y cualificada para este trabajo.
Debe conocer perfectamente todos los detalles específicos acerca de la maquinaria como está especificado en el manual ,. El personal sin experiencia debe ser entrenado y cualquier Reparamiento de maquinaria debe ser verificado por la persona responsable .

1.3

Peligros por incumplimiento de las instrucciones de seguridad

El incumplimiento de las normas de seguridad puede tener como consecuencia un riesgo tanto para las personas como para el medio ambiente y la misma maquinaria . El incumplimiento de las instrucciones de seguridad puede significar además la pérdida de los derechos a las indemnizaciones que pudieran exigirse.

Dicho incumplimiento sobre las instrucciones de seguridad , tienes los peligros siguientes:

-fallo importante de funciones de la máquina e instalación

- fallo de los métodos establecidos para mantenimiento y reparación --

peligro al personal por causas eléctricas, mecánicas o química

-peligro para el medio ambiente por fuga de substancias peligrosas

1.4

Precauciones de seguridad

Además de las instrucciones de seguridad dadas en el manual , las normas existentes de carácter nacional para la prevención de accidentes y las posibles normas internas de trabajo, de fabricación y de seguridad que la empresa usuaria de esta máquina haya establecido.

1.5 Instrucciones de seguridad para el usuario y operario de la máquina

-Si hay algún tipo de peligro por cualquier componente de la maquinaria frio o caliente ,

El operador debe utilizar el equipo o vestuario para prevenir que dichos componentes sean expuesto al contacto .

-La protección que evita el contacto (p.ej. del acoplamiento elástico) debe tenerse puesto cuando la máquina esté funcionando.

- Las fugas o derrames (p.ej. el sello del eje) de materiales peligrosos (p.ej. explosivos, tóxicos, materiales calientes) tienen que evacuarse de tal manera que no cause peligro para las personas ni para el medio ambiente. Deben cumplirse las disposiciones legales al respecto.

-cualquier tipo de peligro de la energía eléctrica debe ser eliminada (para más detalles ver p.ej. referirse a las regulaciones de seguridad de su compañía suplidora de electricidad .

Las bombas NEMO® se caracterizan por su alta calidad y por su seguridad de funcionamiento. Específicamente si estas bombas integran componentes de cerámica técnica, como p. ej. un rotor cerámico NEMO CERATEC®, puede garantizarse además una larga vida útil. Sin embargo, el rotor cerámico y otros componentes cerámicos de la bomba pueden provocar daños si no se utilizan de manera adecuada o destinada .

El operario debe investigar cuáles son los efectos que podrían estar vinculados con un fallo de los materiales cerámicos, así como si deben adoptarse medidas de seguridad para proteger a las personas o al medio ambiente.

,

Más allá de los derechos de garantía citados en nuestras condiciones generales, así como de las propiedades del producto garantizadas en nuestra confirmación de pedido, la empresa no se hará responsable de ningún tipo de daño por fallo, así como tampoco de daños consecuenciales.

La empresa únicamente se hará responsable en caso de premeditación o negligencia grave.

1.6 Instrucciones de seguridad para trabajos de mantenimiento, inspección e Instalaciones

El usuario debe asegurarse que todos los trabajos de mantenimiento, inspección e instalaciones sean realizados por personal técnico autorizado, entrenado y cualificado para entender las instrucciones sobre operación de la maquinaria .

Trabajo en la maquinaria deben realizarse cuando esta esté parada, apagada y aislada . trabajos mencionados se realizarán, en principio, sólo con la máquina parada. La máquina tiene que estar además sin presión y haberse refrigerado. Es indispensable que se respete el proceso de parada de la máquina escrito en el manual de instrucciones.

Las bombas que transportan medios peligrosos para la salud tienen que ser descontaminadas.

Antes de dar por finalizados los trabajos, todos los dispositivos de seguridad y protecciones tienen que volver a reinstalarse o ponerse en funcionamiento.

Antes de poner la maquinaria en marcha , se tendrán que cumplir los puntos mencionados en el apartado “Puesta en marcha”.

1.7 Modificaciones no autorizadas a la máquinaria y fabricación de repuestos no originales

Las modificaciones o cambios de la maquinaria sólo estarán autorizados si el fabricante los consiente. Las piezas de recambio originales y los accesorios autorizados por el fabricante son elementos de seguridad. El uso de otras piezas de repuesto no autorizadas por NETZCH anulara cualquier reclamo sobre daños emergentes .

Con el fin de garantizar la seguridad de funcionamiento y del aparato, las máquinas suministradas únicamente deben ponerse en funcionamiento con piezas originales, y los materiales adicionales para la producción deben utilizarse exclusivamente de conformidad con nuestras indicaciones de fabricante.

Como consecuencia de la aplicación de las leyes europeas actualmente vigentes sobre la responsabilidad del operario de instalaciones y las cuestiones con ella relacionadas sobre la fiabilidad del funcionamiento de la instalación, deseamos indicarle en este punto un requisito indispensable para el funcionamiento de nuestro producto:

No se autoriza el uso de piezas de recambio y de desgaste de otros fabricantes en nuestros productos; el uso de dichas piezas infringe las instrucciones de funcionamiento que le han sido suministradas.

En este caso no podrán excluirse efectos negativos en la seguridad de funcionamiento y en la seguridad en el trabajo, y no se autoriza el uso de nuestros productos.

Cualquier consecuencia que repercuta en la autorización de uso de su instalación, así como cualquier consecuencia de responsabilidad legal sería entonces de su exclusiva responsabilidad.

Con el fin de garantizar la seguridad de funcionamiento de sus productos, NETZSCH Pumpen & systeme GmbH realiza durante la fabricación de los mismos extensos análisis de aplicación, así como procesos de calidad y de seguridad que también se extienden al desarrollo y a la fabricación de piezas de recambio. De este modo se comprueba y se garantiza especialmente la acción conjunta de todos los grupos de componentes.

1.9 Normas específicas para el funcionamiento de las bombas NEMO®

Utilice, las bombas NEMO® únicamente bajo las condiciones especificadas, es decir, sólo para aquella aplicación para la que se suministró la bomba.

Si usted desea cambiar de producto a bombear, debe aclarar primero, mediante consulta al suministrador o fabricante, si la bomba es apta para el trasiego del nuevo producto. Lo dicho se aplica sobre todo al caso de substancias agresivas, tóxicas o peligrosas.

Los criterios de la bomba son:

1. La compatibilidad entre los materiales de las partes de la bomba en contacto con el medio de transportación dada.
2. La Idoneidad del modelo o tipo de las juntas y sobre todo del cierre del eje
3. La resistencia a la presión de la bomba y a la temperatura del producto bombeado

Tenga en cuenta que la bomba NEMO® es una bomba volumétrica de desplazamiento positivo y, como tal, **puede generar una alta presión inadmisible** que sobre pasaría el límite para lo que está diseñada .

Si hay obstrucción en la tubería de impulsión, p.ej. por taponamiento o por el cierre fortuito de una válvula, la presión generada por la bomba puede alcanzar **un valor superior al de la presión admisible por la instalación**. Esto puede acarrear, p.ej., el reventa miento de las tuberías, lo cual debe ser evitado a toda costa, sobre todo si se transportan líquidos peligrosos.

Por consiguiente, en la planta deberán instalarse los dispositivos de seguridad adecuados, p.ej. interruptores de presión, discos de rotura con tuberías de retorno.

Para realizar trabajos de mantenimiento o reparación de la bomba, tenga en cuenta lo siguiente:

1. Durante el período completo de ejecución de los trabajos asegúrese que el motor que acciona la bomba este sin tensión, para impedir cualquier puesta en marcha, ya sea fortuita, ya sea no autorizada.
2. En el momento de abrir la bomba, tenga en cuenta todas las normas referentes a la manipulación del líquido transportado (p.ej. ropa de seguridad, prohibición de fumar, etc).
3. Antes de arrancar de nuevo, asegúrese de que están colocadas en el sitio debido todas las Herramientas mecánicas y de otros tipos (p.ej. la protección de la correa trapezoidal, la protección del acoplamiento).

Siempre considere y observe por la seguridad durante la maquinaria este en operación por lo tanto, para trabajos de mantenimiento y reparación tenga en cuenta la normativa de la EC directiva para máquinas, las correspondientes normas nacionales, la normas europea EN 292, con las reglas de prevención de accidentes establecidas por los sindicatos y otras instituciones técnicas apropiadas.

1.10 Instrucciones para cursar pedido de inspección / reparación

Las normas legales de protección laboral, como es el reglamento alemán de Centros de trabajo, el reglamento de Sustancias peligrosas y las normas de Protección del medio ambiente, como es la ley alemana de Residuos (Abfallgesetz) y la ley alemana de Recursos hidráulicos (Wasserhaushaltgesetz) obligan a todas las empresas industriales a proteger a sus operarios, a las personas y al medio ambiente de los efectos nocivos que pudiera llevar asociados el manejo de sustancias peligrosas.

Importante:

Una inspección y reparación de máquinas de sus piezas únicamente se realizará cuando exista un ”Certificado de no objeción” completado debidamente por el personal técnico autorizado y cualificado.

Especialmente precauciones de seguridad son requeridas para el vaciado y limpienza de la maquinaria , esta información debe ser proveida por la persona certificada para hacer dicha labor .

El "Certificado de autorización de seguridad " es parte del encargo de inspección y reparación y debe rellenarse y firmarse siempre cuando NETZSCH vaya a realizar la inspección y reparación. Independientemente de ello, NETZSCH se reserva el derecho a rechazar el encargo.

CERTIFICADO DE NO OBJECIÓN

AVISO:

Podrá descargar el "Certificado de no objeción" en nuestra página web:

http://www.netzsch-pumpen.de

o bien consulte a nuestro Servicio de Atención (ver sección 16 - Contactos).

2. Safety

2.1. General Regulations

This Operating Manual contains the most important regulations that shall be observed during installation, operation and maintenance. For this reason, this Operating Manual shall be read before installation and operation occurs by both the erector and the responsible specialist/user. It shall be made available on–site for reference at some later date.

2.2. Dangers of non–compliance with Safety Advice Information

Ignoring the Safety Advice Information, may possibly endanger persons, the environment and/or the pump unit. A non–compliance, can for example cause the following dangers to occur:
– Failure of important unit functions,
– Failure of predetermined methods for service and maintenance,
– endanger persons due to electrical, mechanical and/or chemical influences,
– endanger the environment due to leakage of harmful substances and pollutants,
– and other causes.

2.3. Safety Conscious Handling

The Safety Advice Information as listed in this Operating Manual, the appropriate valid Accident Prevention Regulations (APR) and also all Internal Working and Factory Safety Regulations of the User shall be adhered to at all times.

2.4. Warning and Advice Signs

In this Operating Manual, safety symbols are illustrated that can assist in preventing accidents to persons, with the general danger symbol:

As warning for electrical voltages with:

For safety advice, which when not adhered to will cause damage or malfunction of the unit are characterized by the word

Attention

In addition to this, information signs are marked directly on the unit.
These shall be adhered to at all times:
– Direction of rotation and media flow arrows
– Designation of media connections
– Designation of filling and draining ports
– “No dry running”
– And others.

2.5. Safety Advice Applicable for the Operator

– Hot and cold machine parts are potential hazards and shall be protected against access.
– Protection guards, which protect moving parts (e.g. couplings) shall not be removed from the unit during operation.
– Leakage of hazardous media (e.g. from seals) shall be drained to a safe area so that operating persons and the environment are not endangered.
– All legal requirements shall be adhered to.

2.6. Safety Advice Applicable for Service, Inspection and installation.

All service, inspection and installation work shall be carried out by authorized personal who have studied this manual thoroughly. Without exception, all work on the unit shall only be carried out when the unit is stationary. The shut–down regulations as described in this Operating Manual shall be explicitly followed.
Immediately after all servicing or inspection work has been completed, all safety and protection guards shall be refitted.
Before restarting, all points as described under 6.4. shall be followed.

2.7. Denial of Modifications or Alterations without Approval

Alterations and/or modifications to the unit that have not been approved by Messrs. NETZSCH are inadmissible.

2.8. Inadmissible Operating Conditions

The operational safety of the delivered unit can only be assured when operated according to the appropriate instructions. Units shall not be operated under other operating conditions without the manufacturer s permission. The performance limiting data, as listed in the data sheets shall not be exceeded.

2.9. Other Operations and Safety Hazards

All packing materials for the pump, resp. the unit shall only be removed directly before installation is to be carried out.
No foreign matter shall be permitted to enter the pump!
Accident hazards during installation and mounting shall be observed at all times. Thereby shall the stability be assured.
Parts to be assembled shall not be dropped, loose parts shall be supported by proper means.
The pump unit shall not be lifted or lowered via the power supply lines or other supply lines.
Connection of the mains power supply to the motor control unit shall be carried out by a qualified electrician acc. to the circuit diagram as supplied by the motor manufacturer.
Care shall be taken to ensure that the supply lines are of the correct dimension.
All hazards from the power supply shall be eliminated.
VDE–Regulations and regulations of the local Electricity Board shall also be observed.

3. Transport and Intermediate Storage

3.1. Safety Measures

Due to the weight of screw pumps and complete pump units, it is essential that they should be lifted and transported to the installation site via hoists or cranes. During lifting and lowering, an exact equilibrium shall exist. Cranes and hoists shall be correctly dimensioned. Care shall be taken to ensure that the unit cannot topple over. Shelves and racks used to store pump units and spare parts shall be designed to accommodate the appropriate weights.

3.2. Transport Precautions

Care shall be taken to ensure that the pump units are not damaged during transport. Lifting by means of connecting boxes, power supply cables, etc. shall not be permitted. Furthermore, care shall be taken to ensure that the unit cannot slide or fall during transport. The packaging material shall not be damaged and all information as printed on the package shall be strictly adhered to.

3.3. Unpacking

The pump unit shall be immediately inspected on receipt for possible transport damage. Transport damage shall be immediately reported to the appropriate authority. Before installing the pump unit, all packing material shall be completely removed. All uncovered openings of the pump unit, e.g. inspection hole in the coupling housing, shall be inspected for loose parts, e.g. nails, screws, splinters, metal clips etc.
Such articles shall be removed. End covers, blind plugs, etc. shall also be removed.

3.4. Intermediate Storage

The screw pump units, as delivered, contain sufficient protective media acc. to the expected storage time as specified by the user. During longer tut–down periods, the pump units shall be protected from corrosion via an internal/external conservation as described in Par. 3.5.

3.5. Conservation

The time limitation of the preserving material is dependent on the composition of the material. Therefore preserving materials should be used which will be stable for at least 12 months. The following materials can be used for an inside and outside preservation.

Protection points:	Protective media:
All machined and non-painted surfaces e.g. shaft ends, flange cover	TECTYL 506 or a compound TECTYL 506 and TECTYL 511-M (*)
Internal surface of the pump housing, rotor package and end covers	compound consisting of TECTYL 506 and TECTYL 511-M (*)

— (*) Supplier: VALVOLINE OEL GmbH & Co. —

The preservative agent shall be spread by means of brushing or spraying.
The listed protective media shall be considered as recommended media. Other protective media supplied by other manufacturers may also be used. The protective media in the inner of the pump are to be forced out by filling up. Slowly turn the drive screw in the opposite direction to the normal direction of rotation during the filling process. Filling is to be done until the protective media come out of the inlet and without bubbles.

3.5.1. Life Durability of the Conservation

According to the information issued by the protective media manufacturers, the shalf life of TECTYL 506 is 4 to 5 years for indoor storage and 12 to 24 months for outdoor storage; TECTYL 511–M approx. 18 months for indoor storage. For compounds consisting of 50/50% TECTYL 506 and TECTYL 511 M, a shelf life of 2 1/2 to 4 years for indoor storage and 12 months for outdoor storage when stored under a protective roof.
Additional packing will increase the shelf life accordingly. The effective substances contained in these protective media offer an effective corrosion protection even under high humidity conditions (sea air and/or tropical humidity conditions).
They are also not effected by high temperatures.

3.5.2. Reconservation

When the pump units are to be stored for longer periods, the user shall ensure that the corrosion protection is checked from time to time and, if necessary, shall be renewed. No warranty will be accepted for damage caused by incorrect or faulty conservation.

Attention

3.5.3. Protective Media Removal

Before the screw pump units are put into operation, the protective media shall be removed. The internally applied protective media can normally be removed by flushing the unit with the media that is to be transported providing that this does not contaminate it. An appropriate solvent may also be used to remove the internal and external protective media.
Appropriate solvents being: petroleum, kerosene, benzine, diesel, fuels, alcohol, industrial cleaning agents (alkaline), or any other wax solvents. High–temperature steam–cleaning machines with suitable additives can also be used.
The pump shall be immersed in the media to be transported at all times in order to prevent the screws seizing up. Should the plant components, piping, tanks and other parts be covered with petroliferous conservation media, then the complete plant unit shall be cleaned of all conservation media. This is necessary because petroleum lowers the degassing capability of the media. This may cause rough pump running together with an excessive noise level (aeration).

Attention

3.6. Environmental Protection

When storing the screw pump units, the suction side of the pump shall be covered with an appropriate cover (plastic sheet, cardboard, etc.).
The discharge side should be sealed via a flange cover. The storage place shall be dry and dust free. It is recommended, that during storage periods the pump should be manually rotated every 3 to 4 weeks in order to change the position of the internal components. An acceptable corrosion protection can only be guaranteed when the relevant precautions are carefully followed.

4. Description of the Pump

4.1. General Description

NETZSCH screw pumps of the LNAE series are self–priming, positive–displacement pumps and are used to deliver oils or other lubricating media. In the case of media with good lubricating properties, the pump is suitable for a maximum delivery pressure of up to 16 bar, and for media with less good lubricating properties, for a maximum delivery pressure of up to 10 bar.

4.2. Construction and Operation

In principle, two screw screws are necessary as delivery units in the LNAE screw pump. The double–threaded screw set (Pos.150) rotates hermetically sealed but without contact with a triple–threaded Driven screw (Pos.151) in the screw set holes drilled into the pump casing (Pos.1), which encloses the screw set with little clearance.
Sealed areas are formed through the special shape, and their enclosed volumes are moved continuously by rotation in an axial direction from the inlet chambers into the delivery area (casing center) without violent pressure or turbulence.
The drive and driven screws are mounted in interchangeable bearing bushes (Pos.152) on both sides, and the screws do not touch the screw bore as long as the maximum delivery pressure of 16 bar is observed.
Thus wear as a result of metallic contact between the casing and the screws is avoided. All four bearing points simultaneously form choke points between the inlet and delivery spaces and thus are always subject to the differential pressure of the pump media. This produces good lubrication of the rubbing surfaces and ensures adequate removal of heat produced by the friction.
The axial displacement acting on the delivery screws as a result of the delivery pressure is equalized hydraulically. An equalization hole in the pump casing allows pressure to be applied to the faces of the bearing journals on the end side. Deep groove ball bearings (Pos.170) located outside the delivery are used for axial fixing of the drive screw (Pos.150). The driven screw (Pos.151) is fixed in an axial direction by end–side shaft collars (Pos.158, 159) to the driven screws.
This method of construction and action ensure a low level of noise and almost pulsation–free operation.

4.3. Construction of the Components

4.3.1. Pump Casing

The configuration of the pump casing (Pos.1) depends on the type of installation. According to the desired direction of discharge, the inlet and outlet connection is cast, welded or screwed in place in an in–line configuration opposite the casing base plate. The equalization pipes to equalize the hydraulic pressure are cast into the pump casing. The casing is divided by the drive–side pump cover (Pos.45) and the end–side cover (Pos.30). According to the overall type of fastening for the pump, the pump casing can also be equipped with a drive–side attachment flange. In special cases, it is possible to have a heating area arranged within the pump casing. The pump can optionally be equipped with an externally–mounted pressure relief valve.
The pressure relief valve only protects the pump against overloading and is not to be used as a pressure control valve. See Para: 4.3.8. concerning the method of operation and instructions for use of the pressure relief valve.

The pump casing can be completely emptied in any type of installation.
For this reason pay attention to any openings that have not been closed off before start–up (Pos.5, 6).
The direction of flow is marked with a cast arrow at the inlet and delivery connection. Always check the direction of flow before startup.

4.3.2. Screws Set

The drive screw (Pos.150), double–threaded and hardened, is fixed in an axial direction by deep groove ball bearings (Pos.170). The driven screw (Pos.151), triple–threaded and hardened, is arranged parallel to the drive shaft. During operation the shaft collars (Pos.158, 159) provide axial fixing.

4.3.3. Shaft Sealing

One of the following seals is used to seal the drive–side end of the shaft against the inlet pressure. Using this simple method to relieve the hydraulic loading in the sealing spaces, the latter are always under inlet and discharge pressure in the LNAE series.
The corresponding type of sealing of the pump can be found from the type description.

- **Seal W (shaft sealing rings)**

Suitable shaft sealing rings are used for inlet and delivery pressures of up a maximum of 0.5 bar, as long as the composition of the pump media does not require the use of other materials. This standard seal consists of at least two shaft sealing rings (Pos.052) with grease packed between them, with the lips of the seals facing each other.

Operating temperature	Shaft packing ring material
100ºC	Buna
>100ºC to 160ºC	Viton
>160ºC to <200ºC	Teflon

Other arrangements of shaft sealing rings possible with supporting rings, may be necessary for special applications or operating conditions.
The space between the shaft sealing rings is packed with grease at the factory for the life of the shaft sealing rings. This seal is virtually maintenance–free. (See chapter 7 for removal and installation.)

- **Seal G (mechanical seal)**

A mechanical seal (Pos.62) is used for suction and inlet pressures from 0.5 to 4 bar, as it is an unloaded, maintenance–free seal with a simple mode of operation. For pressures above 4 bar, a loaded, maintenance–free mechanical seal (Pos.62) with a simple mode of operation is used. In the standard form, the temperature of the pump media may not exceed 280°C. If the pump media have a tendency to crystallize out or to crack, we recommend the use of a quench on the atmospheric side, to which steam is applied (at a maximum pressure of 1 bar), or else a suitable liquid supply unit with a suitable flushing medium.
The materials and configuration (manufacturer) of the mechanical seal are chosen to match the relevant operating conditions and properties and such details should be quoted when ordering.
The pump media flowing entering the sealing spaces flush the floating surfaces of the seal and flow back via a hole in the inlet apace back into the pump casing. This provides good

lubrication of the floating surfaces and adequate removal of heart generated by friction. When starting up the pump, check that the floating surfaces of the seal do not run dry. (See chapter 7 for removal and installation.)

- **Seal S (packing seal)**

For special operating conditions, packing seal are possible. With these seals, the temperature of the media to be transported shall not exceed 320ºC. Appropriately positioned Packing Rings (Pos.072) prevent air from being sucked in. Via a circular prestressing unit (Gland Pos.075), these seals are pressed together and are therefore pressed against the sealing surface of the Driving Shaft (Pos.150). Via a Regulating Screw (Pos.081), a low excess pressure of (approx. 0,5 bar) shall be set up in the sealing area. This prevents an absolute dry running of the seal from taking place. The Regulating Screw (Pos.081) shall be screwed in until the required excess pressure within the packing is reached. Feed pressure changes shall only be carried out during operation while observing the packing, leakage, and prestressing of the Gland (Pos.075) and resetting of the Regulating Screw has been carried out. For the operating parameters, these settings are carried out in the factory. The respective settings shall be observed when operating parameters are changed.

4.3.4. Case Sealing

With flat seals (Pos.31, 46) and sealing rings (Pos.6, 70). The materials are selected according to the operating conditions and pump media.

4.3.5. Bearings

Axially through maintenance–free deep groove ball bearings (Pos.170) located outside the sealing spaces as per DIN 625 located on the drive screw (Pos.150) and in the drive–side cover (Pos.45).
These bearings are provided at the factory with a suitable filling of grease and can also be regreased. The differential pressure passes through two radial bearing bushes per screw.

4.3.6. Direction of Rotation

The standard direction of rotation is clockwise, as seen at the end of the drive shaft. Direction of rotation arrows as information plates are available for all the pumps. A special direction of rotation, anti–clockwise as seen at the end of the drive shaft, is possible if the operator especially requires it. This must be requested at the time of ordering the pump!

4.3.7. Direction of Flow

The standard direction of flow is forwards as seen at the drive shaft, from left to right. The direction of flow is marked with an arrow at the inlet and delivery connections, and the direction of flow must be checked before startup. If the user requires it, the direction of flow can be arranged to be from right to left. This must be requested at the time of ordering the pump!

Attention

If it is absolutely necessary, the direction of flow through the pump can be reversed by changing the direction of rotation. In such cases the maximum delivery pressure of 4 bar must never be exceeded.
A mechanical sealing ring or packing seal must be installed for sealing in such cases.

4.3.8. Pressure Relief Valve

As described in Para: 4.3.1., the pump can optionally be equipped with an externally–mounted pressure relief valve.
If the set values are exceeded, the valve cone (Pos.219) lifts from the valve seat (Pos.217) and the pump media flow back into the inlet area of the pump casing. The opening pressure is set by preloading the valve spring (Pos.235) with the setting screw (Pos.222) at the factory or by the user as required. Turning the setting screw to the left increases the opening pressure. The pressure relief valve can be equipped with a hand regulator for models above size 40. Turning the hand wheel (Pos.227) can be used to feed back part of the pumped flow into the inlet area without changing the setting of the valve spring.
The pressure relief valve can also be equipped with a return feed to the tank and this must be specified at the time of ordering.
Always ensure that the valve cone (Pos.219) is free to move on its shaft when operating the pump with a pressure relief valve. Do not lock down the valve seat completely by fully tightening up the setting screw (Pos.222) and thus also completely compressing the valve spring (Pos.235), as this could lead to damage to the pump.

4.3.9. Connections

The inlet and delivery connection are fitted with either a DIN or an ANSI flange connection marked with a cast arrow to indicate the direction of flow. For an extra charge, suitable welding mating neck flanges as per DIN or ANSI can be supplied.
The maximum permissible forces and moments are to be taken into account according to the model quoted in the pump dimensions sheets or the installation drawings.

They may never be exceeded. Any connections that are not required for emptying, air purging, heating, etc., should be suitably blanked off before startup.

4.3.10. Drive and Shaft Coupling

The pump is installed directly via a shaft coupling to electric motors of various types or to other drive machines on a through–type base plate with or without an oil sump or with a fixing flange.
Always pay attention to the correct rotational speed and direction of rotation! The pumps can also be installed vertically.

For safety reasons, it is not permissible to install the motor below the pump. The shaft coupling transfers the torque positively as a three–part torsionally–elastic dog clutch and equalizes the axial, radial and angular displacements in the shafts connected.
For an extra charge, various configurations (by the manufacturer) and materials are available.

4.4. Dimensioning and Geometry

4.4.1. Overall and Individual Dimensions Sheets

Overall and individual dimensions sheets for the various sizes and configurations are attached to this document as an appendix. If special dimensions sheets are to be produced for the operators, these must be requested.

4.4.2. Overall and Individual Installation Drawings

Overall and individual installation drawings for the various sizes and configurations are attached to this document as an appendix. If special installation drawings are to be produced for the operators, these must be requested.

4.4.3. Sectional Drawings and Documents

Sectional drawings, complementary sectional drawings and detailed documentation of the various sizes and designs of the pumps are included in the appendix.
If special sectional drawings are required for the operator, these shall be separately requested.
All above mentioned drawings and documents are available in various foreign languages on request.

4.5. Design Versions

4.5.1. Type Code

The combination of all possible pump sizes and designs can be found in the type code in the appendix. Via the alpha–numeric code, all possible standard pumps can be selected.

4.5.2. Standard Materials

Pump casing	0.6025 or 0.7040
Casing, drive side	0.6025 or 0.7040
Casing, end side	0.6025 or 0.7040
Valve casing	0.6025 or 0.7040
Drive screw	1.7139 hardened
Driven screw	1.7139 hardened
Bearing bushes	0.6025 or 2.1090.01
Valve inserts	St
Flat seals CENTELLEN	WS 3820

4.6. Applications

4.6.1. Main Areas of Application

General industrial technology, oil burner, energy, marine and off–shore technology, machine and heavy machine construction, tank farms, chemical and petrochemical and related downstream processing industries; food and gourmet food industry.

4.6.2. Temperature and Pressure Limits


Maximum pumping overpressure16 bar
Maximum viscosity up to 200,000 mm2/s
Maximum inlet pressure up to 0.5 bar (for seal W)
Maximum inlet pressure up to 4 bar (for seal G and S)
Maximum media temperature 200°C (for seal W)
Maximum media temperature 280°C (for seal G)
Maximum media temperature 320°C (for seal S)
Maximum heating overpressure 10 bar
Maximum heating temperature, depending on the seal: 200°C to 320°C

A certain degree of delivery pressure may be required according to the operating conditions.

4.6.3. Performance Data and Speeds

4.6.3.1. Performance Tables

Performance tables for each pump size and power increase tables acc. to various speeds and viscosities shall be requested as required.

4.6.3.2. Power Consumption Diagrams

Power consumption tables for each pump size and power increase tables acc. to various speeds and viscosities shall be requested as required.

4.6.4. Operative Range

4.6.4.1. Space Requirements for Operation and Maintenance

The place of installation must be selected such that trouble–free operation and easy maintenance of the unit are possible. All safety regulations should likewise be heeded.

4.6.4.2. Environmental Conditions

Prevailing environmental conditions that can have a negative effect on the operation of the pump unit, e.g. high temperatures, adjacent components, spray water, etc. shall be avoided. All environmental and mounting conditions shall be made known when ordering the pump unit. Additional environmental and mounting conditions, e.g. insulation, vibration damping elements etc. shall be made known when ordering the pump unit.

4.6.4.3. Foundation, Bedplate and Mounting

The type of mounting required depends upon the pump type and size. If an intermediate pedestal and angular mounting bracket are used to mount the unit, then all the holes, resp. elongated slots in the mounting flange and angular mounting bracket shall be used.

The unit shall be mounted in a manner to prevent it from moving and/or being displaced. All foundations and bedplates shall be statically stable. No vibrations of the pump unit caused by adjacent equipment or components shall be permitted. Should these prevail they shall be eliminated via damping elements.

If the pump casing is to be installed on site onto a base frame, pay attention that the dimensions of the overall arrangement are adequate. All the fastening holes of the pump must be used. All components (pump, coupling and motor) are to be aligned as described in Chapter 5. We assume no liability whatsoever for damage to the unit caused by inadequate fastening down.

4.6.4.4. Pressure and Suction Pipelines

The pump unit shall not be used to support pressure and suction pipelines. The maximum permissible forces and torque that may be applied to the mounting stubs as quoted in the dimensional drawings of the individual pumps, shall under no circumstances be exceeded. This also applies to possible thermal stresses, see Para. 8.3.
The nominal diameters of the pressure and suction pipelines shall be at least as large as those of the pump unit. They shall be selected acc. to the respective media flow velocity. The velocity of flow in the suction pipelines shall not exceed 1 m/s and in the pressure pipelines 3 m/s.

When mounting pressure and suction pipelines, care shall be taken to ensure that restriction of the media flow is not caused by sharp bends, angular valves and non–return flaps and valves. Unavoidable cross sectional area differences of the pipelines shall be overcome by using smooth pipeline transitions, sudden changes in direction shall be avoided. When mounting pipelines, the total pipeline resistance to media flow shall be taken into account. The pressure and suction shall be mounted in a manner to prevent leaks and air pockets from forming.
For this reason the pipelines shall be mounted with an upward tendency.
The screws of the shut–off valves shall be mounted either horizontally or vertically pointing downwards and the pressure pipelines shall be vented at the uppermost position. In addition, the flat flange seals shall not be allowed to protrude into the internal bore of the flanges.
It is recommended that shut–off valves should be fitted on both sides of the pump and also that a non–return flap or valve should be fitted into the pressure pipeline. The shut–off valves are only provided to close the pipelines when the pump is removed and shall remain open at all times during operation.
All pipelines, flaps and valves shall be thoroughly cleaned before the pump is fitted in order to remove any remaining pipe forging slag, welding globules or possible assembling parts, i.e. nuts and bolts (flush pipelines). No responsibility can be accepted for damage to the pump caused by foreign bodies in the transported media.
The media tank shall be mounted in a manner to allow air bubbles and froth, that have formed in the media, to be removed and not allowed to be sucked in again by the pump.

The media tank shall be dimensioned and mounted in a manner that will prevent the maximum permissible flow and media temperatures from being exceeded. For this, special measures when mounted shall be observed.
Due to the close tolerances between the screw and housing bore, the useful life of a screw pump is mainly determined by the degree of purity of the flow media. We therefore recommend that suction filters with the following mesh sizes shall be fitted:

Mesh size viscosity of the media to be

0.3 – 0.5 mm >150 mm2/s
0.1 – 0.3 mm 37 – 150 mm2/s
0.06 – 0.1 mm <37 mm2/s
When connecting the pressure lines, the direction of media flow through the pump shall be observed (Arrow marked on the pump housing).
A connection for a pressure gauge should be fitter quite near to the pump.
The cleaning of the pipework should not be executed with water or with fluids with minimum viscosity below the minimum indicated viscosity shown in the pump data sheet. During hydrostatic test of the whole pipework system, the pump must be isolated.
The hydrotest of the pump (dynamic or static) will cause damage to the pump (especially to the shaft sealing system). If this procedure is not maintained, the guarantee is not void.

4.6.4.5. Supply Connections

All further supply connections shall be correctly dimensioned and connected to the pump unit in an appropriate manner. Material selection and dimensioning is the sole responsibility of the user. No mechanical stresses shall be applied to the pump unit by these supply connections.

5. Mounting and Installation

5.1. Tools Required

For the complete assembly and dismantling work, only standard tools are required:
– Allen key wrenches angled according to DIN 911
– Offset double–ended ring spanners according to DIN 838 ISO3318
– Double open ended spanners according to DIN 3110
– Machinists hammer according to DIN 1041
– Rubber mallet
– Screwdriver according to DIN 5.264/A
– Insulated screwdriver (for electricians)
– Universal 2 or 3 arm gear puller
– Retaining ring pliers according to DIN 5254
– Retaining ring pliers according to DIN 5256
– Mounting bushes for roller bearings

5.2. Initial Installation of the Pump

The shaft ends of the pump and driving motor shall be correctly aligned in order that eccentricity, coaxial and longitudinal running faults shall not cause premature wear of the coupling elements and subsequent damage to the pump. When connecting the pump to the motor, care shall be taken to ensure that the maximum axial displacement (spacing of the shaft ends), the maximum radial displacement (out of center of the shaft ends) and the maximum angular displacement of the shaft ends as stated by the coupling manufacturer are not exceeded.

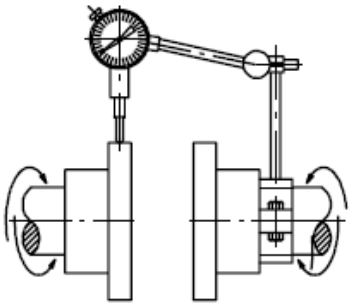
When special couplings are to be fitted, the mounting instructions of the manufacturer shall be adhered to. In addition, no axial forces shall be transferred to the driving shaft of the pump via the coupling.

Careful alignment of the shafts will increase the working life cycle of the coupling. The part of the coupling to be mounted on the pump shaft shall not be subjected to force, i.e. striking with a hammer etc. Pump mounting elements, resp. other equipment for mounting the pump shall be carefully inspected, for possible manufacturing faults, before use. The values for radial run–out (Table 1,N) and concentricity and axial run–out (Table 2,N) shall not be exceeded when fitting the intermediate pedestal.

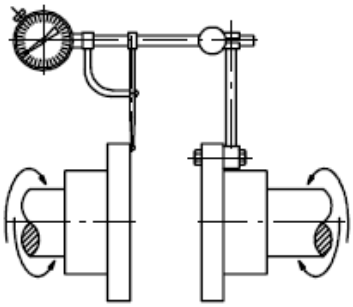
Coupling manufacturers instructions shall be adhered to. Care shall be taken to ensure that all rotating parts are covered to prevent accidental contact. No responsibility can be accepted for damage caused by incorrect mounting, resp. misalignment of the moving components.

5.3. Initial Installation of the Pump Unit

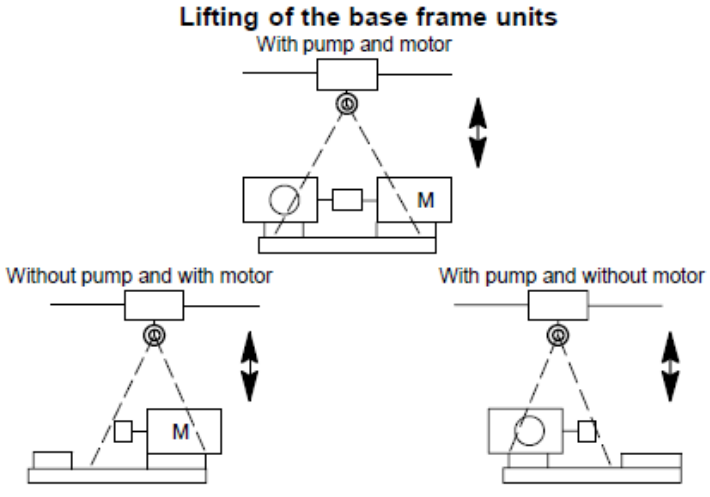
The pump unit shall be inspected on site for possible transport damage.
If the unit is to be assembled on site, this shall be carried out acc. to Para. 5.2. After correctly aligning, the complete unit shall be correctly mounted. For base and foundation information, see Para. 4.6.

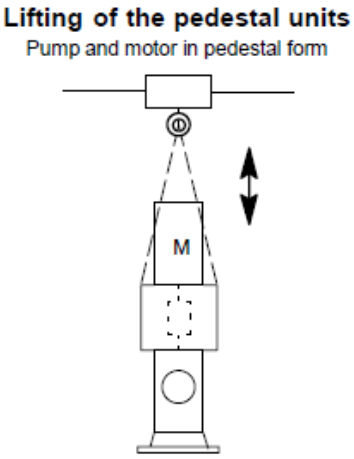


1. Fit the dial gauge to the drive shaft and check concentricity of both hubs by turning, if necessary realign.



2. Fit the dial gauge to the flange of one hub and check the symmetry of both hubs by turning, if necessary realign.





6. Starting Up – Shutting Down

6.1. Technical Documentation

Attention

Before starting up, check all technical demands and documentation. In particular, check the pump unit for the following:

– Serial No.
– Type and Size
– Direction of rotation and mode of operation

6.2. Pipeline Schematic Drawing and Measuring Points

The complete pipeline arrangement within the bundle of pipelines, the correct connections and dimensions of measuring and controlling devices shall be checked.

The cleaning of the pipework should not be executed with water or with fluids with minimum viscosity below the minimum indicated viscosity shown in the pump data sheet. During hydrostatic test of the whole pipework system, the pump must be isolated.
The hydrotest of the pump (dynamic or static) will cause damage to the pump (especially to the shaft sealing system). If this procedure is not maintained, the guarantee is not void.

Damages that occur due to incorrect arrangement, resp. dimensioning of measuring and controlling devices are not covered under warranty.

6.3. Preparation for Starting Up

Before starting up for the first time, the following jobs shall be carried out:
– Clean the connection lines, Para. 4.6.4.4.
– Check the mounting screws, Para. 4.6.4.3.
– Check the mains power supply to the motor
– Check the direction of rotation of the driving motor, the direction of rotation must correspond to the direction of rotation arrow on the pump. By an incorrect direction of rotation, the pump will produce no suction, this will cause the pump to be damaged.
– Remove blind plugs from pressure and suction side of the pump. see Para. 3.3
– Connect pipelines acc. to direction of rotation, Para. 4.3.9. and 4.6.4.4.
– Visual check of the pump unit, acc. to Para. 6.1.
– Open the shut–off valves.
– Fill pump with media to be transported, protect from running dry.
– All regulating and monitoring devices shall be checked for correct functioning after being adjusted, (e.g. Emergency–Off Switch, Pressure gauges, etc.).
– To protect operators, all guards and devices shall conform to the appropriate safety regulations.

6.4. Starting Up

Always check the direction of rotation and speed of rotation before startup.
Watch the pressure and vacuum gauges, and compare them against the ordering and operating details. Monitor the temperature and viscosity of the pump media. At the drive side and end side of the sealing casing, the temperature may be approx. 20–30°C above that of the pump media, but it must not exceed the operating temperature limits of the shaft seal.
The delivery line is to be purged of air at the highest point until pump media comes out of the air bleed valve or the air bleed screw. Then the air bleed units are to be closed firmly.
After the pump has been switched On, the complete flow pressure, media flow, viscosity, temperature, speed and current consumption shall be compared with the order, resp. the operating data. Care shall be taken to ensure that the drive motor is not overloaded due to transporting a flow media with a higher specific gravity or higher viscosity than that of the media for which the pump was designed originally and also that the suction head is not higher than that of the capacity of the pump. In this case, cavitation will take place. The level of the media in the tank shall be checked from time to time. Media level for submerged units shall not fall below the level of the suction input stub.
Please always consider the sealing and its operating safety, see section 7.5.

6.5. Shutting Down

Before shutting down the pump unit, no preparation is necessary. If the motor is switched Off during operation, the pump will stop almost immediately, (for pump and motor quite safe). We recommend that a non–return valve should be fitted between the cut–off valve and shutoff device. During longer shut down periods, all shutoff devices shall be closed. When changing fluid concentrations and the possibility of crystallizing, congealing etc. prevails, then the pump shall be drained and flushed out with an appropriate solvent.

6.6. Restarting

After only a short shut down period, the motor may be restarted without any prior preparation. After longer shut down periods, resp. refitting the pump unit, restarting shall be carried out as described under Para. 6.3.

6.7. Standstill

6.7.1. Standstill Periods of up to 3 Months

If the pump unit is to be put into operation, resp. restarted within roughly 3 months, no special conservation is necessary.

6.7.2. Standstill Periods from 3 to 6 Months

Before initial commissioning (storage), the pressure and suction ports shall be fitted with blind plugs. When closing down for longer periods, the shut–off valves on both sides of the pump shall be closed. In this case the pump remains filled with media. Should the media, that now remains in the pump, contain aggressive substances that could damage the pump, then instructions as listed in Para. 6.7.3. shall be adhered to.

6.7.3. Standstill for Periods Longer Than 6 Months

Close pump pressure and suction ports as stated in Para. 6.7.2 and fill with an appropriate conserving media. In order to prevent pressure marks appearing on the surface of the bearings due to

vibration or shocks, the drive shaft of the pump shall be manually rotated at regular intervals, e.g. once a month. The position of other moving parts, i.e. driven screws and bearing, will then also be changed.

6.8. Operation Monitoring

Monitoring of NETZSCH screw pumps can be kept to a minimum by correct mounting and operation. At regular intervals, the operating pressure, media flow, excess current consumption of the electric motor, couplings, seals and gaskets, filter soiling and shall be observed. Any unusual pump noises shall be investigated. The useful life cycle of the pump depends upon the degree of purity of the flow media.A visual check of the pump unit shall be carried out at least once per month. The pump shall operate smoothly without undue vibration. The pump shall not be allowed to run dry! Check shaft seals. Leakages occur especially during run–in periods.

Seal G (mechanical seal)

A leakage of roughly one or two drops of fluid every hour can be regarded as normal for an undamaged seal.

– The mechanical seal shall not be run dry!

- ***Seal S (Packing Seal)***

A leakage of a few drops of fluid per hour can be regarded as normal for an undamaged packing seal as the sealing elements on the drive shaft must be continuously covered with a fluid film. In order to guarantee this, a slight excess pressure of approx. 0,5 bar shall prevail in the sealing area. The Adjusting Screw (Pos.081) shall therefore not be fully opened.
The tension and the resulting sealing are adjusted during operation.

– If the leakage quantity of the packing seal is too high, then the Gland (Pos.75) must be tightened, without tilting, via the Mounting and Adjusting Elements (Pos.76, 77, 78). Due to the normal wear of the packing rings during operation, the packing gland shall be tightened at regular intervals.
– If the operating parameters are changed, then the adjusting screw of the packing seal must be readjusted.
– Under no circumstances shall the packing seal be allowed to run dry!
If standby pumps are installed, these must be put into operation occasionally so as to ensure that they are fully operational when needed. In addition, the screws shall be manually rotated at regular intervals acc. to Para. 6.7.3.

6.9. Drive Shaft Bearing

The bearing of the driving shaft is a service free, grease– filled, externally mounted grooved ball bearing. This bearing is designed for a working life cycle of 20 000 operating hours under the operating conditions as described in Para. 4.6.2. Due to rough operating conditions, high temperatures, non–conforming to the oiling and greasing intervals as stated, the working life cycle will be considerably reduced.
If there is a regreasing–possibility at the pump, the groove ball bearing has to be regreased regularly. The regreasing intervals depend on the grease service life of the used grease–media and on the operational charges.
A monthly inspection respectively an inspection after 500 operating hours would be recommended by the manufacturer.
Project–related differently expressed stipulations are to be adhered to!

For the lubrication, all high – quality and temperature – resistant ball bearing – greases as proposed as follows, can be used.

Manufacturer	– 150ºC	– 250ºC
Aral	Aralub HLP 2	
BP	BP–Enerrease LS–EP2	
Castrol	Spheerol Ap2	
DEA	Glissando EP2	Diskor Plus 2
Esso	Beacon Ep2	Unirex S 2
Fuchs	Renolit FEP 2	Renoplex EP 3
Mobil	Mobilux EP 2	Mobiltemp SHC 32
Optimol	Olit 2 EP or Longtime PD 2	Optitemp HT 2
Shell	Alvania Grease EP 2	Darina Grease 2

or comparable grease – products

grease–filling–quantities – regreasing interval , n= 1450 rpm
Type of grease–filling–quantities regreasing interval in hours pump

		=rotation / Stauffer grease cup	to 70ºC	to 100ºC	to 150ºC
LNAE 30	2 g	0.7	20 000	5 000	400
LNAE 40	4 g	1.5	20 000	5 000	400
LNAE 48	5 g	2	17 000	4 250	340
LNAE 62	6 g	2.3	16 000	4 000	320
LNAE 70	7 g	2.7	14 000	3 500	280
LNAE 82	9 g	3.5	12 500	3 125	250
LNAE 96	10 g	4	12 000	3 000	240
LNAE 116	12 g	4.5	11 000	2 750	220
LNAE 126	14 g	5.4	10 000	2 500	200
LNAE 140	18 g	7	8 500	2 125	170
LNAE 164	20 g	2	8 500	2 125	170

7. Service/Maintenance

7.1. General Information

Service work normally includes checking the pump components for wear and damage.
NETZSCH screw pumps of Type LNAE require little or no service providing that the respective operating data are not exceeded and that the flow media does not contain abrasive particles. The degree of purity and lubricating factor of the flow media are largely responsible for determining the useful life cycle of the pump. If however a higher operating degree of safety is required, then we recommend that the maintenance and inspection intervals should be followed as described in Para. 7.2.

7.2. Service and Inspection

– After 500 hours operation the pump shall be inspected.
Extraneous noises emerging from the pump unit shall be investigated. Furthermore, the temperature difference between the end cover and the driving cover shall be measured with an appropriate thermometer. The difference shall not exceed 20 to 25ºC
– After about two years, the pump should be dismantled and all internal parts inspected for possible damage and wear. Investigate with special care to see if the contact paths of the roller bearings, the rubbing surfaces of the shaft, the remaining take–up space in the packing seal, the wear in the individual packings, the bearing locators for the screws and the bearing bushes are in proper condition.
Also examine the faces of the running surfaces of the shaft collars for any wear. Worn parts must always be replaced.
– Minor striations on the running surfaces of the screws and i the area of the shaft seals can be smoothed off with a suitable polishing tool, but such striations point to the pump media being contaminated.
– The lower regions of the pump housing, e.g. suction side housing shall be checked for sludge deposits. If present this shall be removed.

7.3. Dismantling and Reassembly

7.3.1. General Precaution

With careful monitoring of the pump, operating interruptions that would make a dismantling necessary, are extremely rare. If however faults occur, the cause of these should be located, if possible, before the pump is dismantled. The Trouble Shooting able in Para. 8.1. lists possible causes. During dismantling and assembly work, all components shall be treated with the utmost care. Shocks and impacts shall be avoided. All components shall be carefully cleaned, serviced and, if necessary replaced with the appropriate spare parts. After reassembly, it shall be possible to rotate the driving shaft freely. If this is not the case, premature damage may be caused to the bearings and shaft seals. For all work, the respective sectional drawings shall be observed.

7.3.2. After Sales Service Technicians/Dangers

NETZSCH–Service Technicians for mounting and repairs can be made available to the user upon request.

If repair work is to be carried out by the user or by NETZSCH service personnel, the pump must be at atmospheric pressure, completely drained and cleaned. This is especially applicable for pumps that are returned to the factory for repair. In order to protect our service personnel and also for environmental reasons, pumps filled with flow media will not be accepted for repair. Should they be accepted for repair, the user must bear the costs involved for an environmentally appropriate waste disposal.

Attention

For pumps handling dangerous media and/or environ–mental endangering products, if repair work has to carried out either on site or the pump has to be returned to the factory, the user must inform personnel on site and also the factory personnel of this. In this case, a proof of flow media in the form of a DIN Safety Data Sheet shall be supplied.
– Toxic, cancer inducing, fruit and vegetable damaging and gene changing materials or materials that can endanger the health of persons
– Corrosive materials
– Irritating materials, explosion endangering materials, flame exhilarating and highly and lightly flammable materials.
The user is solely responsible for mounting on site warning signs, which naturally shall be observed at all times.
On site service personnel and/or NETZSCH service personnel, who are required to carry ourservice work, shall be informed of all dangerous materials they may encounter.

7.3.3. Dismantling and Assembly Information

The most important dismantling and assembly steps are described in the following paragraph. These steps shall be carefully followed. For damages caused due to unauthorized and/or incorrect dismantling and/or assembly, no warranty can be accepted.

7.3.4. Mounting Tools

List of the necessary mounting tools, see Para. 5.1.

7.4. Dismantling the Pump

– Disconnect the mains power supply. This shall be carried out by a qualified electrician. It shall not be possible to operate the motor or other driver.
– Check that the shut off valves in the pressure line are closed.
– Allow the pump to cool down to room temperature
– Disconnect suction and pressure lines
– Drain pump
– Loosen and remove the supply pipings for heating and draining
– Unscrew fixing screws, the pump can now be removed
– Draw out the half of the coupling on the pump side with the help of an extractor tool, remove the feather key (Pos.180) from the pump shaft stub.
– Undo the screws (Pos.47) and pull off the drive–side cover (Pos.45) and liner (Pos.2) from the pump casing (Pos.1) with the pulling–off screws, paying attention to the screw set, the shaft seal and the ball bearings.

– Remove Flat Seal (Pos.46).
– Undo the screws (Pos.32) and pull rear cover (Pos.30) and Flat Seal (Pos.31)
– Undo the locking ring (Pos.173).
_ Undo screw (Pos.50) and pull Front Cover (Pos.45).
– Only if sealed with shaft sealing rings (Pos.52): remove locking ring (Pos.53).
– Only if sealed with packing rings (Pos.72): detension the gland (Pos.75), undo (Pos.75, 76, 77 and 78).
– Only if sealed with mechanical seals (Pos.62): undo the mechanical seal pin (Pos.61) from the rotating parts and carefully pull them off the screw (Pos.150), and undo the locking ring (Pos.64) if there is one.
– Draw the complete screw package (Pos.150, 151) to the rear and out of liner(Pos.2).
– Separate the driven screw (Pos.151) and the drive screw (Pos.150).
– Remove the drive–side bearing bushes (Pos.152) from the liner (Pos.2).

.

Dismantling seal G (mechanical seal)

– Dismantle the drive-side cover (Pos.45) or seal Housing (Pos.64), if any and bolts (Pos.47), together with the flat seal (Pos.46).
– Carefully press the clamping mechanical ring, the static part of the mechanical seal (Pos.62), and the seal collar or O–ring out of the drive–side cover (Pos.45) or seal Housing (Pos.64).

.

Dismantling seal W (shaft sealing rings)

– Press the shaft sealing rings (Pos.52) and any spacer or bearing rings out of the drive–side cover (Pos.45), note carefully their arrangement and installation sequence (only when sealed by shaft sealing rings)

.

Dismantling seal S (packing seal)

– Remove the preloading screws (Pos.76) and tensioning nuts (Pos.078), dismantle the gland (Pos.75).
– Push the packing rings (Pos.72) out of the drive–side cover (Pos.45).
– Remove the acorn nut (Pos.82), undo the tensioning nuts (Pos.79) but do not remove them, turn the adjusting screw (Pos.82) back.
– Carefully draw the deep groove ball bearings (Pos.170) out of the drive–side cover (Pos.45) with an extractor tool.
– Undo the locking ring (Pos.164).
– Remove the feather key (Pos.165).
– Pull off the shaft collar (Pos.159, and if applicable, Pos.158), from the screws with an extractor tool.
– Push the end–side bearing bushes (Pos.152) from the screws.
– Undo the screws (Pos.21), remove the heating plate (Pos.11) with the flat seal (Pos.12) (* only applicable in models with a heated base).

.

Dismantling Externally–Mounted Valve (Pressure Relief Valve)

– Undo the screws (Pos.27) and the seal (Pos.26) from the pump casing, remove the valve casing (Pos.200) with the intermediate plate (Pos.203), (** Only if configured for back–flow to the tank.)
– Turn the adjusting screw (Pos.222) to the right until the valve spring (Pos.235) is detensioned. Note the number of turns made.
Remove the two screws facing each other (Pos.211) and replace them with longer cylindrical bolts inserted up to the end of the thread, then undo them by equal amounts and remove any remaining screws or bolts. Warning: the compression spring will untension itself.
– Once the compression spring (Pos.235) has been fully untensioned, draw out the complete cover (Pos.209) with the adjusting screw (Pos.222) and spring plate (Pos.220) from the valve casing.
– Remove the compression spring (Pos.235) and the flat seal (Pos.210).
– Undo the locking ring (Pos.223) and push the adjusting screw (Pos.222) out of the cover (Pos.209). Unscrew the drain plug (Pos.215) and seal (Pos.216) from the valve seat. (*** Only if configured without a hand wheel.)
– Undo the screws (Pos.214) and pull the valve seat cover (Pos.217), complete with the valve cover (Pos.219), out of the valve casing, undo the seal (Pos.213).
– Dismantle the hand wheel (Pos.227) and adjusting screw (Pos.225) and unscrew it out of the valve seat cover (Pos.217). (*** Only if configured with a hand wheel.)

7.5. Installation of Pump

The pump shall only be reassembled after all component parts have been inspected and found to be fully operative. No fault or damaged component parts shall be reassembled.
We recommend that heavily soiled component parts shall be cleaned before reassembling.
– Position the flat seal (Pos.12) on the heating plate (Pos.11) and attach it with the screws (Pos.21). (* Only if configured with a heating plate.)
– Lubricate the bearing bushes (Pos.152/1520) and pushes them onto the set screws (Pos. 150/151), then insert the feather key (Pos.165).
– Align the shaft collar(s) (Pos.152/1520 and if applicable, Pos.158) and lock them in place with the locking ring(s) (Pos.164).
– Push the drive screw (Pos.150) and driven screw (Pos.151) with the lubricated bearing bushes from the end side into the screw holes in the pump casing and liner (Pos.1 and Pos.2), the latter holes must have been oiled beforehand.
– Install the drive–side bearing bushes (Pos.152/1520) with lubricated running surfaces into the pump casing.

.

Installation of seal G (mechanical seals)

– When installing the mechanical seal (Pos.62), pay great attention to cleanliness, and in particular, avoid any damage to the rubbing surfaces and the elastomers.
– Position the clamping floating ring, the static part of the mechanical seal (Pos.62), with the seal collar or O–ring in the drive–side cover (Pos.45), and if applicable, in the seal Housing (Pos.64).
Ensure that the pressure is distributed equally when pressing in the clamping floating rings, and the amount of O–ring friction is to be reduced by using only water or alcohol. If applicable, pay attention to correct location of the slot in the clamping floating ring and the location of the close–tolerance grooved pin (Pos.61) in the drive-side cover (Pos.45).
– Position the seal housing (Pos.64), if applicable, and bolt it up tightly with the drive–side cover (Pos.45) and the flat seal (Pos.66).
– Install the locking ring (Pos.64), if applicable, on the driving screw (Pos.150).
– The seat diameter of the driving screw must not show any damage at all in the area of the mechanical seals. In order to reduce the amount of friction when installing the mechanical seal (Pos.62), the driving screw (Pos.150) should be thinly

smeared with oil or silicon grease in the area of the rotating seal elements. Since O– rings made of EP rubber must never come into contact with mineral oil or grease, we recommend the use of silicon grease.
Tighten up the turning lock (threaded pin).

Attention This is not applicable for rubber bellows seals that should be assembled with water, alcohol or a suitable solvent.

– Under no circumstances shall grease or oil be applied to the working surfaces. All working surfaces shall be absolutely dry, dustfree and perfectly clean when reassembling.
– Before pushing on the drive–side cover (Pos.45), the feather key slot of the driving screw (Pos.150) is to be unglued to prevent damage to the mechanical seal.
– Position the flat seal (Pos.31) on the drive side of the pump casing (Pos.1).
– The equalization holes in the pump casing and the drive–side cover must never be covered up.
– Carefully push the drive–side cover (Pos.45) over the end of the shaft of the drive screw (Pos.150).
– Bolt up tightly the pump casing (Pos.1) with the bolts (Pos.47).
The bolts must be tightened up equally. Ensure that the connecting flange (flow direction) is positioned correctly.
.

Installation of seal W (shaft sealing rings)

– The seat diameter of the driving screw must not show any damage at all in the area of the shaft seals.
– Push the shaft sealing rings and any spacer or bearing rings into the drive–side cover (Pos.45). Refer to the cross–section drawing and any notes for arrangement, installation sequence, etc.
– Install the locking ring (Pos.53).
– Position the flat seal (Pos.31) on the drive side of the pump casing (Pos.1).
– The equalization holes in the pump casing and the drive–side cover must never be covered up.
– Before pushing on the drive–side cover (Pos.45), the feather key slot of the driving screw (Pos.150) is to be unglued to prevent damage to the mechanical seal.
– Carefully push the drive–side cover (Pos.45) over the end of the shaft of the driving screw.
– Bolt up tightly the pump casing (Pos.1) with the bolts (Pos.47).
The bolts must be tightened up equally. Ensure that the connecting flange (flow direction) is positioned correctly.
.

Installation of seal S (packing seal)

– The seat diameter of the driving screw must not show any damage at all in the area of the packing rings.
– Tighten up the adjusting screw (Pos.81), install the seal elements (Pos.80), tensioning nut (Pos.79) and acorn nut (Pos.082), turning the adjusting screw (Pos.81) until it is completely within the inner part of the drive–side cover (Pos.045), as it will be set when the pump is started up.
– Position the flat sealing ring (Pos.31) on the drive side of the pump casing (Pos.1).
– The equalization holes in the pump casing and the end–side cover must never be covered up.
– Carefully push the drive–side cover (Pos.45) with the fixing parts (Pos.76, 77, 78) and the preassembled gland (Pos.75) over the end of the shaft of the driving screw (Pos.150).
– Bolt up tightly the pump casing (Pos.1) with the bolts (Pos.47).
The bolts must be tightened up equally. Ensure that the connecting flange (flow direction) is positioned correctly.
– Arrange the packing rings individually around the driving screw and press them one after another and with equally distributed force with the gland into the packing casing, and in doing so, the parting lines of the individual packing rings (Pos.72) must be offset from each other by 90°. Pay attention to the number and size (cross–section) of these.
– Press the gland (Pos.75) equally and without kinking into the packing casing.
– Install the fixing and preloading pieces (Pos.76, 77, 78), but without pushing in the packing rings firmly in place, the preloading is only done when the pump is started up.
– Push the supporting disk (Pos.172) onto the drive shaft.
– Check the deep groove ball bearings (Pos.170) for any damage, out of roundness, for free running, and for the amount of grease, etc., then warm them up to approx 80°C and push them or press them onto the driving screw (Pos.150) by using a sleeve or ring bush and then into the drive–side cover (Pos.45). Never apply hammer blows to deep groove ball bearings, as this would damage either the ball race or the ball bearings, and the entire screw package is to be supported at one end while this is being done.

– Push the supporting disk (Pos.172) and locking ring (Pos.173) onto the driving screw, lock the deep groove ball bearings (Pos.170) with the locking ring (Pos.174).
– If the deep groove ball bearings are to be relubricated, install the spacer ring (Pos.178) and the locking ring (Pos.173) on the driving screw, seal the deep groove ball bearings (Pos.170) with the O–ring (Pos.176) and the labyrinth ring (Pos.188), finally, lock it off with the locking ring (Pos.174). The compression lubricator (Pos.120) must be topped up or refilled with a suitable high–temperature grease.
– Position the flat seal (Pos.31) at the end side on the pump casing (Pos.1).
– The equalization holes in the pump casing and the end–side cover must never be covered up.
– Bolt up tightly the end–side cover / socket (Pos.30, 40) with the fasteners (Pos.32 / 33, 35).
– Insert the feather key (Pos.180).
– Once the pump has been reassembled, the driving screw must be turned by hand (in the case of the larger pumps, with the help of an extension such as a screw clamp or similar).
– Warm up the pump side of the coupling half to around 110°C

and push it over the end of the connecting shaft (Pos.150), never apply hammer blows to the coupling half, as otherwise this would damage the deep groove ball bearings and the shaft seal.
.

Installation of externally–mounted valve (pressure relief valve)

– Screw in the regulator screw (Pos.225) with the O–ring (Pos. 226) into the valve seat cover (Pos.217), install the hand wheel (Pos.227) on the regulator screw (Pos.225). (*** Only if configured with a hand wheel.)
– Screw in the drain plug (Pos.215) with the seal (Pos.216) and the valve seat cover (Pos.217). (*** Only if configured without a hand wheel.)
– Insert the valve cone (Pos.219) with the shaft into the valve seat cover (Pos.217).
– Push the valve seat cover (Pos.217), complete with the valve cone (Pos.219) and flat seal (Pos.213) into the valve casing (Pos.200) and do it up tightly with the screws (Pos.214).
– Push the valve spring (Pos.235) with the fore–part onto the pressure spring guide of the valve cone (Pos.219).
– Insert the O–ring (Pos.224) into the groove of the adjusting screw (Pos.222).

– Screw the spring collar (Pos.220) into the adjusting screw (Pos.222) up to the join, lubricate the shaft of the adjusting screw and turn it while pushing it into the drilled hole in the valve cover (Pos.209).
– Lock the adjusting screw (Pos.222) with the locking ring (Pos.223) to prevent any axial displacement.
– Install the valve cover (Pos.209) with the adjusting screw (Pos.222) and the flat seal (Pos.210) on the valve casing (Pos.200).
– Next, to fasten it, use two longer panhead screws placed opposite each other and with a equal number of turns up to the stop.
– Insert the screws (Pos.211) into the remaining fixing holes, finally, remove the longer installation screws and insert the remaining screws (Pos.211).
– Install the spacer plate (Pos.203). (** Only if configured for back– flow to the tank.)
– Install the valve casing (Pos.200) and flat seal (Pos.026) on the pump casing (Pos.1).

After the pump has been completely reassembled, it should be connected to the driving unit and mounted according to Para. 5.2. Subsequently, suction and pressure pipelines shall be fitted.
When being put into operation again acc. to Para. 6, the pressure relief valve, when fitted, shall be adjusted to the required value.

.
Setting of pressure relief valve (opening pressure)
Exact setting of the opening pressure can only be done with measurement of the flow throughput and operating pressure. If that is not possible on site, it must be done at the factory by the manufacturer.
If the number of turns to untension the pressure relief valve had been noted during disassembly, the opening pressure can be set to approximately the same as before by applying the same number of left–hand turns of the adjusting screw (Pos.222). This does not apply if the valve spring has been replaced!

Simplified Setting of the Opening Pressure:

– Lightly preload the valve spring (Pos.235) with the setting screw (Pos.222).
– Let the pump run, and open throttle slide A (delivery side).
– Close valve C at the inlet point so that the pressure display shows approx. –0.4 to –0.5 bar.
– Close valve A slowly while constantly watching pressure gauge D (delivery side) and D (inlet side).
– If the pressure at D moves slightly towards atmospheric pressure, then the valve has opened at value B.
– If the desired value has not been reached yet, open valve A again and change the opening pressure with the setting screw (Pos.222).
Turning clockwise sets the opening pressure lower, and turning anti–clockwise sets it higher.
– Adjustment has to be repeated as many times as necessary until the correct setting–pressure is reached.
Proceed as described under Para. 6.4!

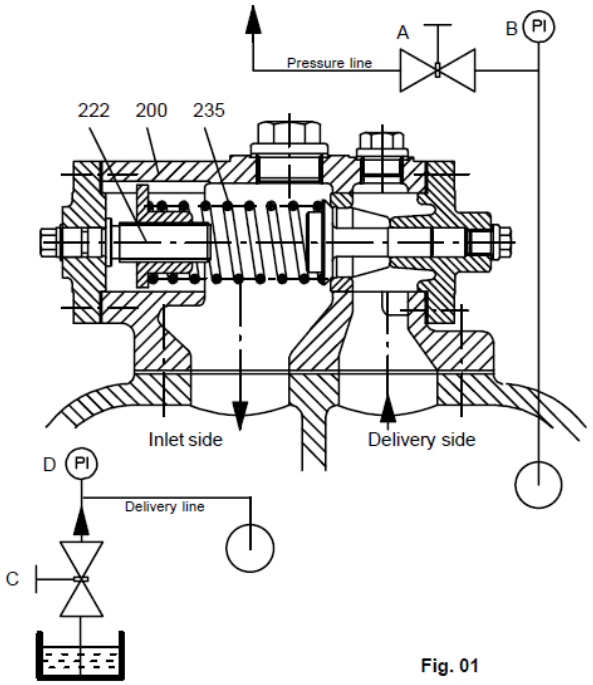


Fig. 01

7.6. Spare Parts

In general, we recommend that the user should keep a complete set of spare parts for the pump unit on stores. It is also possible to select a set of appropriate spares acc. to our spare parts list for the individual user.
In order to do this, the following information shall be supplied when ordering.
– Pump type
– Pump size
– NETZSCH serial Number
– Designation, sectional drawing number and Pos.No.
– Orderer/User
– Name of responsible person
– Address and Telephone Number

Attention An interchangeability can only be guaranteed when exact information is supplied.

For information regarding preservation and intermediate storage of spare parts, resp. replacement units, see Para. 3.4. and 3.5.