

**Site Documentation**  
**K 70101 ASU No. 9 Košice**

**Chapter 3.7.4 Truck Filling Pump**

- LIN Truck Filling Pump P72001  
Type: C-20/EM-15  
Instruction Manual for Liquid Gas Centrifugal Pump

# Instruction Manual for Liquid Gas Centrifugal Pump

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*LOX Truck Filling Pump P62100*  
*LIN Truck Filling Pump P72100*

Pump - Type : C-20/EM-15  
Sefco Ref. No. : 04.271/1-2  
Customer : Air Liquide AGS GmbH  
Customer Ref. No. : Order. No.: Z11/4500023387 of 23.07.2004  
Project: K70101  
Project name: "ASU Košice"

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Test certificate for discharge hose	

**1 Declaration by the Manufacturer**

(according CE Directive 98/37/EEC, Article 4.2. and Annex II, sub B.)  
Prohibition to put into service

**Manufacturer : SEFCO AG**

**Address : Wuhrmattstrasse 15, Postfach  
CH-4103 Bottmingen**

Herewith declares, that

**the Centrifugal Cryogenic Pump(s)**

- Type: C-20/EM-15
- Ref. No.: 04.271/1-2
- Tag No.: P62100 - P72100
- Customer : Air Liquide AGS GmbH
- Order No.: Z11/4500023387 of 23.07.2004
- Project name: "ASU Košice"

is/are designed and manufactured according to the standards:

- EN 13275 Cryogenic vessels - Pumps for cryogenic service
  - EN 809 Pumps and pump units for liquids - Common safety requirements
- and is/are intended to be incorporated into machinery or to be assembled with other machinery covered by Directive 98/37/EEC, as amended;

and furthermore declares, that it is not allowed to put the machinery into service until the machinery into which it is to be incorporated or of which it is to be a component has been found and declared to be in conformity with the provisions of Directive 98/37/EEC and with national implementing legislation, i.e. as a whole, including the machinery referred to in this declaration.

This declaration becomes invalid by modifications of original parts or by use of foreign products.

Bottmingen, 26. November 2004

G. Lachenmaier, Responsible technique



## 2 Introduction

This instruction manual is based on a long theoretical and practical experience of SEFCO AG. It is helpful to the operating personnel to get familiar with the installation and operation of the delivered machines and components. Moreover, it points to possible dangers in connection with the use of these machines, and the means to avoid them. This manual must all time be available at the operating place of the machine.

Evidently, this instruction manual cannot cover all possible installation and operation conditions with the associated security precautions. In case of doubt, please consult SEFCO for further advice and guidance.

It is recommended by SEFCO that the owner/plant operator gives a profound training to his personnel according to the instruction manual; at the same time he makes sure, that the given instructions are understood and will be observed. Additional training at SEFCO is recommended.

It is expected that these machines/components will be operated exclusively by responsible and trustworthy professionals.

The responsibility of the owner/operator for installation, operation and safety (also in case of fire) will by no means be diminished through this instruction manual or a training at SEFCO.

In all cases the owner/operator is obliged to observe the current laws, regulations, instructions and recommendations.

In case of resale, modifications and/or alterations of the machine/installation, the information in the manual will have only limited validity; therefore a consultation of SEFCO is strongly recommended.

Spare parts must correspond with the technical requirements defined by SEFCO. This is guaranteed by original spare parts due to on-going quality systems. The use of spare parts of another origin can be a risk for safety. Spare parts of another origin can possibly change the features of the installation defined by design and cause significant defects and risks, SEFCO is not responsible for.

If for a product like electric motors a specific operation manual is attached to this manual it is relevant.

This manual was put together with greatest care. If you still need more information please contact:






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Wuhrmattstrasse 15 / Postfach  
CH-4103 Bottmingen  
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## 3 Safety

### 3.1 Notes and symbols

The dangers are classified into several grades. The following list shows a summary of symbols, grades of danger, signal words for dangers and possible consequences.

Symbol	Damage for...	Signal word	Definition	Consequences are...
	Persons	<b>DANGER!</b>	Immediately threatening danger	Death or heavy injuries
	Persons	<b>DANGER!</b>	Immediately threatening danger by voltage	Death or heavy injuries
	Persons	<b>WARNING!</b>	Possibly dangerous situation	Possible middle to light injuries
	Goods	<b>CAUTION!</b>	Possibly dangerous situation	Possible damage to - product - its surrounding
		Note! Information! Recommendation!	Notes for application or other useful informations and recommendations	efficient operation



## 3.2 General notes about dangers

Observe local regulations for accident prevention with all kind of work at liquid gas centrifugal pumps!

### DANGERS!



#### - Cryogenic fluids:

Cryogenic fluids cause blisters in case of contact with the skin. Always wear appropriate protective clothes and glasses. Touching extremely cold subjects with bare hands one gets stuck. Always wear suitable gloves!



#### - Liquid oxygen:

For transferring liquid oxygen, **pumps made of stainless steel are not allowed!** By handling liquid oxygen **danger of fire** may exist. All parts coming in contact with liquid oxygen **have to be free of oil and grease**. This also applies to workshops, spare parts as well as tools in use and hands ! Attention with oxygen saturated clothing! The increased concentration of oxygen in clothing can be stable over a longer period and is therefore a significant risk of fire together with possible sources of ignition like cigarettes a.o.



#### - Liquid hydrocarbon:

By handling liquid hydrocarbons exists the danger of explosion! Observe the relevant regulations; only use non sparking tools.



#### - Works at pump:

For all works at the pump make sure that the driving motor is standing still and a start up can be excluded under all circumstances! Start working only when the pump is no longer pressure containing and has warmed up to ambient temperature (to avoid ice formation by humidity)



#### - Sprinkling liquid:

Make sure that sprinkling liquid (leaking seals) doesn't come in contact with persons! Wear protective clothes and glasses! There is danger of burning the skin.

## 3.3 Important notes for operation

### CAUTION!



#### - Operational data's:

On the pump's data sheet of this manual (§ 6 ) the specific operational data's are listed. These data's describe an admissible range of operation for the pump. Operating outside of this range needs the approval by SEFCO!

#### - Parallel Operation:

To secure an optimum operation, the following points have to be observed:

- stable pump performance curve
- separated suction lines
- pumps of the same type
- consultation of SEFCO

#### - Series Operation:

Only after consultation of SEFCO!

## **4 Machinery description**

### **4.1 Pump**

The machinery-design suits the heavy duty industrial requirements and is characterised as following:

- Centrifugal pump, directly driven by electric motor.
- Support between motor and pump
- Centrifugal pump cold-end which consists of the casing, mechanical seal, safety-,rotating- and performance components.
- Purge-gas connections at pump rear casing, standardwise built in.
- The rotating parts are carefully balanced. The critical clearances between impeller and casing are kept large (simple assembling, secure operation).

#### **Material used**

Cold-End : - all pump parts are of bronze-alloy  
(Cu-content > 80 %), required for oxygen operation.  
- bronze nickered available.  
- mechanical seal and screwing are stainless-steel.

Support : - stainless-steel

Pump shaft : - stainless-steel

## **5 Additional Subsystems**

The following subsystems can be provided on customer special demand. Appropriate connections are available on the machinery unit.

### **5.1 Cold End**

- Purge gas subsystem, with leak-gas lead-off after the seal.
- The penetration of humidity is avoided by feeding gaseous (approx. 0,5 - 1 Nm<sup>3</sup>/h), dry nitrogen (<2ppm ); see also sectional drawing and spare parts list.

### **5.2 Additional Control-Subsystems**

- Motor-monitoring-system:
  - Temperature control of winding by means of built-in PTC- sensors, alternative by RTD's (PT 100)
  - Temperature control of bearings by means of built-in PTC- sensors, alternative by RTD's (PT 100)
- Delivery-pressure monitoring-system:  
Machine shut down at a pressure falling below a set limit (pressure drop caused by cavitation), or at rising above a set limit (e.g. VFD operation)
- Other subsystems on customer request.

## 6 Machinery and Subsystems Data

### 6.1 Machinery Data

Fluid	:	LIN	LOX
Density (kg/l)	:	0.81	1.139

#### Pump / Gearbox

Pump-Type	:	C-20
Material/Cold-End	:	bronze
Material/Impeller	:	bronze
Number of Stages	:	1
Impeller Standard $\varnothing$ (mm)	:	210/11
Impeller Effective $\varnothing$ (mm)	:	200
Impeller Rotating Speed ( $\text{min}^{-1}$ )	:	approx. 2950

Differential Head $\Delta H$ (m)	:	50	50
Differential Pressure $\Delta p$ (bar)	:	4	5.58
Flowrate (lit/min.)	:	1000	1000
Required NPSH (m)	:	0.9	0.9

Gearbox-Type	:	-
Lubricant	:	-

#### Electric Motor

Manufacture	:	Theo Halter GmbH
Type	:	DDG 160 MB2
Frame Size	:	160M
Design-Form	:	IMB 35
Rated Power (kW)	:	15
Rated current (A)	:	27.1
Rated Frequency (Field weakening point) - (Hz)	:	50
Rated Rotating Speed ( $\text{min}^{-1}$ )	:	2820 / max. admissible:
Protection / Insulation Class	:	IP55 / F used B
Max. ambient temperature / installation altitude (°C / m above sea level)	:	40 / 1000
$\Delta$ - Voltage / Frequency / Phases (V / Hz)	:	400 / 50 / 3

## Variable Frequency Drive (VFD)

Manufacture	:	-	
Type	:	-	
Protection	:	-	
Ambient Temperature (°C)	:	0 - 40	
Mains Voltage / Frequency / Phases (V / Hz)	:	-	
Rated output Current (A)	:	-	
Rated output Frequency (Hz)	:	-	/ max. admissible:
Max. Cable Length to the Motor (m)	:	-	

## 6.2 Additional Subsystems and Components

- Suction strainer DN100
- Flexible suction hose DN100 PN6
- Flexible discharge hose DN65 PN10
- Seal leakage detection RTD's

## 7 Pump preparation

### 7.1 Before delivery

- Hydrostatic pressure test of cold-end casing at 1.5 times the maximum admissible discharge pressure of the pump.
- Thorough mechanical checkouts
- Standardwise degreased for oxygen operation (independent of pumped liquid and application)
- Cold-test with liquid nitrogen

### 7.2 On arrival at customer site

- Check for transportation damage

#### CAUTION!



If unit is not put immediately into operation:

**„STORE IN DRY AND CLEAN ROOM“**  
protected from oil, dust and moisture

**Keep material sealed/packed until required for use!**

### 7.3 Handling

- Prepare suitable tools and hoists. Pay attention to the weight!

#### WARNING!



- Too poor dimensioned or damaged lifting equipment could tear!
- Always check the lifting equipment for correct size and faultless condition!
- Take care that no built up equipment is damaged by lifting

## 8 Pump installation

See installation-schematic No. E10200-1

### 8.1 Correct suction-line:

#### NOTE!

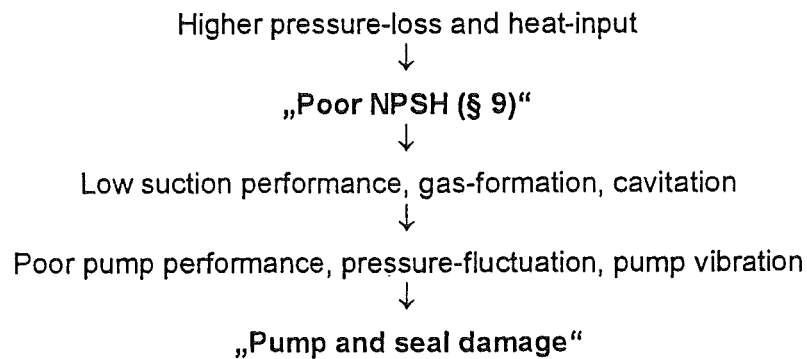


- **short and well insulated.**
- **simple and straight** ducting, without narrow bends and sudden section-changes.
- **continuous down-flow** towards pump, **no gas accumulation on suction side.**
- **optimum section** to minimise pressure-loss and heat-input.

#### Attention on errors!

- Narrow bends and sudden section-changes = higher pressure-loss.
- Long, narrow and poorly-insulated pipe = higher pressure-loss and heat-input.

#### CAUTION!



#### WARNING!



- Installation of a **strainer**, especially for oxygen operation!  
foreign particles may damage the pump and could cause fire or explosion.
- Installation of a **safety-valve** between main closing-valve up-stream and pump inlet  
(set about 1,5 bar above operational suction pressure); to avoid inadmissible pressure build-up.



## 8.2 Piping system and components:

We recommend a piping-system according to schematic No. E10200-1.

### CAUTION!



„Piping forces on the pump casing have to be kept at a minimum“  
( see list „Maximum nozzle loading“ )

### NOTE!



Suction- and pressure pipes should be straightened and adjusted!  
Take care of pipe-shortening due to cold (contraction).

Accordingly install „Fix points“ and use „Flexible Pipes“ on the pump suction- and pressure side.

It is recommended to finally fix the holding down bolts of the machine only in cooled down condition.

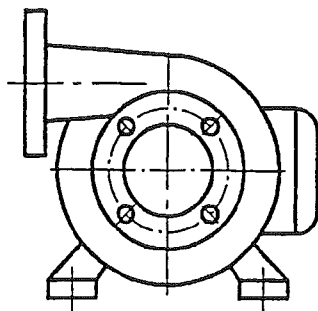
Minimise flow disturbances at pump-inlet.

### NOTE!

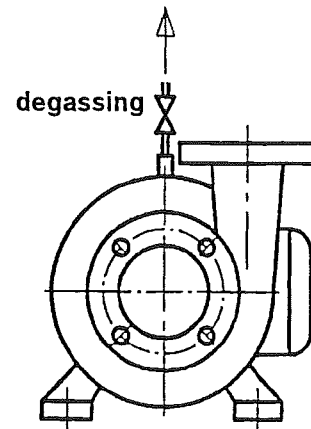


Flange- position on delivery side: (only for horizontal pumps)

In order to cool and degas the pump optimally, the following flange positions should be applied



optimum  
(for correct piping)



Only permitted with built-in  
device for degassing

For other flange positions refer to SEFCO first

## NOTE!



### Piping system:

Schematic E10200-1 illustrates the typical installation (piping and components) for a centrifugal pump unit. The required and recommended components are indicated there.

## 8.3 Pump protection

### RECOMMENDATION!



- In every case: put a cover over the pump to protect it against dripping water. Splashing the pump with water has to be avoided.
- At fixed installation: Purge the sealing chamber with dry (< 2ppm) nitrogen-gas to avoid moisture penetration; the appropriate connections are available on the pump rear casing. Feed will be connected to the upper union on the pump rear casing. The lower connection union will be kept open. Feed pressure  $\leq 0,1$  barg.
- Pump permanently cold: for motor bearing protection, the purge chamber should be permanently purged with dry (< 2ppm) warm (20 to 40°C) nitrogen-gas.

## 8.4 Electric connections

### DANGER!



These works are to be carried out only by authorised professionals.



The motor connections are to be installed according to the information on the motor plate as well as schematic E 10669-1. For differing installations the schematics in the annex are valid.

### CAUTION!



For VFD operated motors, make sure not to exceed the maximum admissible speed of the pump or the motor!

## 9 Suction pressure - NPSH required

For secure start up and running of the pump, a minimum suction pressure is required (according to design, flow rate and rpm).

Liquid gases have an equilibrium pressure, usually close to the vaporisation pressure  $p_D$ . Thus, a static pressure  $p_s$  greater than  $p_D$  is necessary at the pump inlet, to **avoid or minimise vaporisation and gas-formation** at a critical point of the pump.

This critical point of a centrifugal pump is commonly the leading edge of the impeller blade, where the flow is accelerated to the maximum relative velocity. Local stall will lead to even higher velocity, causing a **minimum static pressure**  $p_{crit}$  at the blade leading edge, which should **not be smaller** than the local **liquid vaporisation-pressure**  $p_D$ .

Hence, with respect to the fluid mechanics entering the pump (losses, acceleration), a static pressure  $p_s$  at the suction flange is required such that the following condition at the pump critical point is satisfied:

### CAUTION!



$$p_s > p_{crit} > p_D \quad (p_D \text{ at critical point of the pump})$$

If this condition is not met, gas-formation and cavitation will occur in the impeller: the flow will stall, causing pressure-drop, vibration and pump damage.

## The „NPSH“

The NPSH (Net Positive Suction Head) expresses the required pressure difference ( $p_s - p_D$ ) above vaporisation pressure  $p_D$  at the pump suction flange. This pressure difference being divided by the liquid specific weight  $\gamma_s$  at suction flange, gives:

$$NPSH = \frac{p_s - p_D}{\gamma_s} = \text{Liquid} - \text{Height}$$

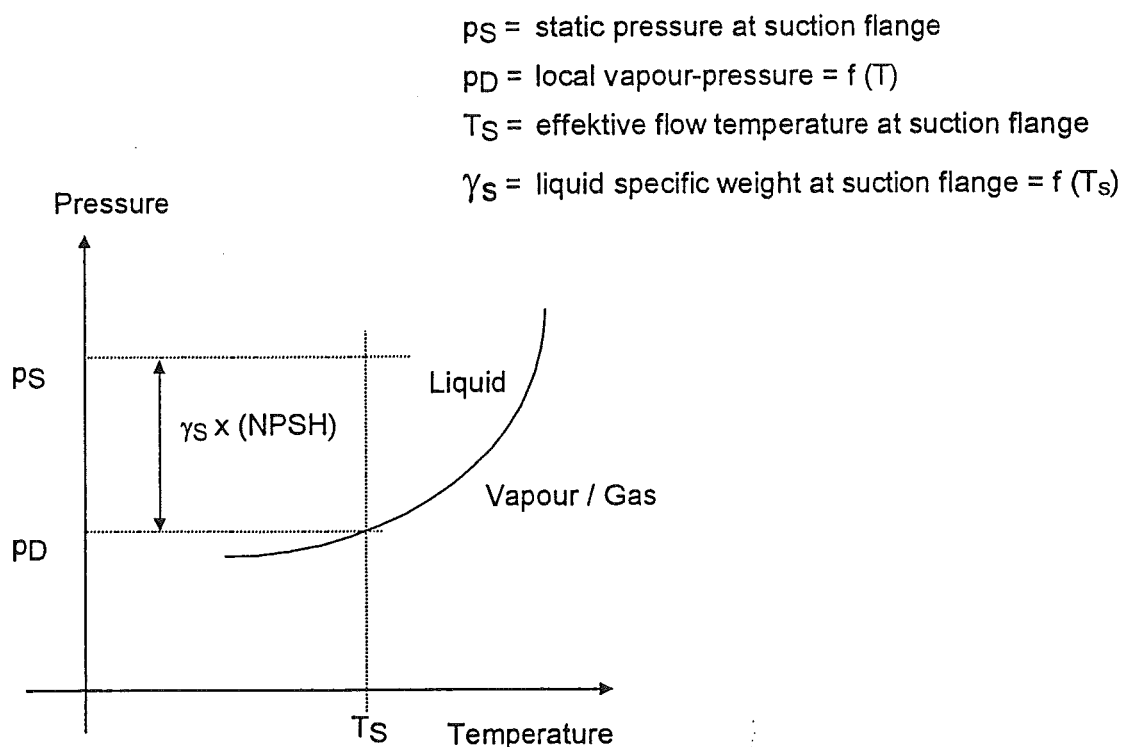
### CAUTION!



For secure start-up and running of the pump, the NPSH must be such, that  $p_{crit}$  is greater than  $p_D$  at the pump critical point!

The NPSH is always given in „metres“ at the pump suction flange

The following figure represents the NPSH in the vapour-pressure curve:



According to performance and design, the machinery manufacturer determines experimentally the required NPSH for each pump type:

$$\text{NPSH} = f(\text{flow rate, rpm})$$

## NOTE!



### To improve the NPSH:

- Increase the flow suction head.
- Increase the tank pressure (only efficient for a short time, as temperature will adapt again to the pressure level).
- Subcool the liquid (decrease vapour-pressure)
- Insulate the suction pipe and minimise pressure losses well
- Add an inducer (axial impeller) to increase the flow static pressure at the radial impeller leading-edge

## 10 Pump Operation Start-Up

### 10.1 Before start-up

#### NOTE!



- Rotate machine by hand, acting on motor fan-blade or slinger-disc, to check the shaft for free rotating.
- Check rotational sense (only on cooled-down pump) for correct electric-motor connection as following:  
Short electric motor start. The observer stands behind the motor looking in direction cold-end: the fan-blade and the pump- impeller must rotate in clockwise direction (observe also slinger-disc).

### 10.2 Operation start-up (see schematic No. E10200-1)

#### CAUTION!



**Pump should not run dry, otherwise seal will be damaged!**

#### 10.2.1 Cool-down of the pump (cold-end)

#### WARNING!



**Observe chapter 3 „ Safety “ when operating the pump.**

- Open bypass-valve **10**, fully open Suction-valve **1**.
- Valve **7** and **8** closed
- Actuate pressure build-up system (if available), in case of low suction pressure (NPSH, see § 9): open valve **11** for a short or longer time and observe pressure build-up on pressure gauge **4**.
- Observe frost formation on cold-end casing.
- Pump is sufficient cooled down for start-up, once the cold-end casing is covered with frost and is completely degassed; Check by short opening of degassing-valve **8**.
- Slightly throttle bypass-valve **10** and start-up motor! After a short delay the pump will come to operation and reach operating pressure. Control the by-pass valve **10** accordingly so that the maximum admissible performance of the electric motor according to the design-flowrate is not exceeded.

## CAUTION!



- Do never fully open the bypass valve **10**, as there is low counter-pressure downstream. Valve **10** must act as a throttle-valve!

At fully open valve **10**, the flowrate and hence the electric power largely exceed allowable values: the electrical overload protection should immediately shut-down the power supply, otherwise the pump through-flow will stall, causing dangerous cavitation and vibrations!

- Should the pump not come to operation pressure at first start-up, stop motor immediately, cool-down and degas the pump further (2-3 minutes), then start-up again.

## CAUTION!



At **excessive** cool-down (frost covering support), **do not start-up pump**, shaft could be blocked by **shrunk bearings**:

Check the shaft for free rotation, acting by hand on slinger-disc (with gloves!). If it is rotating freely, the pump can still be started, otherwise the cold-end has to be warmed up.

### 10.2.2 Operation of the pump

- Close slowly bypass valve **10** and open progressively valve **7** to consumer.
- Bypass valve **10** completely closed.
- Adjust valve **7** to meet design-pressure **9** and flowrate: a reference value is the flow measurement or the electric motor power consumption, which can be controlled with an amperemeter.

## CAUTION!



**Do not use suction valve 1 for regulation purpose! A reduction of the suction pressure could cause cavitation (bad NPSH!)**

**Fluctuations in pressure and flow ( pulsations ) as well as impacts of liquids lead to an increased and uncontrollable load on the bearings as well as to an extreme stress for the mechanical seal- and driving parts.**

### 10.2.3 Stop of the pump

- Cut off electric current to motor.
- Open bypass valve **10**, close valves **7** and **1**.
- Use valve **12** to release tank pressure.
- Close valve **10**. Release pipe pressure with valve **8**.

## 10.3 Operation disturbances

### WARNING!



Observe chapter 3 „ Safety “ when operating the pump.

Disturbance	Possible reason	Correction pump <i>not</i> operating
Pump does not perform (Pressure and Flowrate)	Wrong direction of rotation Insufficient suction pressure Gas formation Suction filter blocked	Reverse motor pole connection Raise tank pressure Cool-down/degas pump well Clean suction filter
Pressure and Flowrate too low	Gas-liquid mixture (bad NPSH) Suction filter blocked Impeller- Labyrinth-clearance excessive Impeller damaged Inducer damaged	Check suction piping (see § 8.1) Raise tank pressure Clean suction filter  Replace wear-rings Replace impeller Replace inducer
Power consumption too high	Electrical defects	Check electrical system
Pump vibration	Gas-liquid mixture / cavitation (flowrate too high or low)  Unbalance caused by damaged impeller, inducer or shaft	Check suction-piping (increase required NPSH)  Replace damaged parts or possibly re-balance. (SEFCO)
Unusual noises	Motor bearings damage Bad motor bearings lubrication  Unbalance  External tubing forces too high for the pump casing	Replace bearings Regrease or replace life greased bearings  Replace impeller or inducer or possibly re-balance (SEFCO )  Check fix points Exactly align pump and tubing (see § 8.2)
Pump leaks	Mechanical seal damaged	Check/replace mechanical seal



## Operation disturbances ( continuing )

Disturbance	Possible reason	Correction pump <i>not operating</i>
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Unusual bearing temperature	Motor bearings damage Bad motor bearings lubrication	Replace bearings Regrease or replace life greased bearings
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Disturbance	Possible reason	Correction pump <i>operating</i>
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Power consumption too high	Max. flowrate exceeded	Reduce flowrate
Pump vibration	Gas-liquid mixture / cavitation (flowrate too high or low)	Check suction-piping (increase required NPSH) Adjust flowrate
Pressure and Flowrate too low	Low rotation speed	Check rotation speed
Unusual noises	Flowrate too high or low	Adjust flowrate

## 11 Overhaul and maintenance

Repair and service must only be done by **qualified and especially trained personnel**.. Such training can be provided at SEFCO.

### 11.1 General requirements

at leakage of the mechanical seal or other disturbances:

- Dismantle the pump
- Clean all parts and degrease carefully for oxygen operation
- Check and replace all worn-out parts
- Inspection of the electric motor:
  - Check the condition of the bearings
  - Check the insulation resistance

### 11.2 Lubrication

#### CAUTION!



- Motors without regreasing device are life greased and don't need any servicing. (Recommendation: preventive bearing change approximately every 20.000 operating hours).
- Motors with regreasing device: Intervals, grease amount and grease type according to specific tagging on the motor.
- Do not grease during standstill or at rotational speeds above 3500 rpm.
- Electric motor bearing grease: Klüber Isoflex Alltime SL2

### 11.3 Repairs and Spare parts

It is most recommended to hold spare parts stored:  
Fast replacement / repairs without delay (see spare-parts list).

Indicate on spare-parts order:

- **Pump type**
- **Customer-Ref. No.**
- **Sefco Ref.-No.**
- **Part name and position** (according to spare parts list)

For larger repairs and complete overhaul, we recommend to send the machine to SEFCO. (for planning purposes and shipping formalities, please contact SEFCO first).

## 12 Pump Disassembling ( Drawing No. 2 11785 )

### DANGER!



Observe chapter 3 " Safety " when working at the pump.

- The machine is electrically dead and checked for de-energizing. All tubing is at ambient temperature and not pressurized).
- Remove suction- and pressure pipe.
- Put **Pump/Motor** unit in vertical position, with motor below.  
(for motors with frame size  $\geq 250$  dismantle first fan and fan hood)
- Remove hex. nuts **21**, washers **20** and pull off pump casing **16**.
- Remove screws **18** and wear ring **17** from pump casing only if necessary to change.  
(using take-off device)
- Remove flattened seal-cord **22**. (Casing seal)
- Remove circlip **36**, safety screw **35**, screw **34** and strain washers **33** and draw-off impeller cap **40** or inducer **41**.
- Draw-off impeller **30** with keys **32** from shaft.
- Draw-off rotating seal-ring **29** and shims **28**.
- Remove screws **39**, washers **38**, **48**, mechanical seal **37** and seal washer **15**.
- Remove screws **6** and rear-casing **7** from support **1** (observe position). Remove labyrinth outer bushing **12** only if necessary to change.
- Remove screws **9** and wear-ring **8** from rear-casing only if necessary to change.  
(using take-off device)
- Remove insulation-ring **5**, draw-off labyrinth shaft-bushing **27** and labyrinth-bushing **26** from shaft.
- Remove screws **25** and dismount slinger disc **24**.  
**If support 1 should be dismounted, mark its position to motor-shield before removal; same condition applies for motor-shield as to motor.**
- Remove hex. nuts **4**, screws **2**, washers **3**, **13**, and dismount support **1**.

## 13 Pump Assembling ( Drawing No. 2 11785 and Checklist No. 4 12823 )

### DANGER!



Observe chapter 3 „ Safety “ when working at the pump.

- Prior to assembling, all parts must be carefully degreased and checked for damages. Spare parts shall remain originally packed until they are used.
- Do not use lubricants to assemble.
- Running tolerance of shaft end: 0,04 mm
- Mount support 1 on motor-flange. (observe position)
- Mount slinger-disc 24. (align screws to flattened areas)
- Place labyrinth-bushing 26 and labyrinth shaft-bushing 27 on shaft.
- Mount wear-rings 8 in rear-casing 7 and 17 in pump casing 16 and secure with screws 9 / 18. Slightly hammer screw-thread to secure.
- Press labyrinth outer-bushing 12 in rear-casing 7.
- Place insulation-ring 5 and rear-casing 7 in support 1 and fasten with screws 6. (observe position)
- Place softened seal-washer 15 in rear-casing 7.
- Place mechanical seal 37 in lead-bushing 46 and check pretension of approx. 1 mm, then adjust mechanical seal concentrically and fix with screws 39.
- Mount lead-bushing together with mechanical seal in rear-casing 7.
- Place shims 28 and rotating seal-ring 29 on shaft. (The rotating seal-ring must move easily on shaft!).

### CAUTION!



#### Pretension of mechanical seal :

The mechanical seal 37 must be prestressed through the rotating seal-ring 29 of

**2,3 to 2,6 mm**

- **Measuring procedure:** (see checklist no. 4 12823 § C)
  1. Move rotating-ring 29 on shaft until touching the PTFE compound ring of the mechanical-seal:  
Measure distance from rotating-ring to shaft-end : measurement ①
  2. Press rotating-ring 29 against shim 28 firmly:  
Measure distance from seal-ring to shaft-end : measurement ②
  3. ② - ① = pretension
  4. Adjust required pretension through peeling of shim 28:  
This shim consists of sheet-metal layers (0,05 mm thickness), which can be peeled off each with a sharp knife.
  5. Check if pretension is correct.
- Mount impeller 30, place both keys 32, mount impeller-cap 40 or inducer 41 and tighten with screw 34 at approx. 38 Nm. Secure with screw 35 and circlip 36.
- Put self-adhesive seal-cord 22 on seal-face of pump-casing 16, end overlapped.
- Mount pump-casing 16 and tighten uniformly.

## CAUTION!



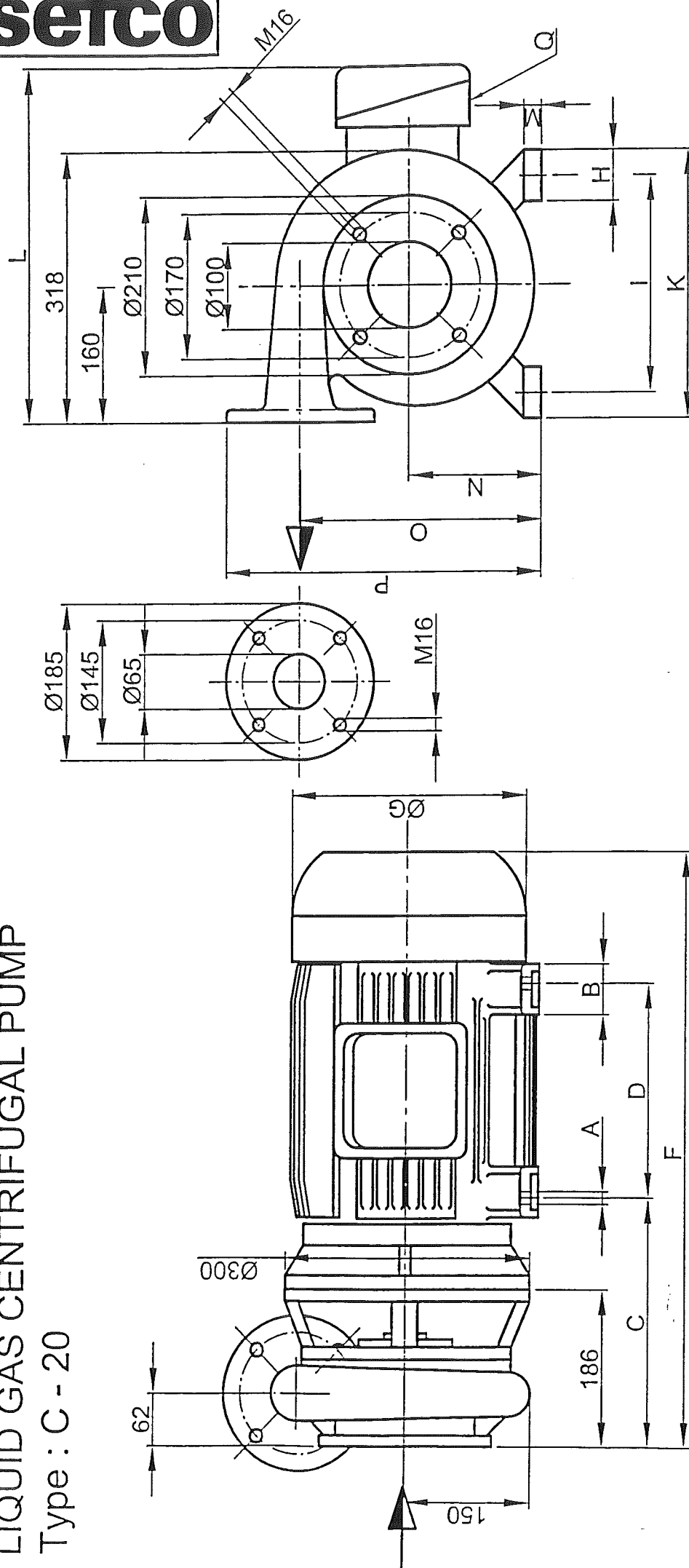
**During the whole tightening process, check shaft for free rotation.**

**Same control of free-rotating after pump installation and before motor-start**

Max. nozzle loading according to drawing 4 13942

		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Motor type	132 S	12	60	275	140	180	605	260	58	216	266	316	20	132	267		360	2 x M32x1.5
	160 M	15	75	294	210	270	701	318	70	254	320	420	22	160	295		388	2 x M32x1.5
	160 L	15	75	294	254	314	745	318	70	254	320	420	22	160	295		388	2 x M32x1.5
	180 M	15	80	307	241	300	803	341	70	279	345	450	28	180	315		408	2 x M32x1.5

## Type: C - 20



## Maximale Flanschbelastungen / Kräfte- Momente

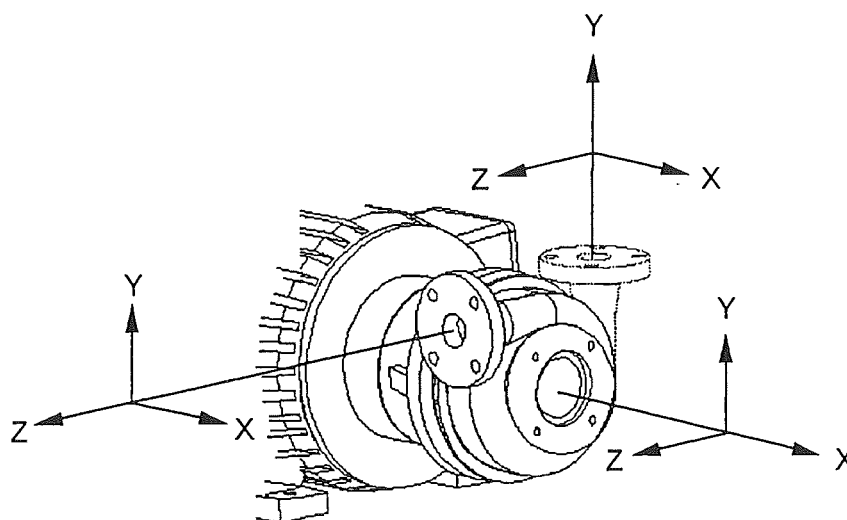
### Max. Nozzle Loadings / Forces- Moments

### Efforts max. aux brides / Forces- Moments

Pumpen-Typ :

Pump- Type : **C-20, CU-20, CL-20**

Pompe- Type :



		Saugflansch Suction nozzle Bride d'aspiration	Druckflansch vertikal Top discharge nozzle Bride de refoulement verticale	Druckflansch horiz. Side discharge nozzle Bride de refoulement horizontale
<b>Kräfte Forces [N]</b>	$F_x$	355	135	135
	$F_y$	285	110	167
	$F_z$	235	167	110
	$F_r$	510	240	240
<b>Moments [Nm]</b>	$M_x$	265	105	105
	$M_y$	135	53	53
	$M_z$	200	80	80
	$M_r$	360	143	143

r = Resultierende, Resultant, Résultante

## Connection for squirrel cage induction motors

Squirrel-cage induction motors are connected to the three-phase conductors L1, L2, L3. The rated voltage of the motor in the running connection must agree with the phase-to-phase voltage of the supply system.

### Single speed motors:

For direct on-line starting, the running connection of the motor may be the star connection or delta connection. (For star/delta starting, the running connection must be the delta connection).

Motor winding arranged for	Supply voltage V	Running connection	
		Direct on-line starting in	Y / $\Delta$ -starting
230 $\Delta$ / 400 Y	230 400	230 $\Delta$ 400 Y	230 $\Delta$ not possible
400 Y 400 $\Delta$	400	400 Y 400 $\Delta$	not possible 400 $\Delta$
500 Y 500 $\Delta$	500	500 Y 500 $\Delta$	not possible 500 $\Delta$
400 $\Delta$ / 690 Y	400 690	400 $\Delta$ 690 Y	400 $\Delta$ not possible
690 Y 690 $\Delta$	690	690 Y 690 $\Delta$	not possible 690 $\Delta$

The connection of links and lines on the terminal board are dependant of the rated voltage and winding phase; e.g. for a squirrel cage induction motor with winding phase for 230 V  $\Delta$  / 400 V Y with one speed the following connections must be done:

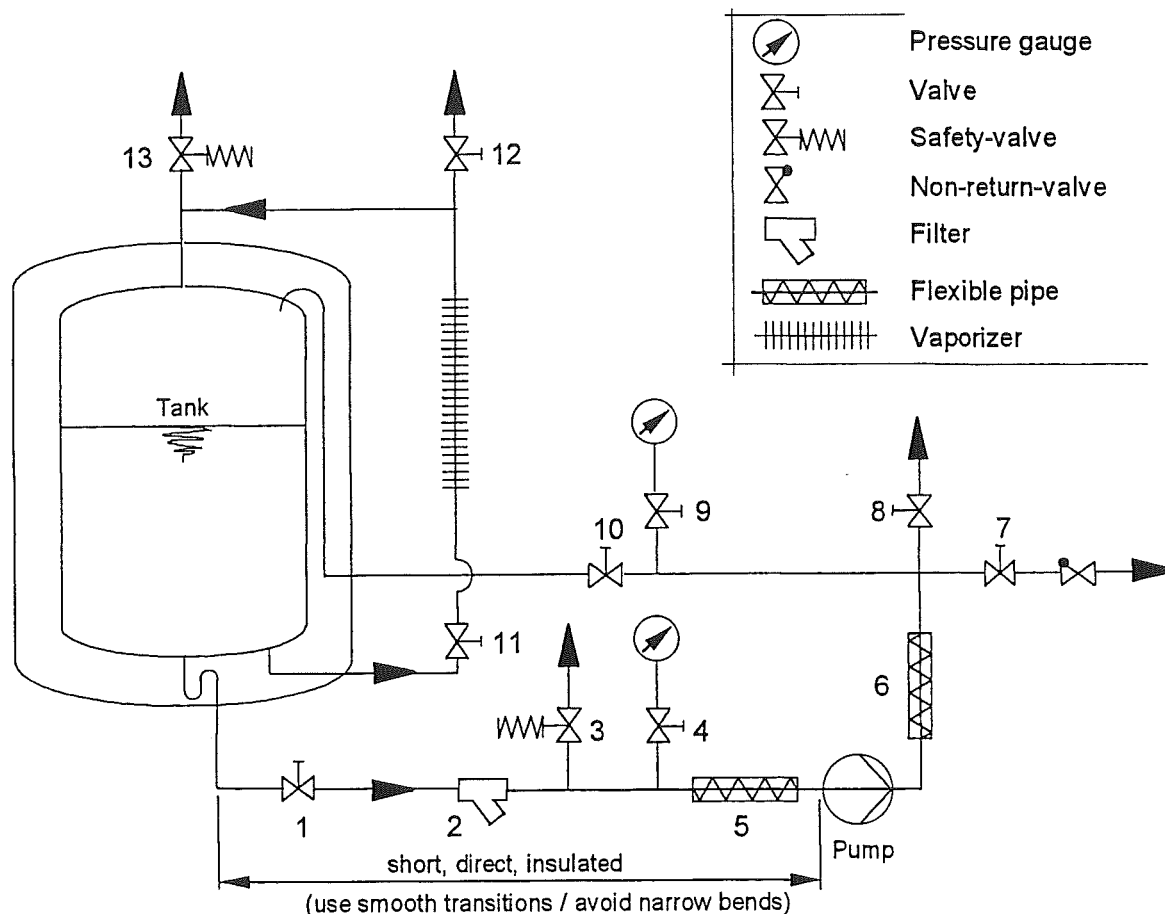
	Running connection		
	Direct-on-line starting in		Y $\Delta$ - starting
	230 V	400 V	230 V
Connection of the winding phases			The ends of the 3 windings are connected to the Y- $\Delta$ starter
Connection of links and lines			

Instead of star-delta-starter preferably an electric soft-starter can be used.

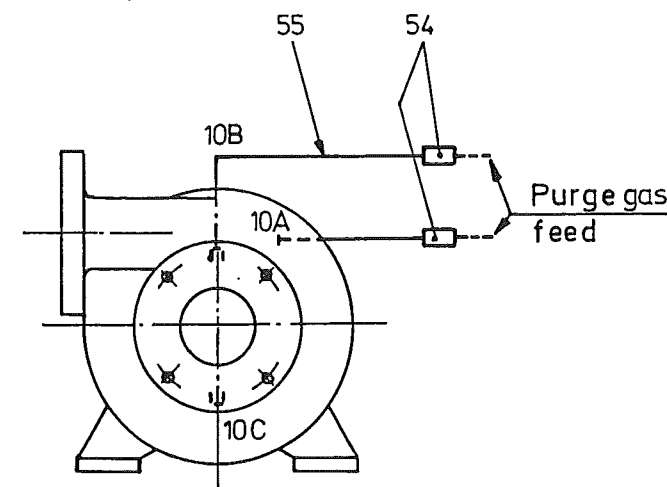
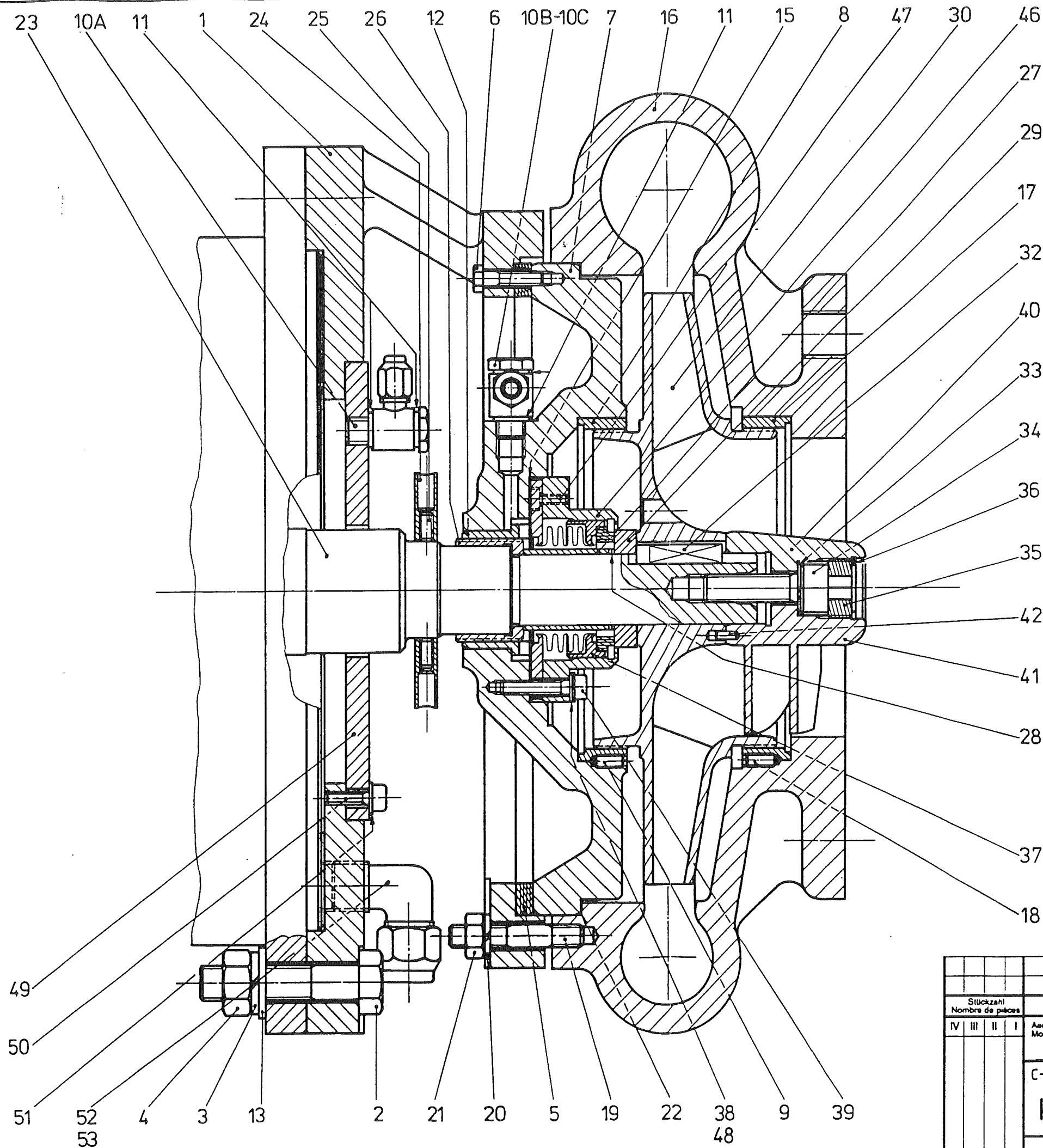


## Installation schematic for centrifugal pump

The present schematic illustrates a typical system-installation for liquid-gas centrifugal pump operation, and can be extended according to needs. Accessories should at this stage be reduced to a minimum.



Pos.	Designation	Required	Recommended
1	Suction-Valve	X	
2	Filter	X	
3	Safety-Valve (Suction line)	X	
4	Pressure gauge (Suction line)		X
5	Flexible Pipe (Suction line)	X	
6	Flexible Pipe (Discharge line)	X	
7	Pressure- and Non-return-valve (to consumer)	X	
8	Degassing-Valve (Discharge line)	X	
9	Pressure gauge (Discharge line)		X
10	Bypass-Valve	X	
11	Pressure build-up System (Tank)		X
12	Degassing-Valve (Tank)	X	
13	Safety-Valve (Tank)	X	



Stückzahl Nombre de pièces	Gegenstand Spécification	Pos. Rep.	Werkstoff Matériau	Modell Modèle	Bemerkungen Observations
IV III II I	Änderungen: 1) 14.01.91 Modifications: 2) 21.08.91				Ersetzt durch: Remplacé par: Ersatz für: Remplace:
	C-20			Maßstab Echelle	Gestechnet Dessiné
	Kaltes Ende			1:1	Geprüft Contrôlé
	SEFCO AG				Gesehen Vu
					19.6.90
					2 11785

C-20, Drawing: 2 11785

Cold End

1	1			Support	
2	4			Hex. cap screw M12 x 55	
3	4			Split lock washer M12	
4	4			Hex. nut M12	
5	1			Insulation ring	
6	2			Hex. cap screw M5 x 20	
7	1			Rear casing	
8	1	1	1	Wear ring	
9	2			Socket set screw M5 x 10	
10	3			Fitting	
11	6			Seal washer Ø 13,5 x 10 x1,5	
12	1		1	Labyrinth outer-bushing	
13	4			Washer M12	
14	-				
15	1	1	3	Seal washer Ø 75 x 48 x 0,2	
16	1			Pump casing	
17	1	1	1	Wear ring	
18	2			Socket set screw M5 x 10	
19	8			Stud M8 x 35	
20	8			Split lock washer M8	
21	8			Hex. nut M8	
22	1m	5m	10m	Seal cord 3 x 1,5 x ca 1000	
23	1			Motor shaft end	
24	1			Slinger disc	
25	2			Socket set screw M5 x 10	
26	1		1	Labyrinth bushing	
27	1		1	Shaft bushing	
28	2	1	1	Shim Ø 30 x 24 x 1	
29	1	1	2	Rotating ring	
30	1			Impeller	
31	-				
32	2			Key C8 x 6 x 30	
Nomenclature					Material
Recommended Spare Parts					Rev: Date:
Required Spare Parts					0 5.10.00
Parts per Unit					
Item-No					

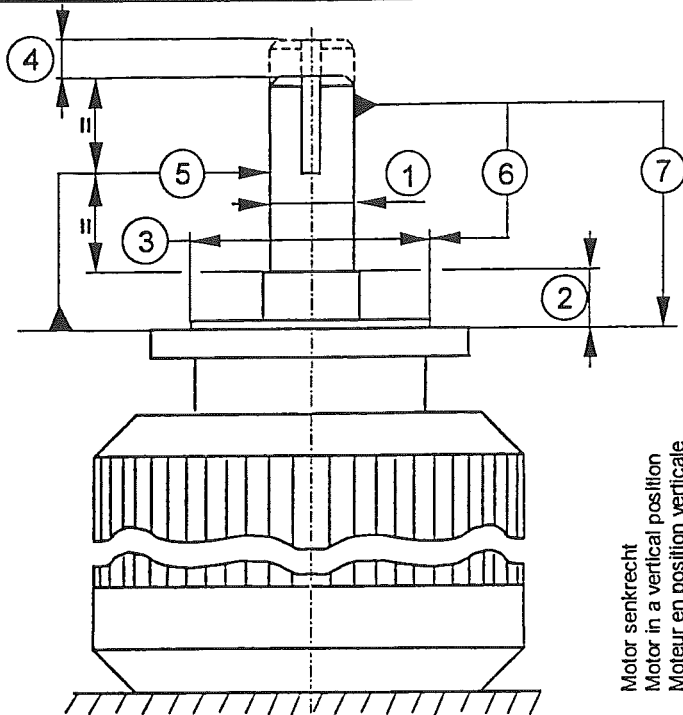
C-20, Drawing: 2 11785

Cold End

33	2			Strain washer M10	
34	1			Socket head cap screw M10 x 35	
35	1			Safety screw M20 x 1	
36	1			Circlip Ø 20 x 1	
37	1	1	1	Mechanical seal	
38	8			Strain washer M5	
39	8			Socket head cap screw M5 x 25	
40	1			Impeller cap ( Inducer Pos.41 as alternative )	
41	1			Inducer ( Impeller cap Pos.40 as alternative )	
42	2			Spring tension pin Ø 3 x 8	
43	-				
44	-				
45	-				
46	1	1	1	Lead bushing	
47	4			Socket head cap screw M4 x 10	
48	8			Washer M5	
49	1			Rear casing	
50	4			Socket head cap screw M5 x 16	
51	4			Strain washer M5	
52	1			Fitting	
53	1			Stopper	
54	3			Fitting	
			3	PTFE compound ring for mechanical seal	
Nomenclature					Material
Recommended Spare Parts					Rev: 0
Required Spare Parts					Date: 5.10.00
Parts per Unit					
Item-No.					

Motor Nr. / Moteur no.	Pumpe Nr. / Pump no. / Pompe no.	Ref. / Réf.
------------------------	----------------------------------	-------------

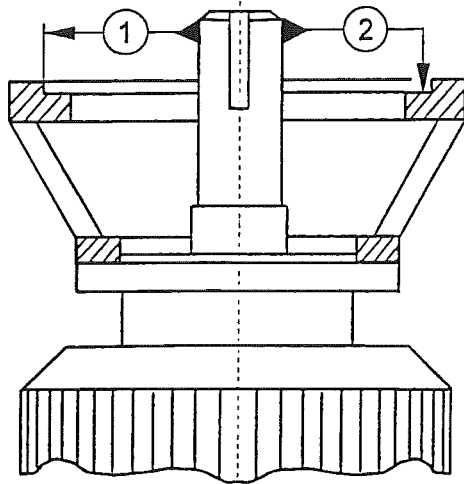
### A Motor / Moteur



Motor senkrecht  
Motor in a vertical position  
Moteur en position verticale

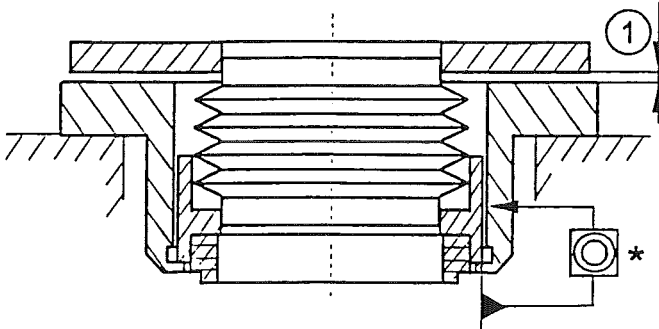
	min.	max.	gemessen measured mesuré
1	23,993	24,007	
2	68,9	69	
3	229,987	230,016	
4	-	-	
5	-	0,04	
6	-	0,05	
7	-	0,05	

### B Support - Welle / Support - Shaft / Support - Arbre



	min.	max.	gemessen measured mesuré
1	-	0,07	
2	-	0,07	

### C Gleitringdichtung - Führungsbüchse / Mechanical seal - Lead bushing / Joint mécanique - Manchon de guidage



	min.	max.	gemessen measured mesuré
1	0,8	1,5	

Bestmögliche Konzentrität einhalten  
\* Observe best possible concentricity  
Respecter la meilleure concentricité possible

REV	0	Date	13.02.02	Drawn	MR	Checked	Ge
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# ANNEX

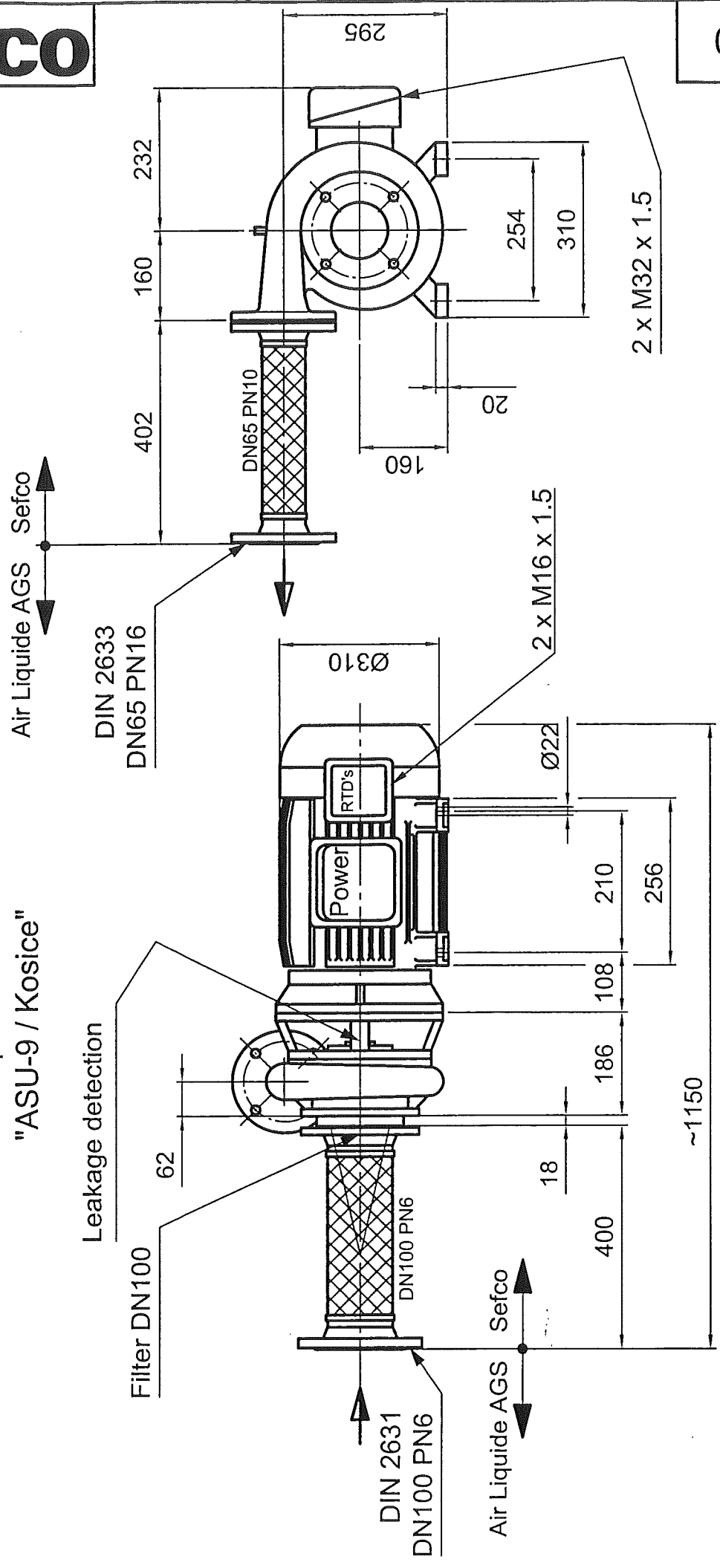
0	27.07.2004	G.L.	Gezeichnet Dessiné	Geprüft Contrôlé
1	30.07.2004	G.L.		

2	26.08.2004	NS	Gezeichnet Dessiné	Geprüft Contrôlé
---	------------	----	-----------------------	---------------------

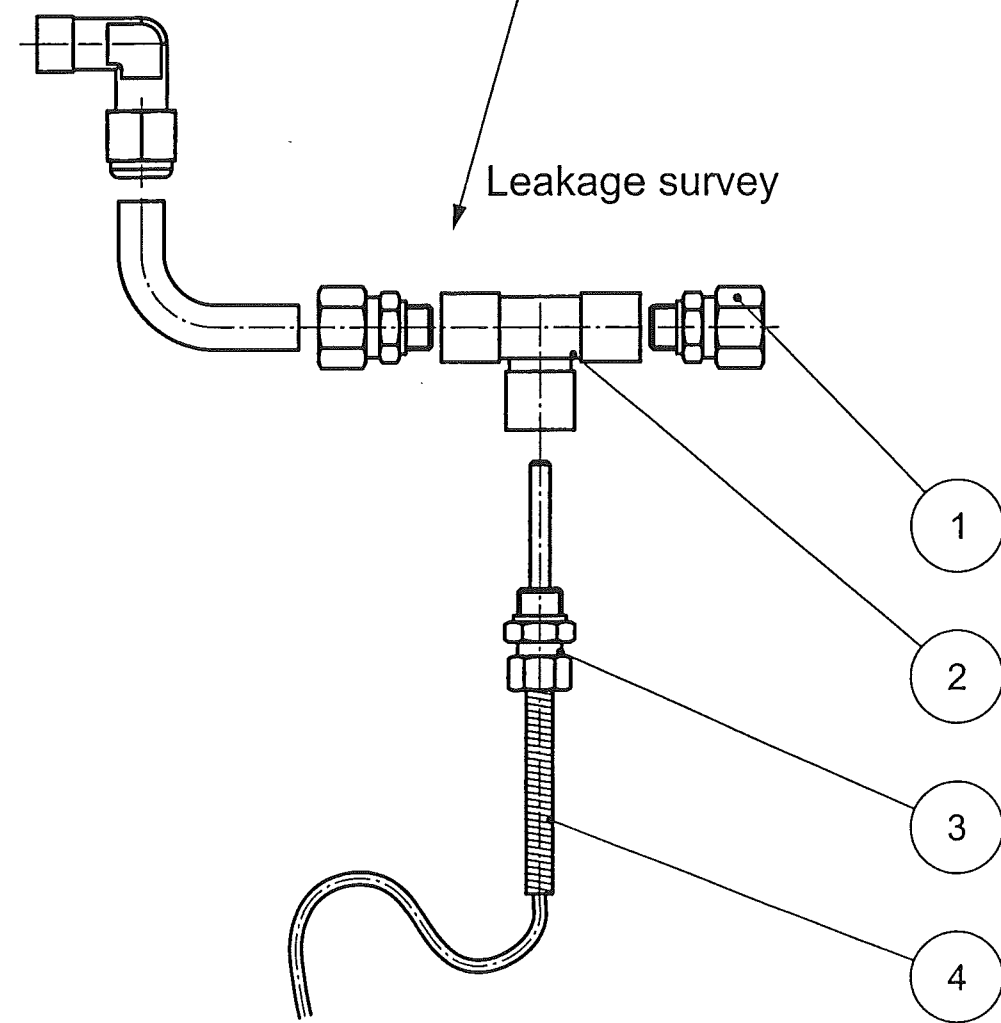
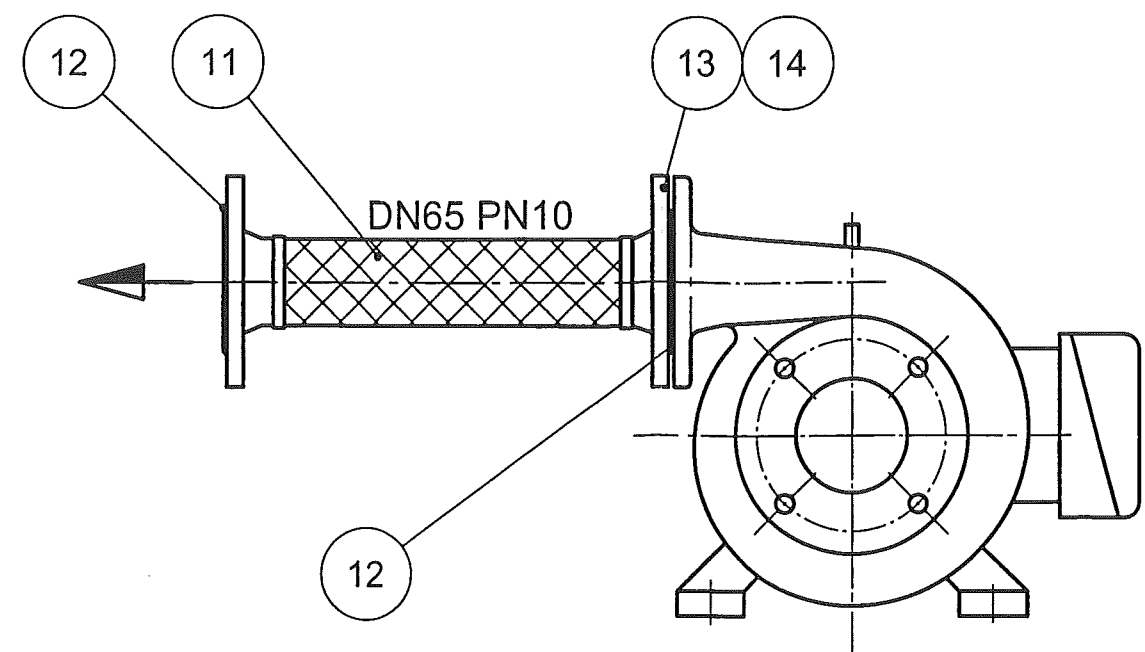
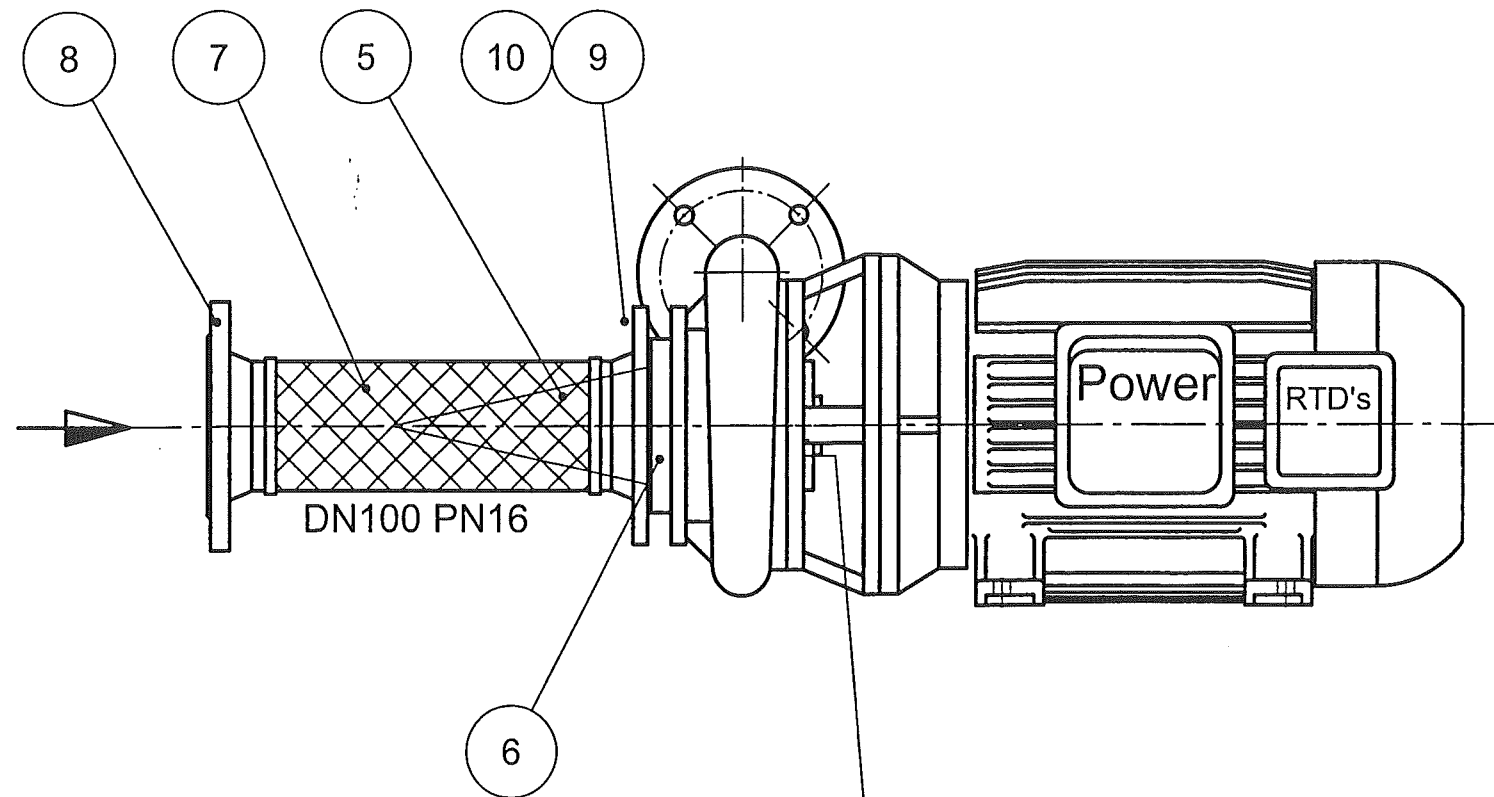
**sefco**

Pump Type : C - 20 / EM - 15  
Motor Type : 160M - 15 kW  
Weight approx. 160 Kg



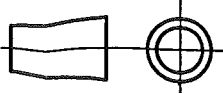
# Arrangement Drawing : LOX - LIN Truck Filling Pump P62100 (LOX) - P72100 (LIN) Air Liquide AGS "ASU-9 / Kosice"



04.271



LOX - LIN Truck Filling Pump  
P62100 (LOX) - P72100 (LIN)  
Air Liquide AGS  
"ASU-9 / Kosice"

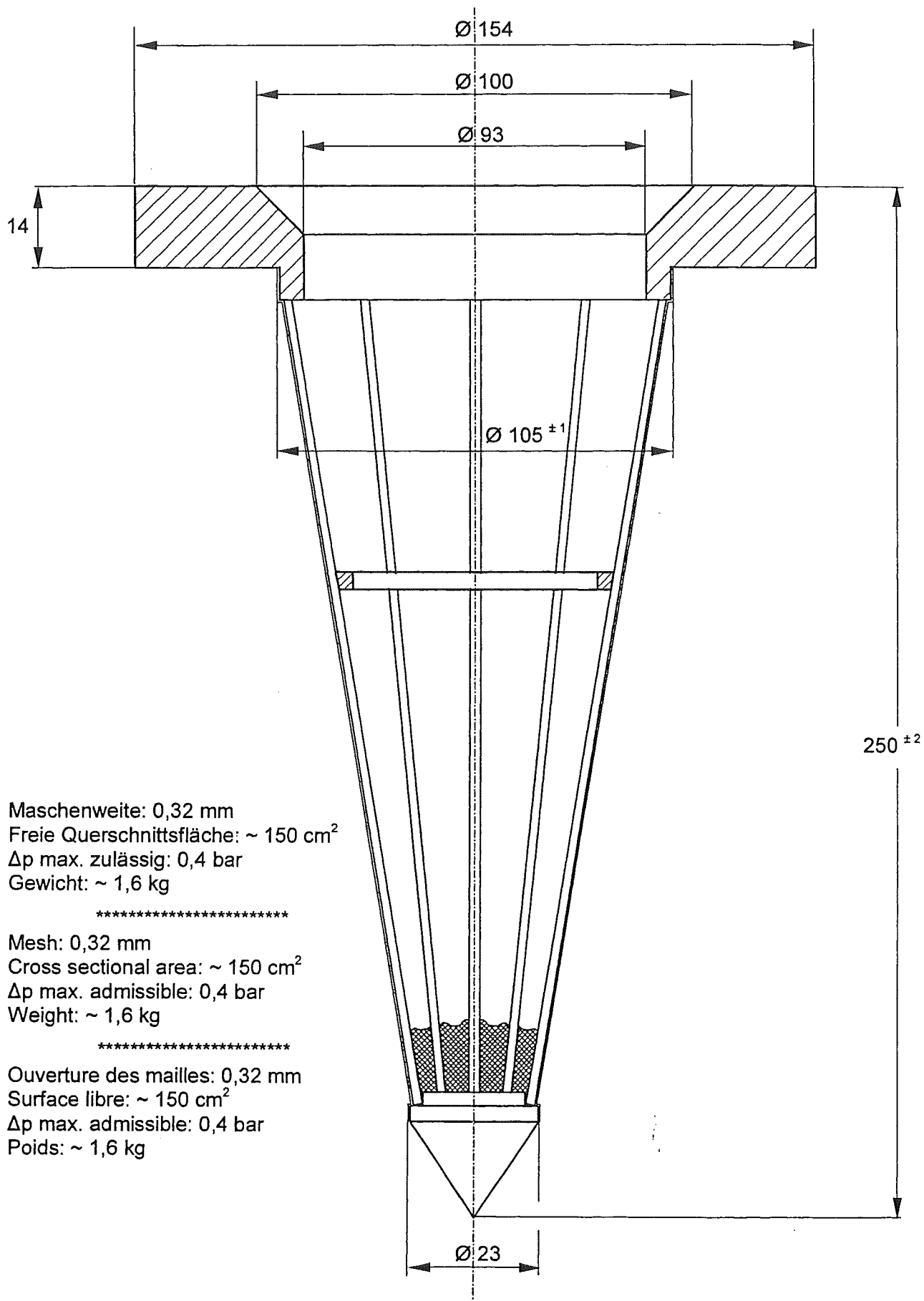
Stück Nbre	Gegenstand Spécification								Pos. Rep.	Werkstoff Matière			Modell Modèle	Bemerkungen Observations	
Masse ohne Toleranzangabe															
	0 bis 6	über 6 bis 30	über 30 bis 100	über 100 bis 300	über 300 bis 1000	über 1000 bis 3000	über 3000 bis 4000	über 4000 .	Aenderungen						Ersetzt durch :
Fein	± 0.05	± 0.1	± 0.15	± 0.2	± 0.3	± 0.5								Remplacé par :	
Mittel	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2	± 3						Ersatz für :	
C - 20 / EM - 15										Massstab Echelle		Gezeichnet Dessiné		N.S.	26.11.2004
Accessories												Geprüft Contrôlé			
												Normgeprüft Conforme aux normes			
												Gesehen Vu			
												04.271/14			



Drawing: 04.271/14

Accessories P62100 - P72100

1	2	Male adaptor union Ø 6 - 1/4"	
2	1	T female Ø 1/4"	
3	1	Temperature probe union Ø 6 - 1/4"	
4	1	Dual RTD's	
5	1	Suction strainer DN100	
6	2	Gasket Ø 152 x 115 x 2	
7	1	Flexible suction hose DN100 PN6	
8	1	Gasket Ø 152 x 115 x 2	
9	4	Washer M16	
10	4	Hexagon cap screw M16 x 55	
11	1	Flexible discharge hose DN65 PN10	
12	2	Gasket Ø 127 x 77 x 2	
13	4	Washer M16	
14	4	Hexagon cap screw M16 x 45	
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
		Nomenclature	Material
		Parts per Unit	Rev: Date
Item-No.		0	2.12.2004



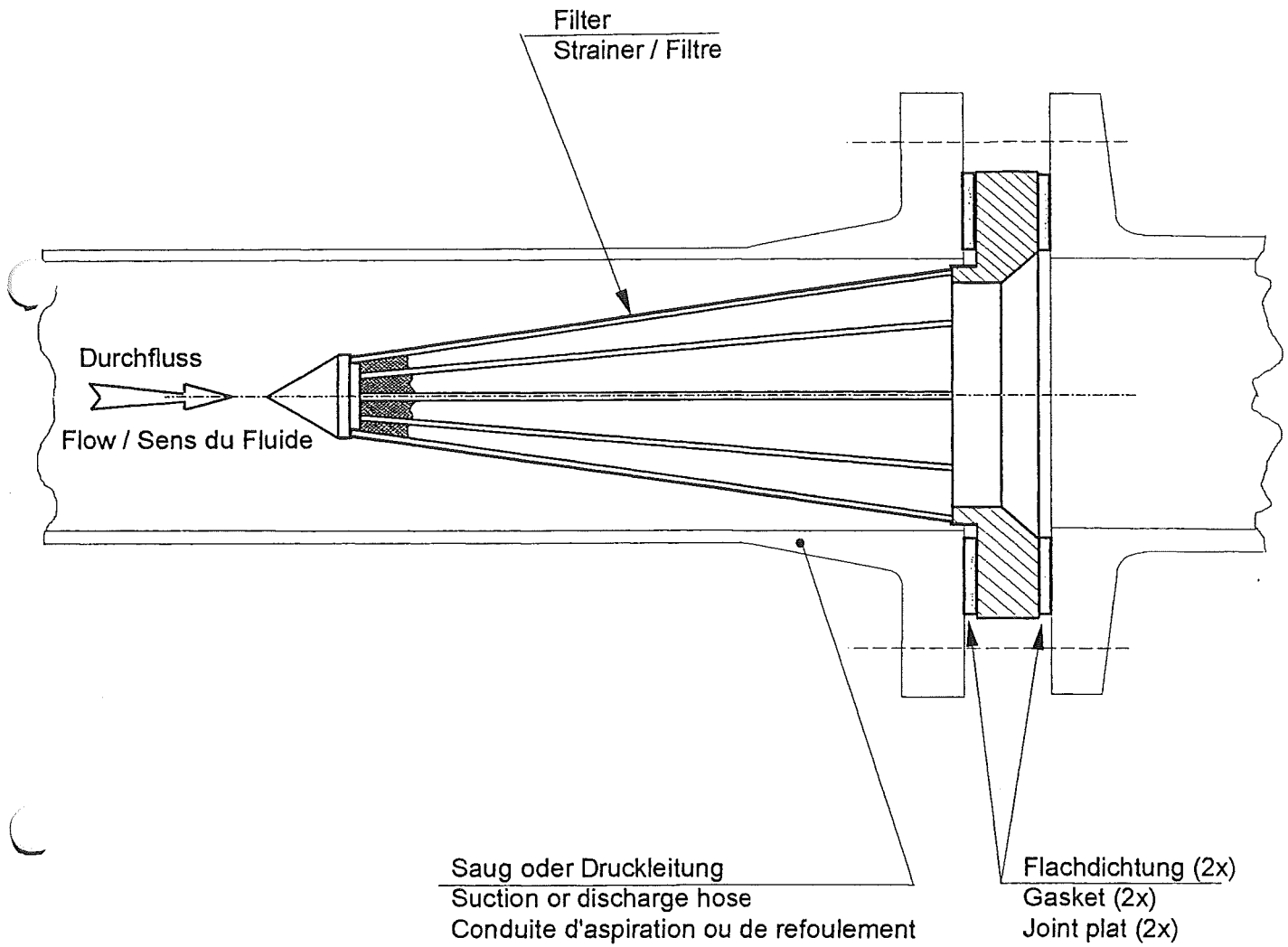
Maschenweite: 0,32 mm  
 Freie Querschnittsfläche: ~ 150 cm<sup>2</sup>  
 Δp max. zulässig: 0,4 bar  
 Gewicht: ~ 1,6 kg

\*\*\*\*\*

Mesh: 0,32 mm  
 Cross sectional area: ~ 150 cm<sup>2</sup>  
 Δp max. admissible: 0,4 bar  
 Weight: ~ 1,6 kg

\*\*\*\*\*

Ouverture des mailles: 0,32 mm  
 Surface libre: ~ 150 cm<sup>2</sup>  
 Δp max. admissible: 0,4 bar  
 Poids: ~ 1,6 kg



## Temperaturüberwachung an der Pumpe Temperature control at the pump Protection thermique de la pompe

Die Pumpe *kann* mit folgenden Fühlern ausgerüstet sein :  
The pump *can* be equipped with the following sensors :  
La pompe *peut* être équipée des sondes suivantes :

Funktion	Fühler Typ	Wellendichtung Typ	Empfohlene Schaltpunkte
Function	Sensor type	Shaft seal type	Recommended set point
Fonction	Type de sonde	Etanchéité type	Réglage recommandé

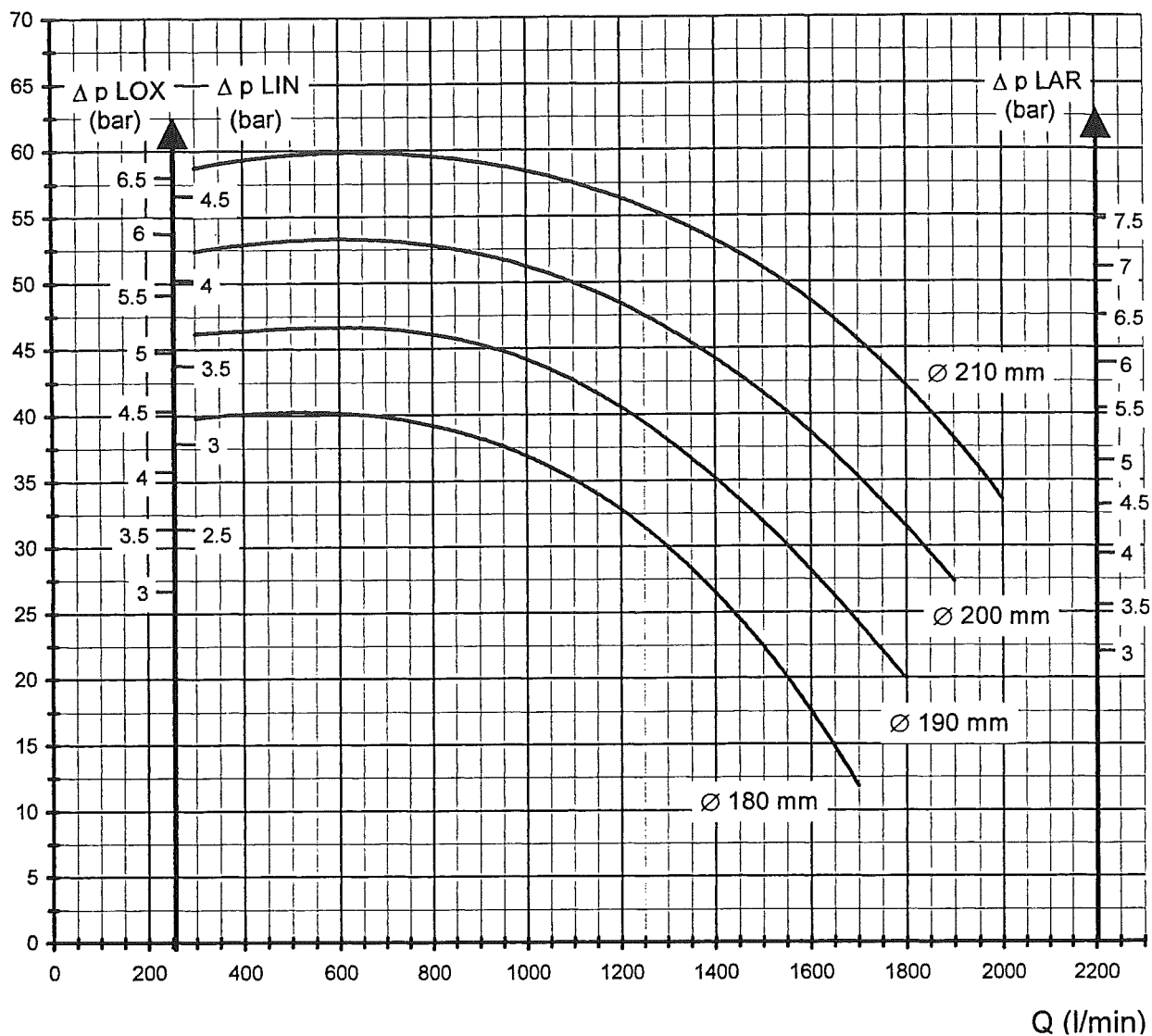
Kaltfahrüberwachung	PT100		-140°C
Cool down survey	RTD		
Contrôle de mise à froid	PT100		

Leckage an der Dichtung	PT100	GRD oder Labyrinth	Alarm, alarme : -130° C Abschalten, shutdown, arrêt : -150° C
Seal leakage detection	RTD	Mechanical or labyrinth	
Détection de fuite à l'étanchéité	PT100	Mécanique ou à labyrinthes	

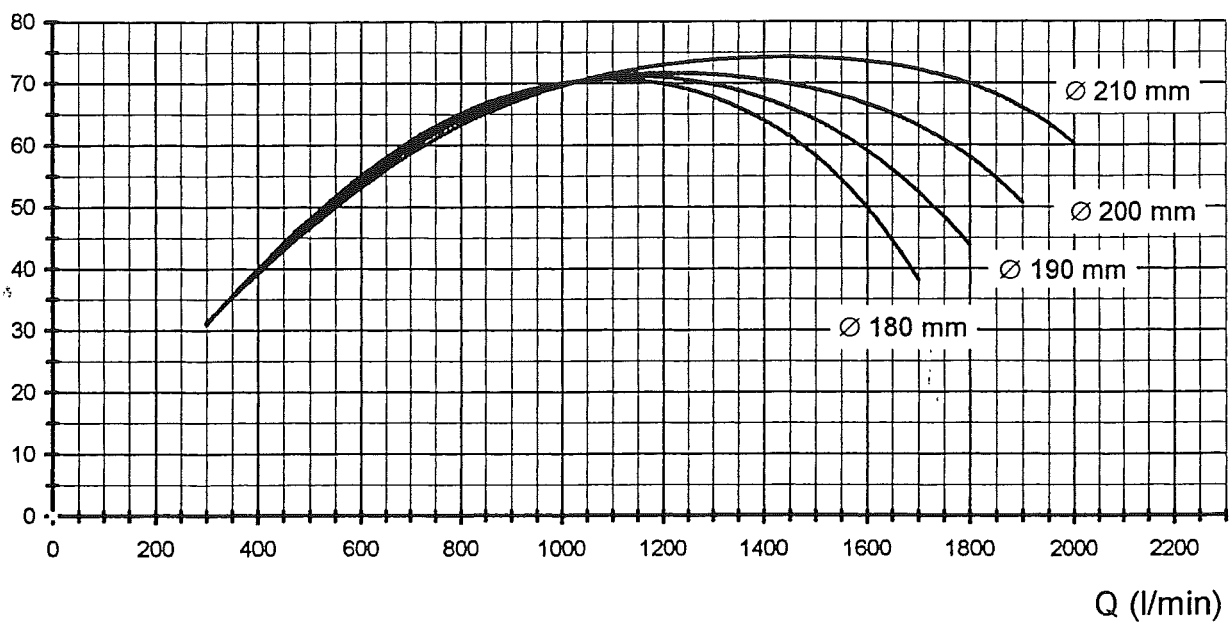
Leckage an der Dichtung	PT100	GRS (abhebende Dichtung)	Alarm, alarme : -160° C Abschalten, shutdown, arrêt : -180° C
Seal leakage detection	RTD	GRS (gas riding seal)	
Détection de fuite à l'étanchéité	PT100	GRS (à film gazeux)	

$n = 2950 \text{ rpm} ; b = 11 \text{ mm}$

$\Delta H \text{ (m)}$

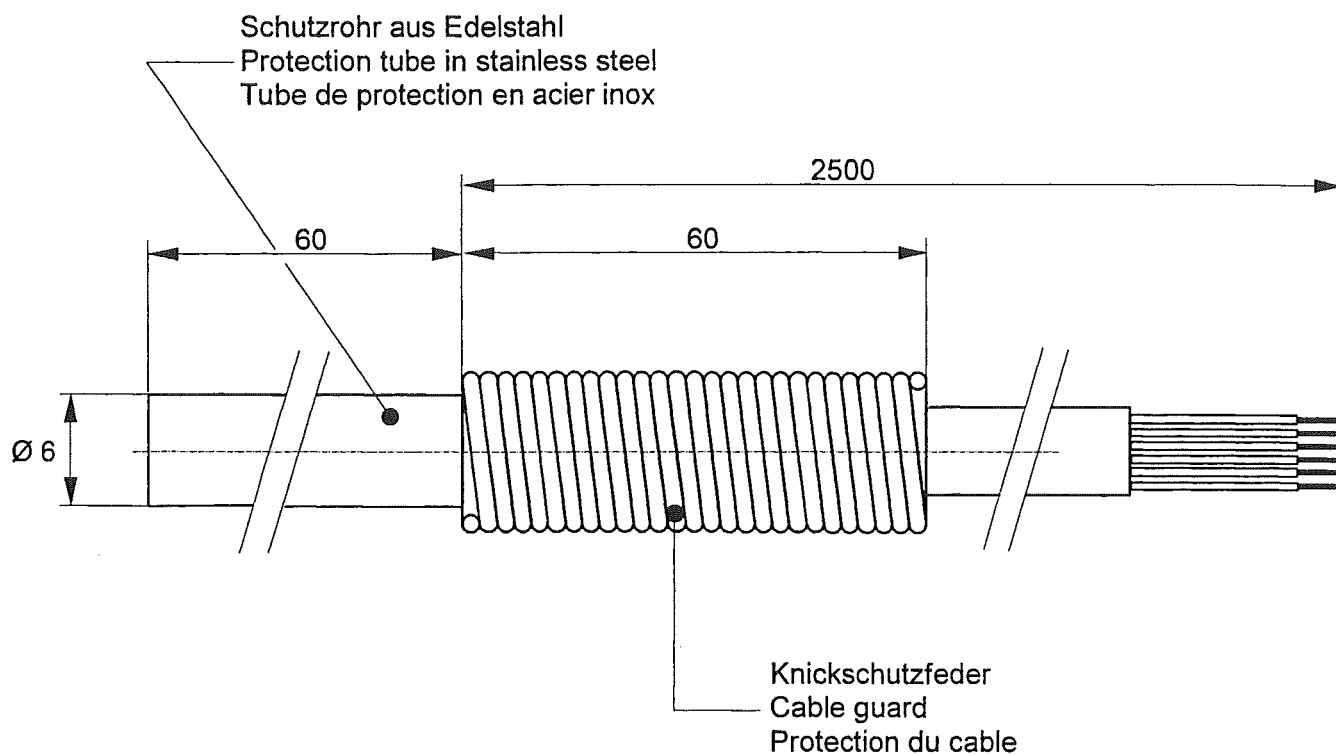


$\eta \text{ (%)}$



Geprüft	Controlle
Gezeichnet	Dessiné

Geprüft	Controlle
Gezeichnet	Dessiné
NS	
08.04.2004	



## Typ - Type

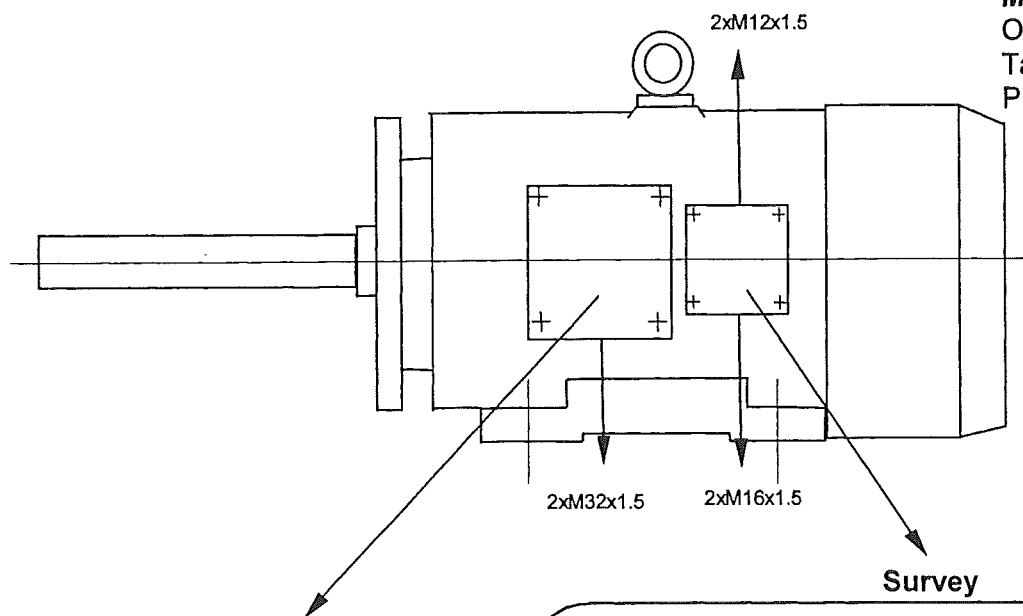
- Widerstandsfühler 2x PT100, 2x 3 Leiter Klasse B
- Temperature sensor 2x PT100 (dual RTD's), 2x 3 wires class B
- Sonde de température 2x PT100, 2x 3 conducteurs classe B

Temperatur :

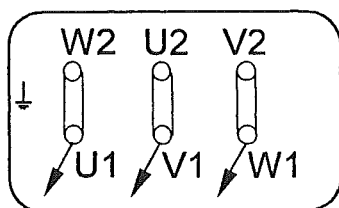
Temperature:  $\pm 200^{\circ}\text{C}$

Température:

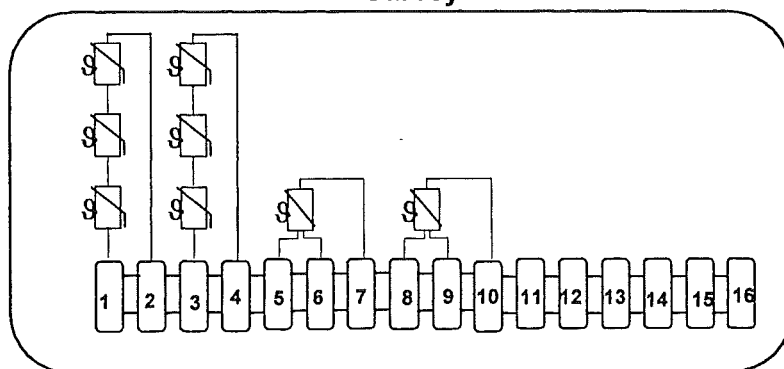
**Messer AGS GmbH**  
 Order No.: Z11/4500023387  
 Tag No.: P62100 - P72100  
 Project Name: „ASU Kosice“



**Motor 160 M**



**Δ-Connection 400V / 50Hz / 29A / 15KW**



### Wiring-Table

1-2	PTC warning	winding	ISO F ISO F
3-4	PTC disconnection	winding	ISO F ISO F
5-6-7	Temperature Detector RTD	Seal leakage detection	} dual RTD's
8-9-10	Temperature Detector RTD	Seal leakage detection	
11-12-13	Reserve		
14-15-16	Reserve		

<b>!</b> RTD :	Measuring current: 1 mA
<b>!</b> PTC thermistor sensors:	Do not apply more than 2.5V!

0	27.08.2004	MR	
REV	DATE	DWG	CHECKED

## Temperaturüberwachung E-Motor Motor temperature control Protection thermique du moteur

Der Motor *kann* mit folgenden Fühlern ausgerüstet sein :  
The motor *can* be equipped with the following sensors :  
Le moteur *peut* être équipé des sondes suivantes :

Messstelle	Fühler Typ	Schaltpunkt Werte können von Hersteller zu Hersteller leicht ändern	Empfohlene Schaltpunkte Alarm Zwischenwerte können nach belieben gesetzt werden
Control point	Sensor type	Trip point Values can change slightly by different manufacturers	Recommended set point Alarm points can be set in between upon need
Point de contrôle	Type de sonde	Température de commutation Ces valeurs peuvent différer légèrement suivant le fabricant du moteur	Réglage recommandé Les points d'alarme peuvent être placés au choix entre ces extrêmes

Lager AS	PT100		-40°C .. +120°C
Bearing DE	RTD		
Palier entraînement	PT100		

Lager BS	PTC	max. +120°C	
Bearing NDE	Thermistor		
Palier ventilateur	Thermistor		

Lager BS	PT100		-40°C .. +120°C
Bearing NDE	RTD		
Palier ventilateur	PT100		

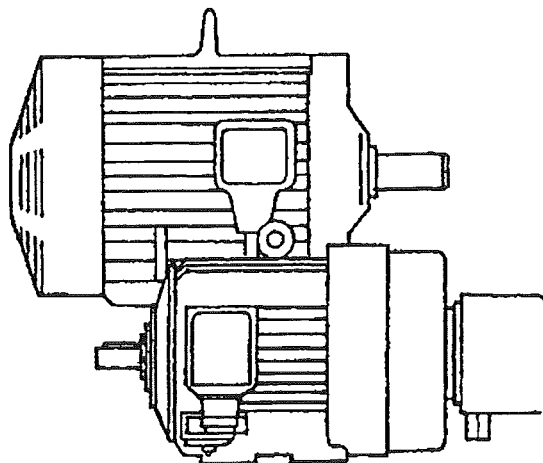
Wicklung	PTC	Isolationsklasse F Alarm : +130°C Abschaltung : +150°C	
Winding	Thermistor	Insulation class F Alarm : +130°C Trip : +150°C	
Bobinage	Thermistor	Isolation svt. F Alarme : +130°C Arrêt : +150°C	



---

# Threephase Induction Motors Type DDA/DDG

## Mounting & Maintenance



**halter**

---

[www.halter-motoren.de](http://www.halter-motoren.de)  
e-mail: [info@halter-motoren.de](mailto:info@halter-motoren.de)

# THREEPHASE INDUCTION MOTORS TYPE DDA/DDG

## - MOUNTING & MAINTENANCE -

### TABLE OF CONTENTS

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3	Mounting	2
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## **1. GENERAL INFORMATION**

This manual concerns normal three phase induction motors with an output varying from small to middle size; they are externally cooled, totally enclosed, supplied in a cast iron frame and provided with ball bearings or roller bearings lubricated with grease.

## **2. DELIVERY**

After receipt, remove the package material if any and mind the parts that have been delivered loose. In the case of unpacked motors, the glands are often put in the terminal box to protect them against damage.

Check the motor to see whether transport damage has occurred. You should be able to rotate the shaft easily and smoothly with the hand.

Compare the details on the rating plate with those of the power network and with the requirements of the motor.

## **3. MOUNTING**

The motor must be fixed on a stable, clean and flat foundation with good fitting foundation bolts, using washers.

Never mount a motor manufactured for a horizontal mounting on a surface with an angle of inclination of more than 15 degrees without consulting the supplier in advance.

Foot & flange motors always have to be mounted in such a way that the drain holes, if any, are situated at the bottom, otherwise you run the risk that moisture has condensed into the motor and cannot be drained off. To this end you need to remove the drain plugs.

Under no circumstance must the free flow of air be obstructed to the cooling fan or the motor will overheat.

This has also to be borne in mind when you are mounting motors in enclosed spaces of small size.

The ambient temperature must not exceed 40 degrees centigrade, unless otherwise agreed upon at the time of ordering.

## **4. COUPLING**

### **4.1 Direct coupling**

The motor and driven shafts must be accurately aligned. In case of a flexible coupling, the manufacturers distance between the parts to be coupled must be adhered to, also the degree of misalignment must be within the makers tolerance. We do not recommend using solid couplings.

## **4.2 Indirect coupling**

### **4.2.1. Flat or V Belts**

Mount the motor on slide rails in order to adjust belt tension.

The belt pulley has to be fitted hard up the shoulder of the shaft. The pulley center line should be within the shaft center line. Use correctly sized belts with a correct profile and in sufficient numbers to drive without slip and undue tension. Align both pulleys accurately in such a way that the center of both pulleys are in line.

Multi V belt drives need to be matched sets.

A belt pulley, which is either too small or too wide, or too high, a tension on the belt may damage the bearing or cause a shaft break.

In case of doubt, consult the supplier.

### **4.2.2. Spur Gear Drives**

The motor and the driven machine have to be positioned in such a way that the two gears mesh correctly. The motor should then be fixed with dowels.

## **4.3. Shaft couplings and pulleys etc.**

Remove the corrosion protection from the shaft extension and the coupling elements. The coupling parts, belt pulleys and gear wheels need to be dynamically balanced and fit easily on the shaft and to be provided with good fitting keyway.

In the factory the rotor has already been dynamically balanced including a half key in the shaft.

The dimension and the tolerances of the shaft extension and the key are indicated on the motor dimension sheet.

Assembling the coupling elements has to be done with great care. Careless handling may damage the bearings, shaft or end shields.

Do not file or emery the shaft to achieve a fit!

When fitting pulleys couplings or bearings, we recommend using heat to elements; therefore the part to be mounted has to be heated till  $\pm 80$  degrees above the ambient temperature.

A large washer and set screw can be useful for pushing on pulleys using the tapped hole in the shaft. Only use proper tools for removing the above mentioned parts e.g. pulley drawers.

## **5. ELECTRICAL CONNECTION**

### **5.1. General information**

On delivery the motor will rotate clockwise looking at the drive when the phases L1, L2 and L3 are connected respectively to the connection terminals U1, U2 and U3.

Exchanging any two-phase lines can change the direction of rotation.

When a motor is only suited for one direction of rotation, it is indicated with an arrow on the motor fan cowl.

Connecting cables must conform to IEE regulations, as must earthing requirements.

Line fuses only protect the cables in case of short-circuiting and do not constitute a safeguard against the overheating of the winding caused by overload. Therefore it is recommended that a motor starter and overload is fitted, giving single phasing and overload protection.

### **5.2. Circuit**

Normally our motors are provided with a terminal box with six connections, to which six leads from the winding are connected either in a delta connection or in a star connection by means of connection links.

Usually two voltages are indicated on the rating-plate of these motors, which means that the motor can be connected to a circuit having one of these voltages.

If the mains voltage is corresponding with the lowest indicated voltage, the winding has to be connected in delta connection (see figure 1); if it is corresponding with the highest indicated voltage, the winding has to be connected in star connection (see figure 2).

A motor with e.g. 230/400 V on its rating-plate is suited to be switched on directly, on a circuit with a voltage of 230 V between phases with the winding connected in a delta connection, or on a circuit with a voltage of 400 V with the winding connected in a star connection.

But if the motor is switched on with a star-delta starter the motor is only suited for a mains voltage on the rating-plate, this is the delta voltage. In this case, the connection strips on the terminal box have to be removed when the motor is connected; the star and delta connection will be made successively in the starter during the run up.

If only one voltage is indicated on the rating-plate together with the delta sign, the motor can be switched on directly at the indicated voltage or with a star/delta starter.

Pole change motors (for two or more speeds) are connected according to a diagram sent together with the motor.

## **6. PUTTING INTO SERVICE**

Before putting a motor into service, one should check especially when the motor has not been used for a long time that the insulation resistance of the winding is sufficient. The insulation resistance has to be at least 10 meg/ohms on a 1000V megger.

If the insulation resistance is not high enough, the motor has to be dried out and revarnished or rewound.

Check all connections and adjust the thermal protection units to the correct current. Switch the motor on in a no load state to determine the direction of rotation. Load the motor gradually and check whether it runs without vibration.

The motor can be used under deviation of the main voltage  $\pm 5\%$  or frequency of max.  $\pm 2\%$  compared to the nominal frequency or nominal voltage, in compliance with the international regulations for electric machines.

## **7. MAINTENANCE**

The totally enclosed and fan cooled three phase squirrel cage induction motors require very little maintenance.

Nevertheless it is recommended to check the motor regularly in order to prevent a breakdown caused by dust, moisture, vibrations, too much or too little greasing.

### **7.1. Dust**

The outer parts of the totally enclosed motors, especially the cooling ribs or cooling channels, have to be kept as clean as possible in order not to obstruct the cooling air from the fan extracting the heat from the motor frame.

### **7.2. Moisture**

Motors, which are not often run, should be started from time to time to prevent moisture affecting the windings in the long term.

### **7.3. Wear & vibration**

To prevent abnormal wear & vibration, one should:

- a. take care that the tension of the belt or the chain is not too high;
- b. check whether the mounting of directly coupled machines is correct;
- c. Check whether the foundation bolts the bolts to fasten the motor and the slide rails are tight.

#### **7.4. Greasing**

Before they leave the factory, the bearings of the HALTER Motors are filled with a high quality Lithium base grease.

The sizes 56 up to and including 250 are provided with shielded/sealed bearings ( ZZ-C3), witch have been filled with life-time grease by the manufacture of the bearings.

Motors with sealed bearings and no re-lubrication system require no maintenance other than checking for noise & temperature during their lifetime.

Sizes 280 up to and including 400, has been provided with a permanent lubrication system containing a grease valve.

The lubrication must take place when the machine is running.

The old grease is ejected from the grease valve thus maintaining the correct level and avoiding overfilling which would be harmful.

#### **7.5. Replacement of ball or roller-bearings**

When a bearing has to be replaced, the old bearing has to be removed from the shaft with proper tools in order not to damage the shaft. Thereupon the bearing location on the shaft has to be cleaned and checked thoroughly.

To fit a new bearing correctly, heat to 80 – 90 degrees centigrade with an electric induction heater, then slip quickly onto the shaft up to the stop. In the case of a roller bearing only fit the inner race in this manner.

A suitable sleeve may be used to help by tapping gently to seat the bearing home. Note that under no circumstances must a bearing be driven home cold with excess force. We must also stress that pressure must not be applied to the outer race of a ball bearing.

Do not mount the end shield until the bearing has cooled down.

## 8. Bearing type and bearing inside diameter

! Only for standard motors

HALTER Motor type	Poles	Driven end	type of bearing Non Driven end	Bearing inside diameter(mm)
DDA-56	2/4	6201 ZZ C3	6201 ZZ C3	12/12
DDA-63	2/4	6202 ZZ C3	6202 ZZ C3	15/15
DDA-71	2/4/6	6203 ZZ C3	6202 ZZ C3	17/15
DDA/DDG-80	2/4/6/8	6204 ZZ / 6204 ZZ C3	6204 ZZ / 6203 ZZ C3	20/20/20/17
DDA/DDG-90	2/4/6/8	6205 ZZ / 6205 ZZ C3	6205 ZZ / 6204 ZZ C3	25/25/25/20
DDA/DDG-100	2/4/6/8	6206 ZZ / 6206 ZZ C3	6206 ZZ / 6206 ZZ C3	30/30/30/30
DDA/DDG-112	2/4/6/8	6306 ZZ / 6306 ZZ C3	6306 ZZ / 6306 ZZ C3	30/30/30/30
DDA/DDG-132	2/4/6/8	6308 ZZ / 6308 ZZ C3	6308 ZZ / 6308 ZZ C3	40/40/40/40
DDG-160	2/4/6/8	6309 ZZ C3	6309 ZZ C3	45/45
DDG-180	2/4/6/8	6311 ZZ C3	6311 ZZ C3	55/55
DDG-200	2/4/6/8	6312 ZZ C3	6312 ZZ C3	60/60
DDG-225	2/4/6/8	6313 ZZ C3	6313 ZZ C3	65/65
DDG-250	2/4/6/8	6314 ZZ C3	6314 ZZ C3	70/70
DDG-280	2	6314 C3	6314 C3	70/70
DDG-280	4/6/8	6317 C3	6317 C3	85/85
DDG-315	2	6317 C3	6317 C3	85/85
DDG-315	4/6/8	6319 C3	6319 C3	95/95
DDG-355	2	NU317	6317 C3	85/85
DDG-355	4/6/8	NU322	6320 C3	110/100
DDG-400	4/6/8	NU326	6326 C3	130/130

Figure 1

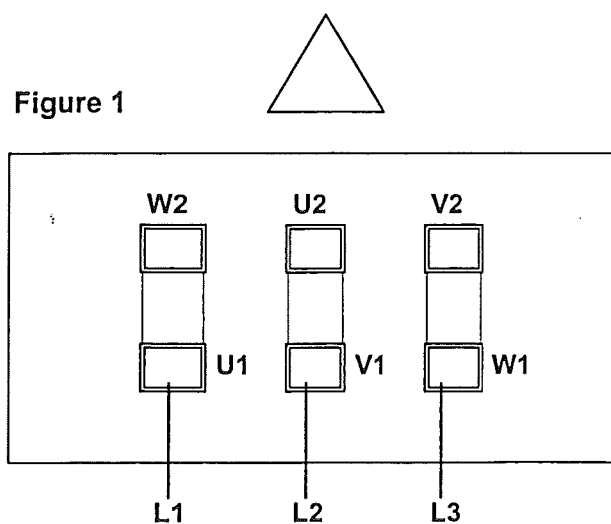
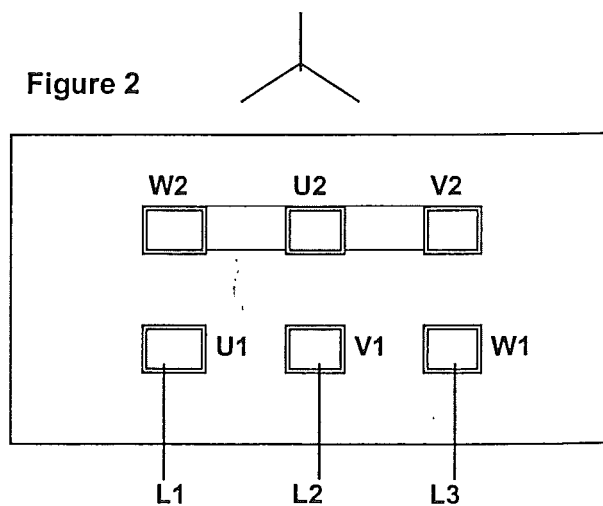


Figure 2





## 9 Grease-interval Bearings

By the term “greasing interval” we mean the number of working hours after which the bearing lubricant has to be replaced.

Electric motors have such a wide range of application that they must cope with many adverse conditions as for instance dust, moisture, vibration, temperature, chemicals, marine atmosphere and of course, the mounting position and loading of the driven machine.

Generally we can say lubrication life is a product of time, speed and the bearing size. Due to the impact of all these factors, it is practically impossible to determine any exact values that are valid under all circumstances.

Nevertheless it is necessary to provide at least some guidelines concerning greasing to the user.

Under normal load and environmental conditions the quality of the grease ensures proper operation of the motor for about 10000 service hours with 2-pole designs and 20000 service hours with multi pole designs. If not otherwise agreed upon the grease need not be refilled during this period. Nevertheless the condition of the grease filling should be occasionally checked also within the said lubricating intervals.

The stated service hours are only current under operation with rated speed. For relubrication thoroughly clean the bearings with a suitable solvent and use the same or substitute grades specified by the motor manufacturer. Bear in mind, however, that the bearings should be filled only up to about 2/3 of their free space as a complete filling of the bearings and bearing covers results in an increased bearing temperature and therefore in increased wear. For bearings with relubricating facility regrease at the grease fitting with the motor running according to the grease amount required for the motor in case. The relubrication intervals should be looked up in the following table:

A chemically aggressive environment, extreme moistness, strong vibrations, high or low ambient temperatures are not normal circumstances and such conditions must be taken into account.

Motortype	Bearing	Grease	Regreasing	Amount
DDG 160 MB 2	1 x 6310 Z P6 1 x 6309 Z P6	Klüber Isoflex Alltime SL 2	20000 h	10 – 12 g

Motor Type:	DDG 160 MB2
Customer:	Sefco AG
Motor – No:	04093862 / 61
Output Power:	15,0 Kw
Speed:	2820 min/1
Voltage:	400 / 690 V
Frequency:	50 Hz
Full - load power factor:	0,89
Connection:	Delta
Rated current at 400 / 690 V	27,1 / 15,6 A
Full – load efficiency	89,7
Protection class	IP 55
Insulation class	F to be off use B
Operating mode	S1
Constuction type	IMB 35
Weight	117 kg



DDG 160 MB 2

## Spare - List

[illegible]

# CERTIFICATE of CONFORMITY

**Theo Halter GmbH**  
Elektromotoren  
Gleisstrasse 36

68766 Hockenheim

The electrical apparatus:

**Three phase asynchronous squirrel cage motors series:**

**DDG / DDA**

are in conformity with the instructions of:

**- 73 / 23 EWG**

Low Voltage Directive amended by: RL 93 / 68 / EWG

**- 89 / 336 / EWG**

Directive on Electromagnetic Compatibility  
amended by: RL 91 / 263 / EWG, 92 / 31 / EWG and 93 / 68 / EWG

The conformity with the instructions of these directives is proved by the observation of the following standards:

- |                           |   |
|---------------------------|---|
| <b>1. IEC Publ. 34-1</b>  | Rating and performance NEN 3173; 1991   |
| <b>2. IEC Publ. 34-5</b>  | Degrees of protection (IP code) NEN-EN 60034-5  |
| <b>3. IEC Publ. 34-7</b>  | Classification of types of construction and mounting arrangements (IM code) NEN-EN 60034-7                      |
| <b>4. IEC Publ. 34-9</b>  | Noise limits NEN-EN 60034-9   |
| <b>5. IEC Publ. 34-14</b> | Limits of mechanical vibrations NEN 10034-14  |
| <b>6. IEC Publ. 34-8</b>  | Terminal markings and direction of rotation NEN 2248  |
| <b>7. IEC Publ. 72-1</b>  | Relationships of the dimensions and output rating of totally enclosed fan cooled 3-phase cage induction motors. |

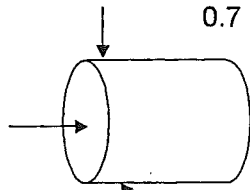
Hockenheim, 28.11.02  
Theo Halter GmbH, Elektromotoren

T. Noor-Herbert

ppa. F. Heinemann

This certificate attests to the conformity with the named directives, however, it is not a guarantee of properties in the meaning of product liability.

# ***Certificates***

sefco		Delivery Certificate				Ref. No.: 04.271/1				
Customer:		Air Liquide AGS GmbH - Z11/4500023387 - ASU Kosice				P62100				
Pump Type:		C-20 / EM-15								
Motor:		Manufacture : Halter		Type: DDG160MB2		No.: 04093861				
		P: 15 [KW]		U: Δ 400 [V]		I: 27.1 [A]				
		n <sub>range</sub> : 2820		/ f <sub>range</sub> : [Hz]		f <sub>field weakening point</sub> : 50 [Hz]				
Gearbox:		Manufacture :		Type:		Nr: i:				
Pressure Test		Hydraulic pressure test of pump casing completed at 25 bar for 5 min								
(EN 13275:2000/§5.2.2)		Date: 13.10.04		Signature: AK						
Degreasing		Pump cold end has been degreased with Trichlorethylene for LOX Operation.								
(EN 12300:1999)		Date: 09.11.04		Signature: Mü						
LIN-Test										
γ		0.7774 [daN/l]								
Q	p <sub>suct</sub>	p <sub>del</sub>	Δp	ΔH	P <sub>el</sub> <sup>1)</sup>	P <sub>mech.</sub>	η <sub>pump</sub>	T	n	f <sub>Converter at operation</sub>
[l/min]	[barg]	[barg]	[bar]	[m]	[kW]	[kW]	[%]	[°C]	[rpm]	[Hz]
150	1.32	5.28	3.96	50.9	6.3			-192.5	2950	50
200	1.30	5.26	3.96	50.9	6.5			-192.5	2950	50
250	1.25	5.25	4.00	51.5	6.8			-192.5	2950	50
300	1.23	5.25	4.02	51.7	7.1			-192.5	2950	50
350	1.22	5.28	4.06	52.2	7.4			-192.5	2950	50
400	1.22	5.28	4.06	52.2	7.8			-192.5	2950	50
1) P <sub>el</sub> measured at converter inlet										
Mechanical shaft seal		Preloading by Lead - Bushing				:	1.6 mm			
		Preloading by Rotating Sealing				:	2.6 mm			
		Total Preloading				:	4.2 mm			
		Date: 10.11.04		Signature: Mü						
Remarks:		Seal leakage RTD's, and motor winding PTC thermistors: functional check OK								
Impeller Ø at test:		200 mm		Vibrations:(at DE motorshield)						
Tip width:		11 mm		(at operating point)						
With Inducer		yes								
With Blade- ring		no								
Diffusor type:				Sound pressure level (at operating point)						
Orifice Ø :				dB(A)						
		Date : 16.11.04		Signature: JM Grieneisen						

sefco		Delivery Certificate				Ref. No.: 04.271/2				
Customer:		Air Liquide AGS GmbH - Z11/4500023387 - ASU Kosice				P72100				
Pump Type:		C-20 / EM-15								
Motor:		Manufacture : Halter		Type: DDG160MB2		No.: 04093862				
		P: 15 [KW]		U: $\Delta$ 400 [V]		I: 27.1 [A]				
		n <sub>range</sub> : 2820		/ f <sub>range</sub> : [Hz]		f <sub>field weakening point</sub> : 50 [Hz]				
Gearbox:		Manufacture :		Type:		Nr: i:				
Pressure Test		Hydraulic pressure test of pump casing completed at 25 bar for 5 min								
(EN 13275:2000/§5.2.2)		Date: 13.10.04		Signature: AK						
Degreasing		Pump cold end has been degreased with Trichlorethylene for LOX Operation.								
(EN 12300:1999)		Date: 09.11.04		Signature: Mü						
LIN-Test										
$\gamma$	0.7819 [daN/l]									
Q	P <sub>suct</sub>	P <sub>del</sub>	$\Delta p$	$\Delta H$	P <sub>el</sub> <sup>1)</sup>	P <sub>mech.</sub>	$\eta$ pump	T	n	f Converter at operation
[l/min]	[barg]	[barg]	[bar]	[m]	[kW]	[kW]	[%]	[°C]	[rpm]	[Hz]
150	1.39	5.40	4.01	51.3	6.4			-193.5	2950	50
200	1.36	5.41	4.05	51.8	6.6			-193.5	2950	50
250	1.31	5.39	4.08	52.2	6.9			-193.5	2950	50
300	1.30	5.40	4.10	52.4	7.3			-193.5	2950	50
350	1.29	5.40	4.11	52.6	7.6			-193.5	2950	50
400	1.28	5.38	4.10	52.4	7.7			-193.5	2950	50
1) P <sub>el</sub> measured at converter inlet										
Mechanical shaft seal		Preloading by Lead - Bushing				:		1.88 mm		
		Preloading by Rotating Sealing				:		2.59 mm		
		Total Preloading				:		4.47 mm		
		Date: 10.11.04		Signature: Mü						
Remarks:		Seal leakage RTD's, and motor winding PTC thermistors: functional check OK								
Impeller Ø at test:		200 mm		Vibrations:(at DE motorshield)		0.45 [mm/s]				
Tip width:		11 mm		(at operating point)		0.8 [mm/s]				
With Inducer		yes		Sound pressure level (at operating point)		dB(A)				
With Blade- ring		no								
Diffusor type:										
Orifice Ø :										
Date :		16.11.04		Signature:		JM Grieneisen				



Suction hose Item 7 on drawing  
no. 04.271/14

Angst+Pfister AG  
Thurgauerstrasse 66  
CH-8052 Zürich  
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Telefon +41 1 306 61 11  
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Case postale 19  
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Téléfax +41 22 979 28 78

Bankverbindung:  
CS, 8050 Zürich, Kto. 570500-91, BC 4857  
UBS, 8050 Zürich, Kto. 803.917.011, BC 269

Customer No. 111219

Sefco AG  
Herr F. Brodesser  
Wuhrmattstr. 15

Sefco AG  
Maschinen-Anlagen  
Wuhrmattstr. 15

CH-4103 Bottmingen

CH-4103 Bottmingen

Official in Charge: Frau Ch. Schweri  
Tel. direct: 01 306 64 05  
26.11.04 10:38:10 /

**Inspection certificate EN 10204-3.1 B FT-A04.202032**

Your reference Herr F. Brodesser / Best.Nr. 04/2373		Our reference Frau Ch.Schweri													
Job No. FT-A04.202032	Order Date 14.10.2004	Delivery Date 18.11.2004	VS A+P Zürich												
<p>Order specification/acceptance requirements:</p> <p>Test item: Our part-no 80 0002 1519 Metal hose assembly ASSIWELL® 100 1.4541 DN 100, U1, NL 400 mm, PED Fitting 1: welding flange DN 100 PN 6 Fitting 2: welding flange DN 100 PN 6 Your part/drawing-no. 4 14784</p> <p>Quantity: 2 pieces</p> <p>Marking: SB/A+P C400854-05 PS6, DN 100, TS-196/+20° C, 11/04, 414784, CE</p> <p>Test: Pressure and Tightness Test: 9 bar air under water Duration: 2 min.</p> <p>Test result: The hose(s) meet(s) the requirements.</p> <p>Remarks:</p>															
<p>Material certificate</p> <table border="1"> <thead> <tr> <th>Element</th> <th>Material</th> <th>Ladle No.</th> </tr> </thead> <tbody> <tr> <td>Corrugated hose</td> <td>1.4541</td> <td>G25109</td> </tr> <tr> <td>Braid</td> <td>1.4301</td> <td>E43024</td> </tr> <tr> <td>Welding Flange DN 100</td> <td>1.4435</td> <td>D91131A/493140</td> </tr> </tbody> </table>				Element	Material	Ladle No.	Corrugated hose	1.4541	G25109	Braid	1.4301	E43024	Welding Flange DN 100	1.4435	D91131A/493140
Element	Material	Ladle No.													
Corrugated hose	1.4541	G25109													
Braid	1.4301	E43024													
Welding Flange DN 100	1.4435	D91131A/493140													

We hereby certify, that the material described above has been tested and complies with the terms of the order contract.

Best regards  
Angst + Pfister AG

ppa. H. Birmele

i. A. Ch. Schweri



# Konformitätserklärung

## nach Druckgeräterichtlinie 97/23/EG

für ein Druckgerät

**Der Hersteller**  
Senior Berghöfer GmbH

Frankfurter Str. 199  
D-34121 Kassel

### erklärt hiermit, dass das Druckgerät

Beschreibung / Verwendungszweck:	Rohrleitung / Edelstahl-Wellenschlauch	
Typ-, Serien-, Fabrikationsnummer:	MW22 U1 - 414784 // C 4.00854-05	
max. zulässiger Druck PS:	6,00	bar
zulässige max./min. Temperatur TS:	+20/-196	°C
Nennweite DN:	100	
Herstelljahr:	2004	
Aufgebrachter Prüfdruck PT:	9	bar
Prüfmedium:	Luft	

**mit der Druckgeräterichtlinie 97/23/EG übereinstimmt.**

Angewandte  
Konformitätsbewertungsverfahren: Modul A

Angewandte Normen und techn.  
Spezifikationen: AD 2000, DIN EN 287-1, DIN EN 288

Weitere angewandte EG-Richtlinien: keine

### Eingeschaltete benannte Stellen:

Überwachung QS-System: --

Prüfung / Überwachung / Kontrollen  
während der Fertigung: TÜV Hessen (0091)

### Zugehörige Bescheinigungen:

EG-Entwurfsprüfbescheinigung Nr.: ./.

EG-Baumusterprüfbescheinigung Nr.: ./.

EG-Konformitätsbescheinigung Nr.: ./.

Ort, Datum:  
Kassel, 16.11.2004

  
\_\_\_\_\_  
Unterschrift    Geselle

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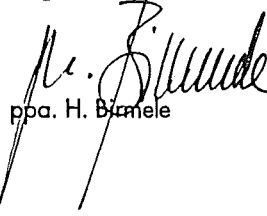
Official in Charge: Frau Ch. Schweri  
Tel. direct: 01 306 64 05  
24.11.04 14:07:51 /

## **Inspection certificate EN 10204-3.1 B FT-A04.202032**

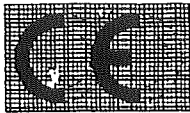
Your reference Herr F. Brodesser / Best.Nr. 04/2373		Our reference Frau Ch. Schweri													
Job No. FT-A04.202032	Order Date 14.10.2004	Delivery Date 18.11.2004	VS A+P Zürich												
<b>Order specification/acceptance requirements:</b> Test item: Our part-no 80 0002 1522 Metal hose assembly ASSIWELL® 100 1.4541 DN 65, U1, NL 400 mm, PED Fitting 1: welding flange DN 65 PN 16 Fitting 2: welding flange DN 65 PN 16 Your part/drawing-no. 4 14783 Quantity: 2 pieces Marking: SB/A+P C400854-06 PS15, DN 65, TS-196/+20° C, 11/04, 414783, CE Test: Pressure and Tightness Test: 24 bar with pure tap water Duration: 2 min. Test result: The hose(s) meet(s) the requirements. Remarks:															
<b>Material certificate</b> <table border="1"> <thead> <tr> <th>Element</th> <th>Material</th> <th>Ladle No.</th> </tr> </thead> <tbody> <tr> <td>Corrugated hose</td> <td>1.4541</td> <td>483669</td> </tr> <tr> <td>Braid</td> <td>1.4301</td> <td>E43612</td> </tr> <tr> <td>Welding Flange DN 65</td> <td>1.4435</td> <td>E40679</td> </tr> </tbody> </table>				Element	Material	Ladle No.	Corrugated hose	1.4541	483669	Braid	1.4301	E43612	Welding Flange DN 65	1.4435	E40679
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Welding Flange DN 65	1.4435	E40679													

We hereby certify, that the material described above has been tested and complies with the terms of the order contract.

Best regards  
Angst + Pfister AG

  
ppa. H. Birmele

  
i.A. Ch. Schweri



# Konformitätserklärung

## nach Druckgeräterichtlinie 97/23/EG

für ein Druckgerät

**Der Hersteller**  
Senior Berghöfer GmbH

Frankfurter Str. 199  
D-34121 Kassel

**erklärt hiermit, dass das Druckgerät**

Beschreibung / Verwendungszweck:	Rohrleitung / Edelstahl-Wellschlauch	
Typ-, Serien-, Fabrikationsnummer:	MW22 U1 // C 4.00854-06	414783
max. zulässiger Druck PS:	15	bar
zulässige max./min. Temperatur TS:	+20/-196	°C
Nennweite DN:	65	
Herstelljahr:	2004	
Aufgebrachter Prüfdruck PT:	24	bar
Prüfmedium:	Wasser	

**mit der Druckgeräterichtlinie 97/23/EG übereinstimmt.**

Angewandte  
Konformitätsbewertungsverfahren: Modul A

Angewandte Normen und techn.  
Spezifikationen: AD 2000, DIN EN 287-1, DIN EN 288

Weitere angewandte EG-Richtlinien: keine

### Eingeschaltete benannte Stellen:

Überwachung QS-System: --

Prüfung / Überwachung / Kontrollen  
während der Fertigung: TÜV Hessen (0091)

### Zugehörige Bescheinigungen:

EG-Entwurfsprüfbescheinigung Nr.: ./.

EG-Baumusterprüfbescheinigung Nr.: ./.

EG-Konformitätsbescheinigung Nr.: ./.

Ort, Datum:

Kassel, 11.11.2004

Unterschrift Geselle