

Instruction Manual for Liquid Gas Centrifugal Pump

LOX Back-up Pump P64101 - P64201

Pump - Type : C-25/G2/EM-55
Sefco Ref. No. : 04.267/1-2
Customer : Air Liquide AGS GmbH
Customer Ref. No. : Order. No.: Z11/4500023387 of 23.07.2004
Project: K70101
Project name: "ASU Košice"

Contents C - 25 / G2 / EM

Title-Page	No. E10500 -1
1 Declaration by the Manufacturer	No. E10863 -1
2 Introduction	No. E10501 -1
3 Safety	No. E10864 -1-2-3
3.1 Notes and symbols	No. E10864 -1
3.2 General notes about dangers	No. E10864 -2
3.3 Important notes for operation	No. E10864 -3
4 Machinery Description	No. E10546 -1
5 Additional Subsystems	No. E10504 -1
5.1 Cold-end	No. E10504 -1
5.2 Gearbox	No. E10504 -1
5.3 Additional control-subsystems	No. E10504 -1
6 Machinery and Subsystems Data	No. E10505 -1-2
6.1 Machinery data	No. E10505 -1-2
6.2 Additional subsystems and components	No. E10505 -2
7 Pump Preparation	No. E10549 -1
7.1 Before delivery	No. E10549 -1
7.2 On arrival at customer site	No. E10549 -1
7.3 Handling	No. E10549 -2
8 Pump Installation	No. E10507 -1-2-3
8.1 Correct suction-line	No. E10507 -1
8.2 Piping system and components	No. E10507 -2-3
8.3 Pump protection	No. E10507 -3
8.4 Electrical connections	No. E10507 -3
9 Suction Pressure- (NPSH) Required	No. E10510 -1-2-3

10 Pump Operation Start- Up	No. E10508 -1-2-3-4-5
10.1 Before start-up	No. E10508 -1
10.2 Operation start-up	No. E10508 -2
10.2.1 Cool-down of the pump (Cold-end)	No. E10508 -2-3
10.2.2 Operation of the pump	No. E10508 -3
10.2.3 Stop of the pump	No. E10508 -3
10.3 Operation disturbances	No. E10508 -4-5
11 Overhaul and Maintenance	No. E10509 -1-2
11.1 General requirements	No. E10509 -1
11.2 Lubrication	No. E10509 -1-2
11.3 Repairs and spare parts	No. E10509 -2
12 Disassembling	
12.1 Pump Disassembling	No. E10854 -1-2
12.2 Gearbox Disassembling	No. E10865 -1
13 Assembling	
13.1 Gearbox Assembling	No. E10866 -1
13.2 Pump Assembling	No. E10855 -1-2-3-4
Machinery External Dimensions	No. 410123
Max. Nozzle Loading / Forces-Moments	No. 413597
Connection for Squirrel Cage Induction Motors	No. E10669 -1
Installation Schematic	No. E10200 -1
Cold-End Drawing	No. 113605
Spare-Parts List Cold-end	No. E10495 -1-2-3
Gearbox Drawing	No. 211231
Spare-Parts List Gearbox	No. E10409 -1
Checklist	No. 412835

ANNEX

ANNEX: C-25/G2

Arrangement drawing	No. 04.267
Accessories	No. 04.267/14
Parts list of accessories	No. 04.267/13
Data sheet suction strainer DN65	No. 3 11246
Suction strainer assembling	No. 4 11366
Temperature control at the pump	No. 4 13700
Performance curves	No. 180-04/1
Data sheet RTD's for seal leakage detection	No. 4 14034
E-Motor wiring diagram	No. 04.267/28
E-Motor temperature control	No. 4 13577
E-Motor operating and maintenance instructions	
Certificates	
Delivery certificate	No. 04.267/1
	No. 04.267/2
Test certificate for suction hose	
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-25/G2/EM-55
- **Ref. No.:** 04.267/1-2
- **Tag No.:** P64101 - P64201
- **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:

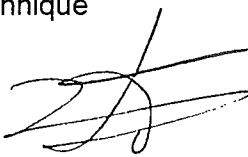
- EN 13275 Cryogenic vessels - Pumps for cryogenic service
 - EN 809 Pumps and pump units for liquids - Common safety requirements
- and is/are intended to be incorporated into machinery or to be assembled with other machinery covered by Directive 98/37/EEC, as amended;

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

prca 

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
Switzerland

Tel: +41 (0)61 421 94 60
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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	DANGER!	Immediately threatening danger	Death or heavy injuries
	Persons	DANGER!	Immediately threatening danger by voltage	Death or heavy injuries
	Persons	WARNING!	Possibly dangerous situation	Possible middle to light injuries
	Goods	CAUTION!	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

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

- Centrifugal pump, directly driven by electric motor through a speed-up gearbox.
- Gearbox with lubricant slinger-disc directly flanged to the motor (motor front shield constitutes gearbox rear-cover). Additional, adequate lubricant-level in the bearing-casing cavity.
- Plug-in unit, consisting of the rotating assembly (shaft, bearings and gear) and support to which the pump cold-end is flanged. This plug-in can be easily dismantled as a complete unit from the gearbox-casing by loosening of four screws: quick and easy mounting/dismounting, replacement and maintenance.
- Centrifugal pump cold-end which consists of the casing, seal- and 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
Plug-in unit (rotating assembly)	: - Casting is bronze-aluminium alloy - Pump shaft is stainless-steel
Gearbox Casing	: - Aluminium alloy hard anodized

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 Nm³/h), dry nitrogen (<2ppm); see also sectional drawing and spare parts list.

5.2 Gearbox

- Lubricant circulation subsystem providing heated lubricant, to warm up shaft and bearings for the pump in stand by position and being permanently flooded. Additional lubrication system with lubricant cooler connected at the place of the lubricant filler plug on the gearbox- casing.
- Temperature control of the bearings. Possibility to connect a PT 100 (resistance temperature detector) for monitoring the bearings.

5.3 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	:	LOX
Density (kg/l)	:	1.139

Pump / Gearbox

Pump-Type	:	C-25
Material/Cold-End	:	bronze
Material/Impeller	:	bronze
Number of Stages	:	1
Impeller Standard Ø (mm)	:	250/5.5
Impeller Effective Ø (mm)	:	250
Impeller Rotating Speed (min ⁻¹)	:	approx. 5000

Differential Head Δ H (m)	:	257
Differential Pressure Δ p (bar)	:	28.7
Flowrate (lit/min.)	:	501
Required NPSH (m)	:	0.6

Gearbox-Type	:	G2 (i = 1.692)
Lubricant	:	Lubcon Turmoxygen LC 40 fluid

Electric Motor

Manufacture	:	WEG
Type	:	TE 250SM
Frame Size	:	250SM
Design-Form	:	IMB 35
Rated Power (kW)	:	55
Rated current (A)	:	91
Rated Frequency (Field weakening point) - (Hz)	:	50
Rated Rotating Speed (min ⁻¹)	:	2960
Protection / Insulation Class	:	IP55 / F
Max. ambient temperature / installation altitude (°C / m above sea level)	:	40 / 1000
Δ - Voltage / Frequency / Phases (V / Hz)	:	400 / 50 / 3

/ max. admissible:

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 DN65
- Flexible suction hose DN65 PN6
- Flexible discharge hose DN50 PN40
- Seal leakage detection RTD's

7 Pump preparation

7.1 Before delivery

Pump:

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

Gearbox:

- Greasing of bearings and gears with oxygen admissible lubricant
- Run in of the bearing casing support

Pump unit:

- Cold-test with liquid nitrogen

NOTE!



The gearbox is delivered with filled in lubricant.

7.2 On arrival at customer side

- 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!

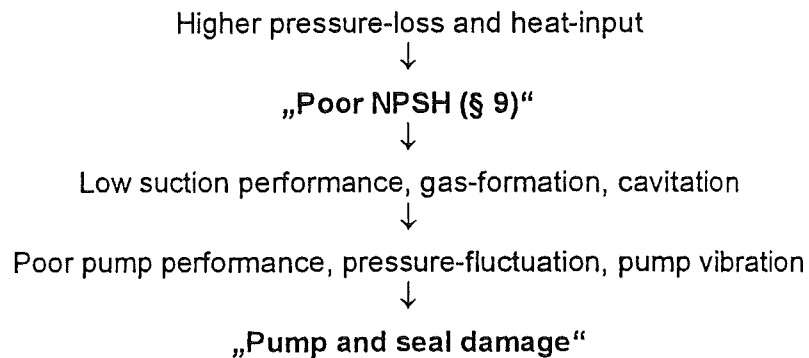


- **short and well insulated.**
- **simple and straight ducting, without narrow bends and sudden section-changes.**
- **continuous down-flow towards pump, no gas accumulation on suction side.**
- **optimum section to minimise pressure-loss and heat-input.**

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.

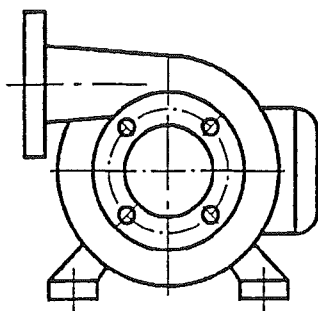
Minimise flow disturbances at pump-inlet.

NOTE!

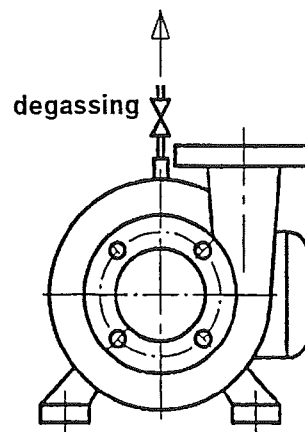


Flange- position on delivery side: (only for horizontal pumps)

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 ($< 2\text{ppm}$) 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. Such purging is also beneficial on a mobile unit.

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 γ_s at suction flange, gives:

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

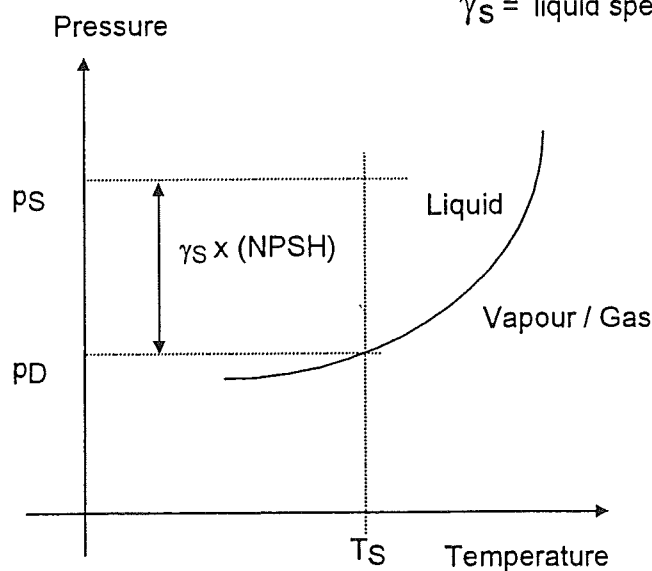
CAUTION!



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:



p_S = static pressure at suction flange

p_D = local vapour-pressure = $f(T)$

T_S = effective flow temperature at suction flange

γ_S = liquid specific weight at suction flange = $f(T_S)$

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

Check lubricant level, top up if necessary.

To fill in/top up, remove lubricant filler plug on gearbox and fill in appropriate lubricant for secure operation. (see § 11.2)

WARNING!



For LOX operation as well as for other liquids, in the gearbox uniquely the use of oxygen admissible lubricants is allowed

CAUTION!



- Lubricant level to be at half height of check glass (in horizontal position). In order to insure sufficient lubrication, the position of the gearbox must not exceed the following limits:
 - turning of longitudinal axis max. $\pm 15^\circ$
 - gradient of longitudinal axis max. $\pm 5^\circ$

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 must rotate in counter-clockwise direction, while the pump-impeller rotates in clockwise direction (observe 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 bearing-casing), **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 bearing casing support 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 or pump shaft bearings damage Bad motor bearings lubrication Bad bearing lubrication in the gearbox Unbalance External tubing forces too high for the pump casing	Replace bearings Regrease or replace life greased bearings Check lubricant level / complete Replace impeller or inducer or possibly re-balance (SEFCO) Check fix points Exactly align pump and tubing (see § 8.2)

Operation disturbances (continuing)

Disturbance	Possible reason	Correction pump <i>not operating</i>
Unusual bearing temperature	Unsatisfactory lubrication	Check lubricant level, lube-system, slinger-disc in the gearbox. Regrease motor bearings
	Used up/dirty lubricant	Replace lubricant, regrease motor bearings
	Bearings damaged	Replace bearings
Pump leaks	Mechanical seal damaged	Check/replace mechanical seal

Disturbance	Possible reason	Correction pump <i>operating</i>
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 and if required gearbox and shaft-bearing assembly
- 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

- Gearbox

WARNING!



For LOX operation as well as for other liquids, in the gearbox **uniquely the use of oxygen admissible lubricants is allowed:**

- LUBCON TURMOXYGEN LC40 FLUID, alternatively:
- KLÜBER OXYGENOEX S4 FLUID

CAUTION!



These two lubricants are mixable among themselves, **but not with others!**

Lubricant-level: Periodical checks of gearbox to be at mid show glass. Lubricant content of the gearbox is approximately 2,0 litres. (in exceptional cases up to 4,0 litres).

Lubricant-change: Every 1000 operating-hours or once a year.

- Electric motor

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.
- Electric motor bearing grease: Universal bearing-grease (Lithium based)

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 Disassembling

12.1 Pump disassembling (Drawing No. 1 13605)

WARNING!



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.
- Remove complete plug-in unit (cold-end and bearing assembly) from gearbox.
- Place plug-in unit in vertical position on appropriate dismounting frame (gear downwards).
- Remove hexagon nuts 66, washers 65 and dismount pump casing 61.
- Remove screws 63 and wear ring 62 from pump casing only if necessary to change (using take -off device).
- Remove flattened seal-cord 67 (casing-seal).
- Remove circlips 72, screws 69, washers 70 and 71 only if diffuser 68 has to be changed.
- Remove circlip 60, safety screw 59, screw 58 and strain washer 57 and draw-off impeller cap 54 or inducer 55.
- Draw-off impeller 52 with keys 53 from shaft.
- Draw-off rotating seal-ring 51 and shims 50 from shaft.
- Remove screws 47, washers 48, 49 and dismount mechanical-seal 44 and seal-washer 46.
- Remove screws 38, washers 37 and rear-casing 33 from bearing-casing support 21, (observe position). Remove labyrinth outer-bushing 36 only if necessary to change.
- Remove screws 35 and wear ring 34 from rear-casing only if necessary to change (using take -off device).
- Remove insulation-ring 32, draw-off labyrinth shaft-bushing 42 and labyrinth-bushing 41 from shaft.
- Remove screws 31 and pull off slinger disc 30.
- Remove screws 20, washers 19 and cover 17.

- Turn around the bearing-casing support, gear on top.
- Remove shaft nut **15**, safety-washer **14**, pull off gear **26**, remove keys **13** and ring **12**.
- Remove circlip **11** and pull out shaft **1** with bearings from bearing-casing support **21**.

RECOMMENDATION!



This dismounting procedure is made easier by heating up the bearing-casing on bearing-seat **10** at approx. 50°C.

- Draw off bearing **10**, distance-rings **8** and **9**, shim **6** and preloading-ring **7**, bearing **5** and supporting-ring **4** from shaft.
- Remove circlip **3** and draw off bearing internal ring **2** from shaft.

12.2 Gearbox disassembling, type G2/EM (Drawing No. 1 11231)

- Drain lubricant.
- Remove screwing **1, 2, 3** and pull off gearbox-casing **11** from motor flange. (if necessary use forcing screws, corresponding threaded holes being on casing-flange).
- Dismount ring **20** only, if to be changed.
- Remove circlip **19** and pull off gear **9**.
- Remove lubricant slinger-disc **10** and ring **8** only if damaged.

13 Assembling

13.1 Gearbox assembling, type G2/EM (Drawing No. 1 11231)

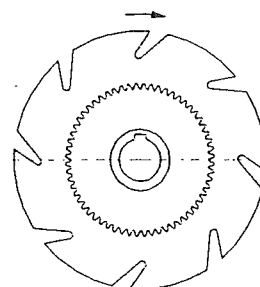
- Prior to assembling, all parts must be carefully degreased and checked for damages. Spare parts shall remain originally packed until they are used.

WARNING!



Greasing of seats and screwing should be done only with oxygen compatible grease!

- Place key 18.
- Mount lubricant slinger-disc 10 and ring 8 on gear 9.
Observe rotational direction!
- Secure screws 5 with Loctite Nr. 0601 or Nr. 0270.
- Pull gear-unit on motor shaft.



RECOMMANDATION!



Warm up gear-unit to approx. 100°C

- Secure with circlip 19.
- Press in ring 20, secure with Loctite Nr. 0672 or Nr. 0641.
- Mount fittings and plug-screws according to drawing.
- Place gasket 12 on motor flange.
- Fasten gearbox-casing on motor-flange.

13.2 Pump Assembling (Drawing No. 1 13605 and Checklist Nr. 4 12835)

WARNING!



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.
- Greasing of seats and screwing should be done only with oxygen compatible grease!
- Shaft concentric running tolerance: 0,03 mm (measured between end-centres).
- Pull bearing internal ring 2 on shaft 1.

RECOMMENDATION!



Warm-up internal ring to approx.100°C

- Mount circlip 3.
- Mount supporting-ring 4.
- Pull split-race ball-bearing 5 on shaft.

RECOMMENDATION!



Warm-up internal rings to approx.100°C

- Mount distance-ring 9.
- Pull bearing internal ring 10 on shaft 1.

RECOMMENDATION!



Warm-up internal ring to approx.100°C

- Put in bearing 2 in bearing-casing support 21.
- Introduce shaft 1 in bearing-casing support 21.

RECOMMENDATION!



Warm up bearing-casing support at seat of bearing 10 to approx. 50-60°C.

- Put in shim 6, preloading-ring 7 and distance-ring 8.
- Mount bearing 10 and secure with circlip 11.
- Measure of shaft axial clearance: 0,15mm to 0,35mm.

Measuring procedure:

Push shaft in gear direction, until preloading-ring 7 is completely compressed (approx. 300 N). Measure gap between external-ring of bearing 5 and bearing-casing shoulder, using thickness gauge through side-slot of bearing-casing.

Adjust clearance, using shim 6, $\varnothing 60 \times 72 \times 0,2$, placed between preloading-ring 7 and ball-bearing 5.

- Put in ring 12 and keys 13.
- Put gear 26 on shaft 1.

RECOMMENDATION!



Warm up gear to approx. 100°C

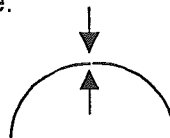
- Secure with shaft-nut 15 and safety washer 14. (using safety-washer only once!).
- Mount V-Ring 16 very carefully.
- Mount O-Ring 18 and cover 17; observe positioning-pin 25!

WARNING!



Do not use lubricants for further mounting!

- Mount slinger disc 30. (align screws to the flattened areas of the shaft)
- Mount labyrinth-bushing 41 and labyrinth shaft-bushing 42.
- Press wear-rings 34 in rear-casing 33 and 62 in pump casing 61 and secure with screws 35 / 63. Slightly hammer screw-thread to secure.
- Mount diffuser 68:
Observe position according to sketch
Secure screws 69 with circlips 72.
- Press labyrinth outer-bushing 36 in rear-casing 33.
- Place insulation-ring 32 and rear-casing 33 on bearing-casing support 21 and fasten with screws 38 (observe position).
- Place softened seal-washer 46 in rear-casing 33.
- Place mechanical seal 43 in lead-bushing 44 and check **pretension of approx. 1 mm**, then adjust mechanical seal concentrically and fix with screws 45.
- Mount lead-bushing together with mechanical-seal in rear-casing 33.
- Place shims 50 and rotating-ring 51 on shaft (the rotating-ring must move easily on shaft).



CAUTION!



Pretension of mechanical seal:

The mechanical seal 43 must be prestressed through the rotating-ring 51 of

2,3 to 2,6 mm

Measuring procedure: (see Checklist No. 4 12835 §C)

1. Move rotating-ring **51** on shaft until touching the PTFE compound ring of the mechanical seal **43**:
Measure distance rotating-ring to shaft-end: measurement ①
 2. Press rotating-ring **51** against shim **50**:
Measure distance rotating-ring to shaft-end: measurement ②
 3. ② - ① = Pretension
 4. Adjust required pretension through peeling of shim **50**: The shim consists of metal-sheets (0,05 mm thickness) which can be peeled with a sharp knife one by one.
 5. Check if pretension is correct
- Mount impeller **52**, place both keys **53**, mount impeller cap **54** or inducer **55** and tighten with screws **58** at approx. 38 Nm. Secure with screw **59** and circlip **60**.
 - Put self adhesive seal-cord **67** on seal face of pump-casing **61**, **ends overlapped**.
 - Mount pump-casing **61** and tighten uniformly.

CAUTION!



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

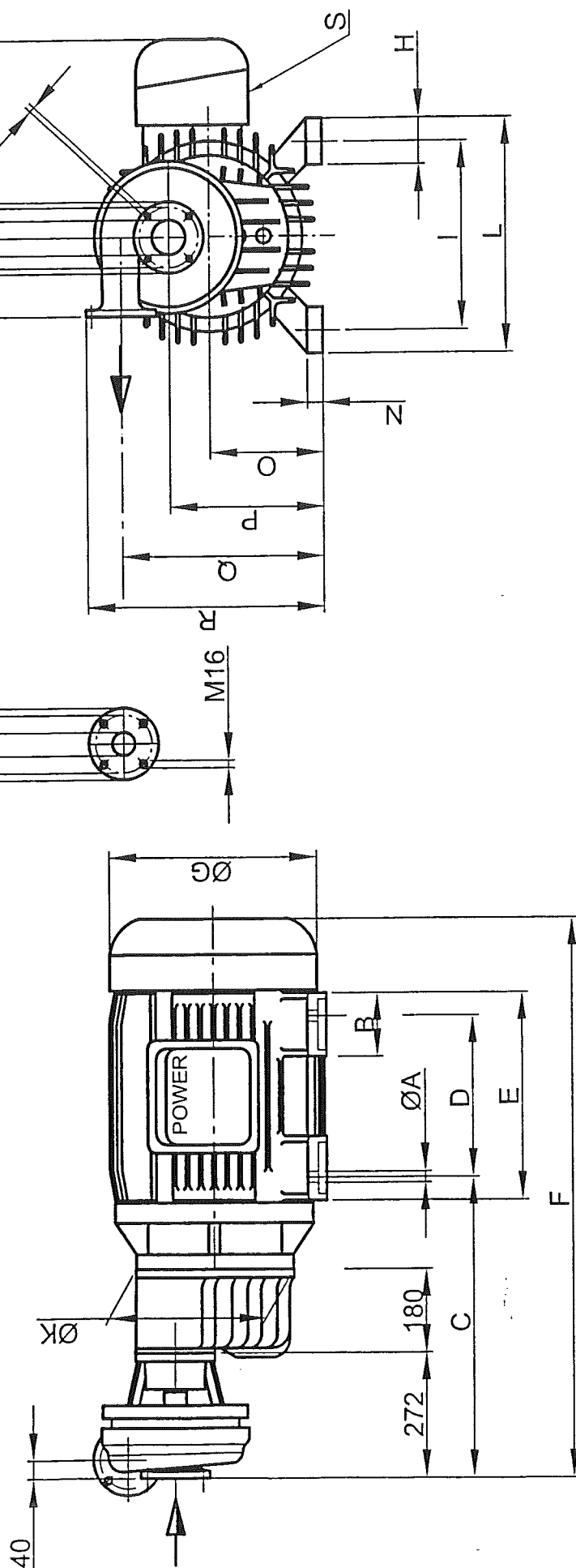
Same control of free-rotating after pump installation and before motor-start

- Mount plug-in unit complete on gearbox.
- Fill in lubricant in Gearbox and check lubricant level.

	Gezeichnet Dessiné	Geprüft Contrôlé
20.03.2002	N.S.	

LIQUID GAS CENTRIFUGAL PUMP

Type : C - 25 / G2 - EM



Subject to change

"External forces according to drawing 4 13597"

Dimensions in mm

280S		24	110	641	368	450	1334	555	105	457	350	550	660	36	280	369	475	553	2 x M50x1.5
280M		26	120	641	419	520	1403	555	105	457	350	570	740	40	280	369	475	553	2 x M50x1.5
250M		24	100	619	349	410	1213	495	90	406	350	470	600	35	250	339	445	523	2 x M50x1.5
225M		19	100	600	311	410	1179	445	90	356	350	452	600	35	225	314	420	498	2 x M40x1.5
200L		19	90	584	305	388	1139	395	85	318	350	403	531	30	200	289	395	473	2 x M40x1.5
180M		15	85	572	241	320	1035	355	80	279	350	360	485	28	180	269	375	453	2 x M32x1.5
Motor type	kw	A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S

Maximale Flanschbelastungen / Kräfte- Momente

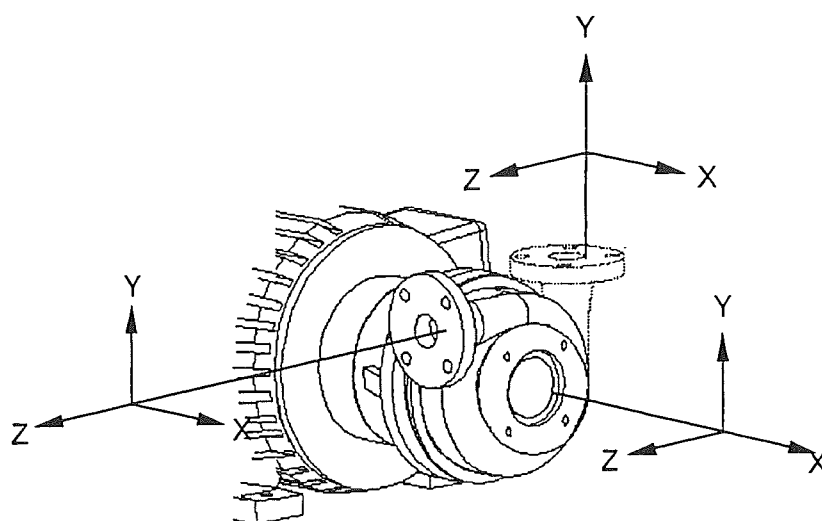
Max. Nozzle Loadings / Forces- Moments

Efforts max. aux brides / Forces- Moments

Pumpen-Typ :

Pump- Type : **C-25, C-25/G2, CL-25**

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
Kräfte Forces [N]	F_x	400	210	210
	F_y	320	180	270
	F_z	270	270	180
	F_r	580	380	380
Moments [Nm]	M_x	290	140	140
	M_y	140	70	70
	M_z	220	105	105
	M_r	385	190	190

r = Resultierende, Resultant, Résultante

Connection for squirrel cage induction motors

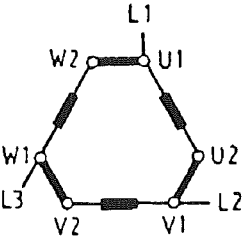
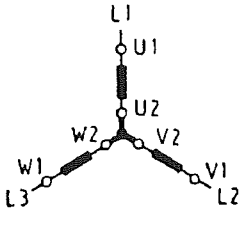
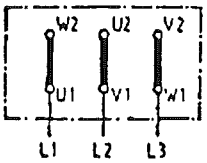
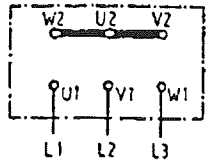
Squirrel-cage induction motors are connected to the three-phase conductors L1, L2, L3. The rated voltage of the motor in the running connection must agree with the phase-to-phase voltage of the supply system.

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 / Δ -starting
230 Δ / 400 Y	230 400	230 Δ 400 Y	230 Δ not possible
400 Y 400 Δ	400	400 Y 400 Δ	not possible 400 Δ
500 Y 500 Δ	500	500 Y 500 Δ	not possible 500 Δ
400 Δ / 690 Y	400 690	400 Δ 690 Y	400 Δ not possible
690 Y 690 Δ	690	690 Y 690 Δ	not possible 690 Δ

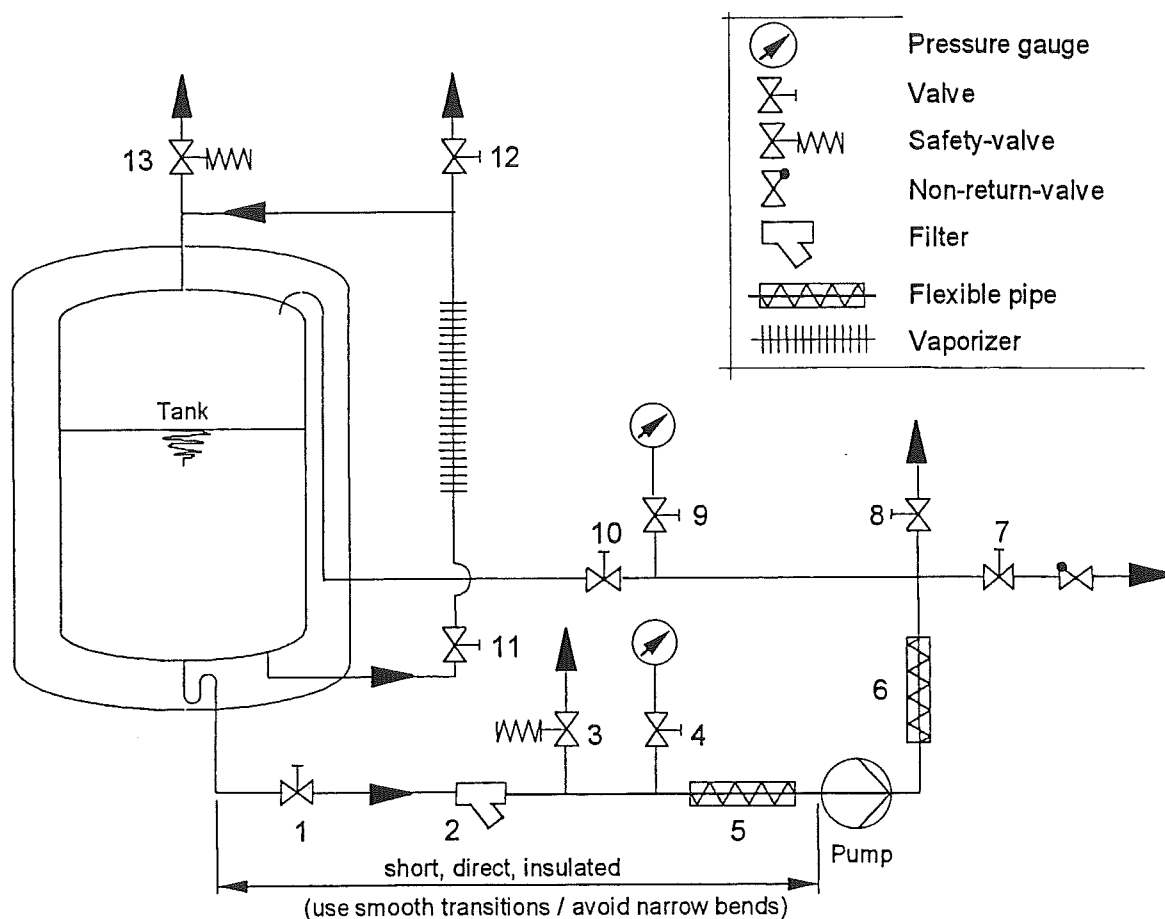
The connection of links and lines on the terminal board are dependant of the rated voltage and winding phase; e.g. for a squirrel cage induction motor with winding phase for 230 V Δ / 400 V Y with one speed the following connections must be done:

	Running connection		
	Direct-on-line starting in		Y Δ - starting
	230 V	400 V	230 V
Connection of the winding phases			<p>The ends of the 3 windings are connected to the Y-Δ starter</p>
Connection of links and lines	 <p>Δ-connection</p>	 <p>Y-connection</p>	

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	

C-25/G2, Drawing: 1 13605

Cold End

1	1		1	Shaft	
2	1	1	1	Roller-bearing	
3	1			Circlip Ø 35 x 1,5	
4	1			Supporting-ring Ø 30 x 42 x 2,5	
5	1	1	1	Split-race ball-bearing	
6	2	2	2	Shim Ø 60 x 72 x 0,2	
7	1	1	2	Preloading-ring Ø 71 x 61 x 0,5	
8	1		1	Distance-ring	
9	1			Distance-ring	
10	1	1	1	Roller-bearing	
11	1			Circlip J72 x 2,5K	
12	1			Ring	
13	2			Key C6 x 6 x 32	
14	1	1	2	Safety washer MB5	
15	1			Shaft-nut	
16	1	1	1	V-Ring	
17	1			Cover	
18	1	1	1	O-Ring Ø 94 x 3	
19	4			Split lock washer M5	
20	4			Socket head cap screw M5 x 20	
21	1			Bearing-casing support	
22	1			Spring tension pin Ø 6 x 14	
23	1			Screw-plug M16 x 1,5	
24	1			Seal-washer Ø 16 x 22 x 1,5	
25	1			Spring tension pin Ø 3 x 8	
26	1			Gear	
27	-				
28	-				
29	-				
30	1			Slinger disc	
31	2			Socket set screw M5 x 10	
32	1			Insulation-ring	
Nomenclature					Material
Recommended Spare Parts					Rev: 0
Required Spare Parts					Date: 2.04.2001
Parts Per Unit					
Item-No.					

C-25/G2, Drawing: 1 13605

Cold End

33	1			Rear casing	
34	1	1	1	Wear-ring	
35	2			Socket set screw M5 x 10	
36	1		1	Labyrinth outer-bushing	
37	4			Washer M5	
38	4			Socket head cap screw M5 x 35	
39	2			Fitting	
40	-			Seal-washer Ø 13,5 x 10 x 1	
41	1		1	Labyrinth-bushing	
42	1		1	Shaft-bushing	
43	1	1	1	Mechanical seal	
44	1	1	1	Lead bushing	
45	4			Socket head cap screw M4 x 10	
46	1	1	3	Seal washer Ø 75 x 48 x 0,2	
47	8			Socket head cap screw M5 x 25	
48	8			Washer M5	
49	8			Strain washer M5	
50	3	1	1	Shim Ø 31 x 27 x 1	
51	1	1	2	Rotating-ring	
52	1			Impeller	
53	2			Key C8 x 6 x 30	
54	1			Impeller-cap (Inducer Pos. 55 as alternative)	
55	1			Inducer (Impeller-cap Pos. 54 as alternative)	
56	2			Spring tension pin Ø 3 x 8	
57	2			Strain washer M10	
58	1			Socket head cap screw M10 x 35	
59	1			Safety screw M20 x 1	
60	1			Circlip Ø 20 x 1	
61	1			Pump-casing	
62	1	1	1	Wear-ring	
63	2			Socket set screw M5 x 10	
64	16			Stud M12 x 70	
Nomenclature					Material
Recommended Spare Parts					Rev: Date:
Required Spare Parts					0 2.04.2001
Parts Per Unit					
Item-No.					

C-25/G2, Drawing: 1 13605

Cold End

65	16			Split lock washer M12	
66	16			Hexagon nut M12	
67	1m	2m	10m	Seal cord 3 x 1,5 x approx 1200 mm	
68	1			Diffusor	
69	6			Socket head cap screw M5 x 22	
70	6			Washer M5	
71	6			Strain-washer M5	
72	6			Circlip Ø 10 x 1	
73	1			Blade-ring (Ring Pos.74 as alternative)	
74	1			Ring (Blade-ring Pos.73 as alternative)	
			3	PTFE compound ring for mechanical seal	
Nomenclature					Material
Recommended Spare Parts					Rev: Date:
Required Spare Parts					0 2.04.2001
Parts Per Unit					
Item-No.					

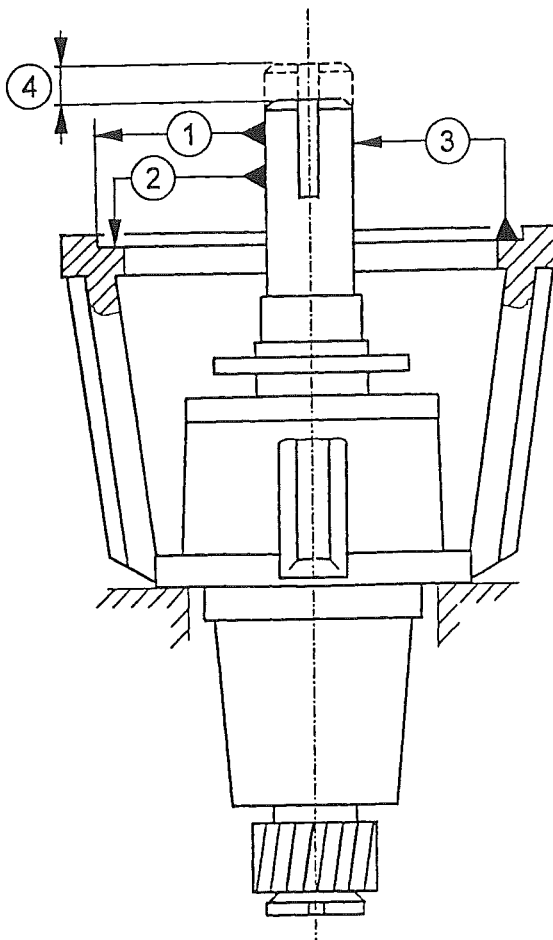
G2/EM, Drawing: 2 11231

Gearbox

1	4			Hex. nut M16	
2	4			Split lock washer M16	
3	4			Washer M16	
4	4			Stud M16 x 40	
5	2			Hex. cap screw M5 x 20	
6	2			Strain washer M5	
7	-			Motorshaft	
8	1			Ring	
9	1			Gear	
10	1			Lubricant slinger disc	
11	1			Casing	
12	1			Gasket Ø 252 x 348 x 0,5	
13	1		1	Vent-filter G 1/2"	
14	1			Lubricant-filling plug G 3/8"	
15	1	1	1	O-ring Ø 124,5 x 3	
16	2			Plug screw M16 x 1,5	
17	2			Seal-washer Ø16 x 22 x 1,5	
18	1			Key A10 x 8 x 40	
19	1			Circlip Ø 35 x 1,5	
20	1			Ring	
21	4			Socket head cap screw M10 x 35	
22	4			Split lock washer M10	
23	4			Thread-bushing M10	
24	1		1	Lubricant-level check-glass G 3/4"	
25	1			Lubricant-drain screw	
	2 lit.		2 lit.	Lubricant LUBCON Turmoxygen LC40	
Nomenclature					Material
Recommended Spare Parts					Rev: Date:
Required Spare Parts					0 26.10.00
Parts Per Unit					
Item-No					

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

A Laterne - Welle / Bearing-casing support - Shaft / Lanterne support - Arbre



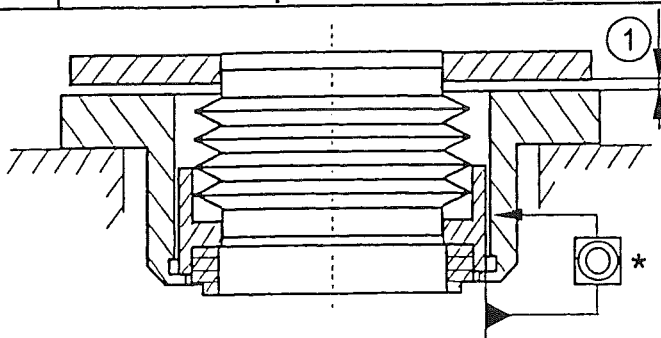
	min.	max.	gemessen measured mesuré
1	-	0,05	
2	-	0,05	
3	-	0,04	
4	0,15	0,35	

Um Maß 4 einstellen zu können, siehe in Betriebsanleitung Paragraph 13.2 "Messvorgang".

To adjust measure 4 see Instruction manual chapter 13.2 "Measuring procedure".

Pour ajuster la cote 4, voir dans le Manuel d'instruction le paragraphe 13.2 "Procédure de mesure".

B 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	G2
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ANNEX

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

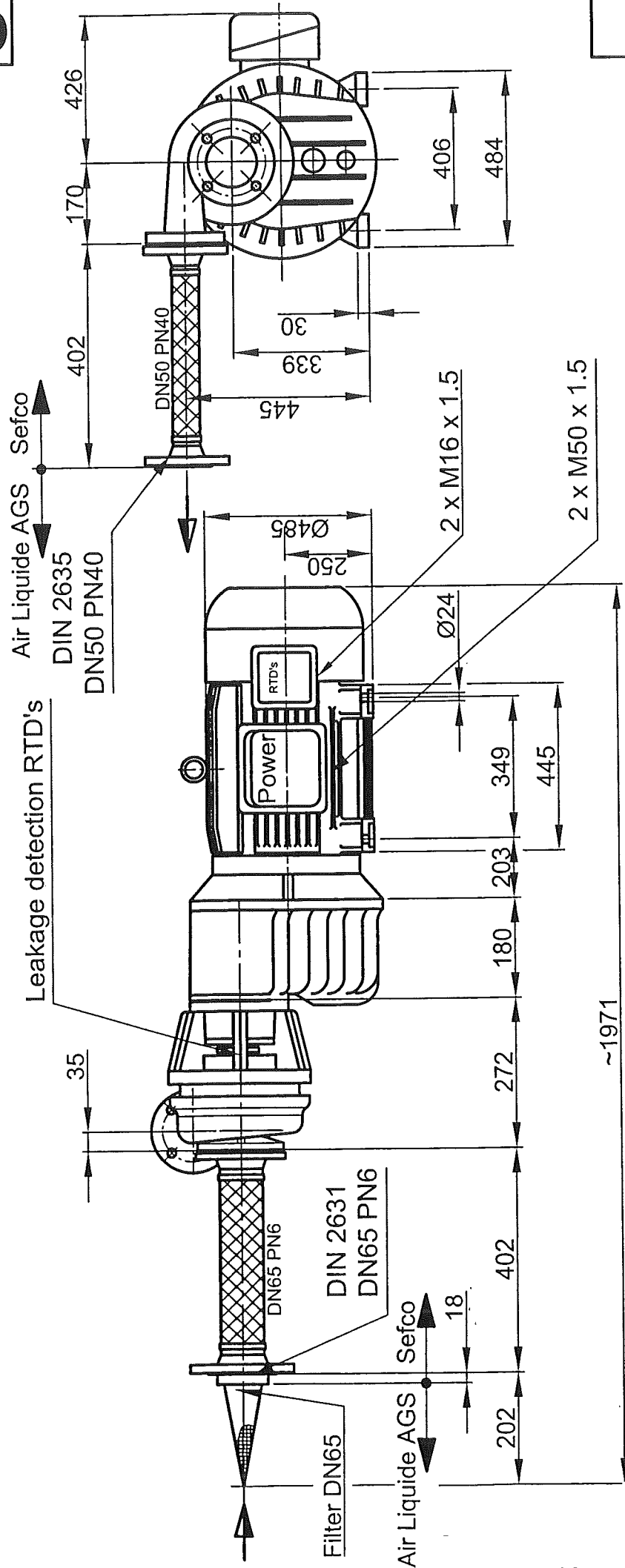
2	23.08.2004	NS	Gezeichnet Dessiné	Geprüft Contrôlé
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sefco

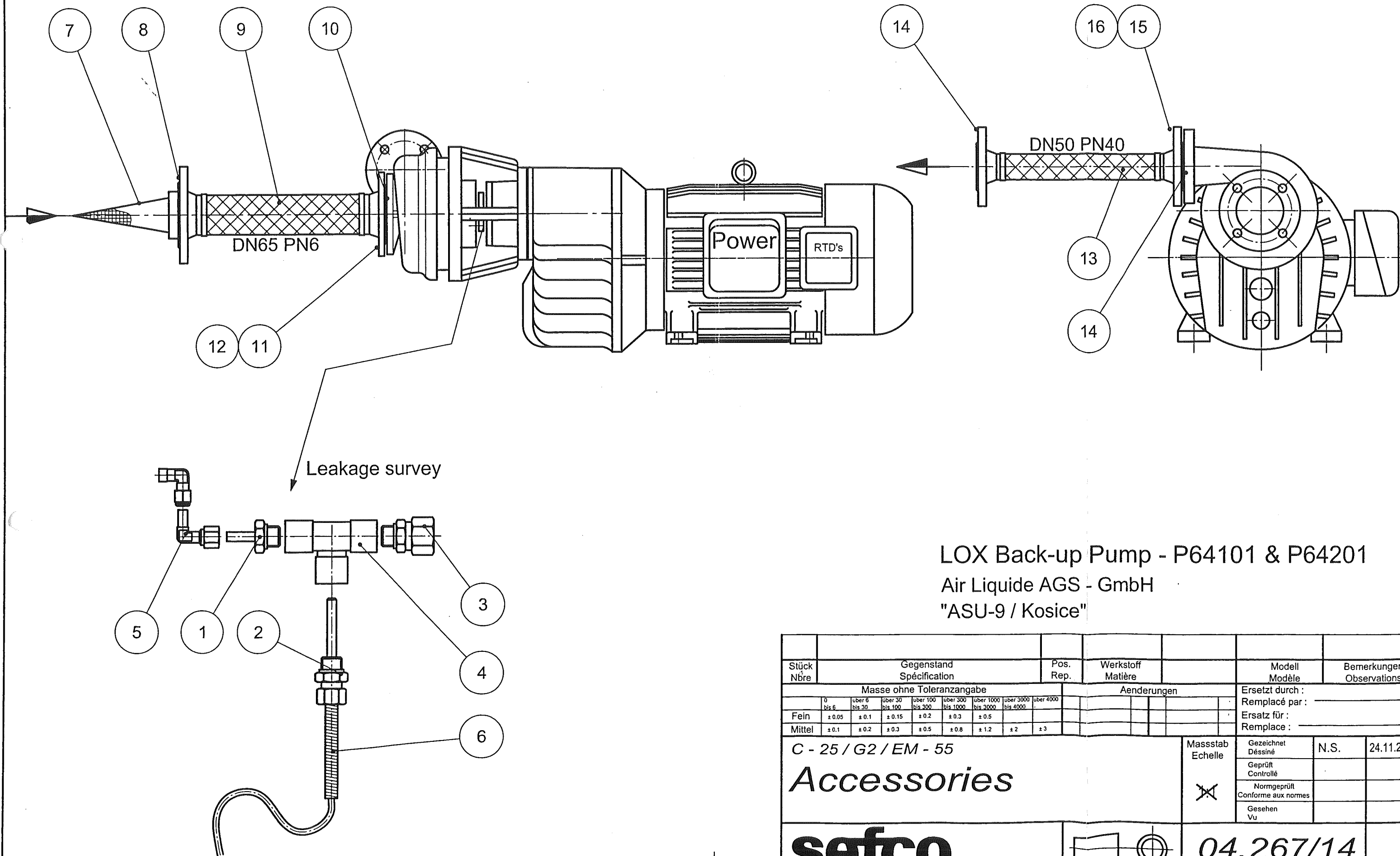
04.267

Pump type : C - 25 / G2 / EM - 55
 Motor type : 250M - 55 kW
 Weight : approx. 510 Kg



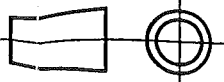
Arrangement drawing : LOX Back-up Pump P64101 & P64201 Air Liquide AGS - GmbH "ASU-9 / Kosice"



Max nozzle loadings according to drawing 4 13576



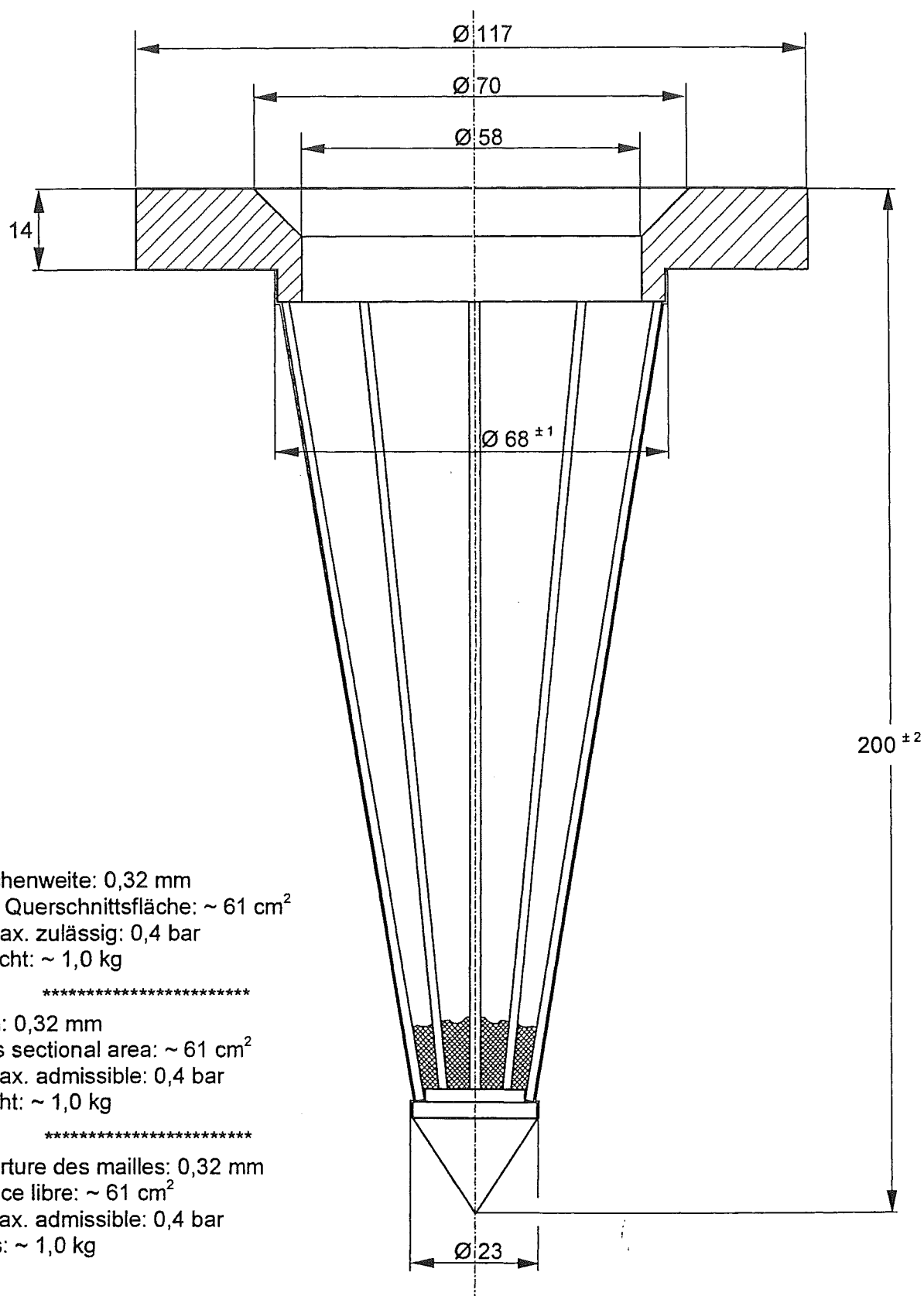
LOX Back-up Pump - P64101 & P64201
Air Liquide AGS - GmbH
"ASU-9 / Kosice"

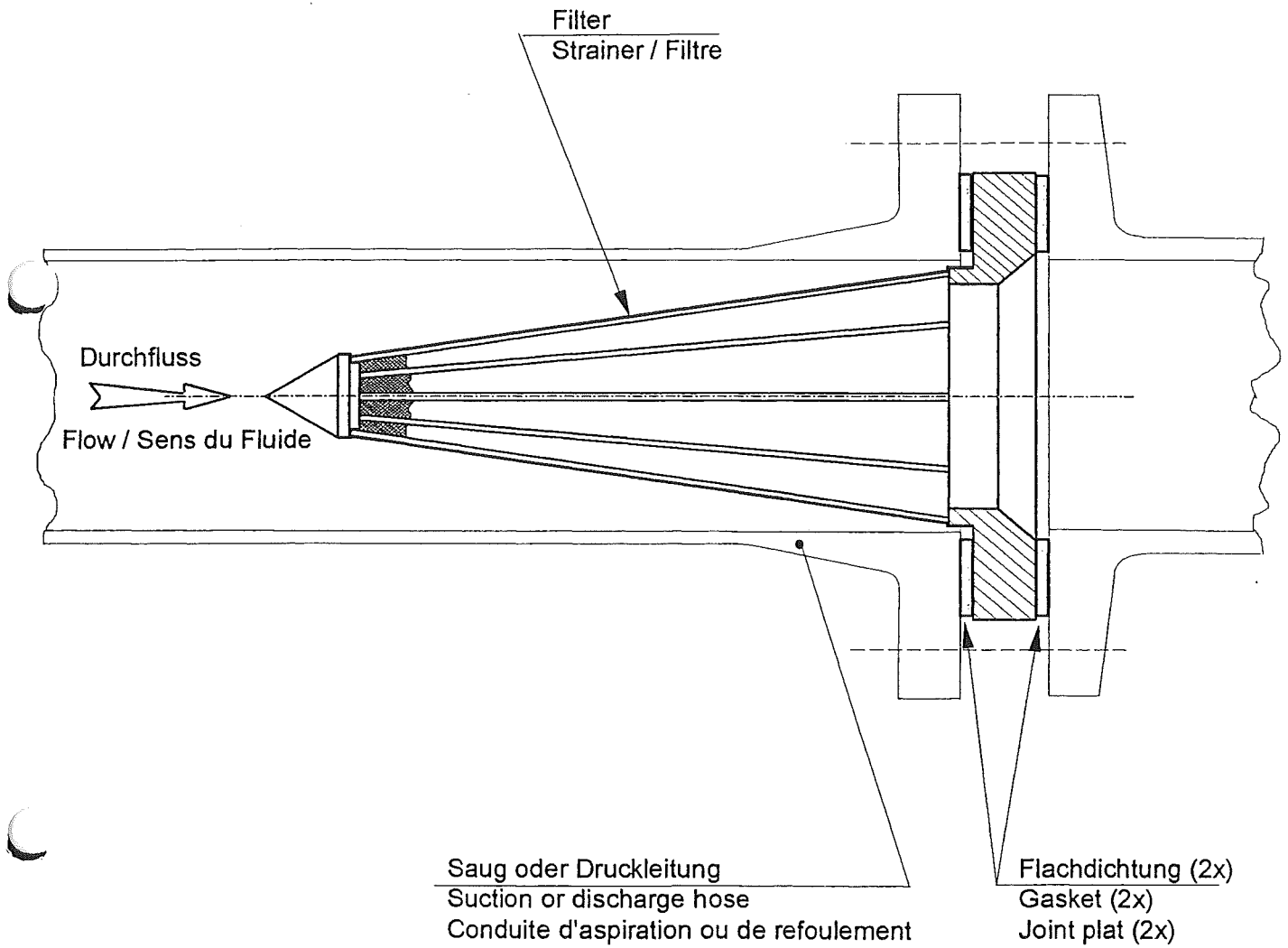
Stück Nbre	Gegenstand Spécification								Pos. Rep.	Werkstoff Matière		Modell Modèle	Bemerkungen Observations		
Masse ohne Toleranzangabe										Aenderungen				Ersetzt durch :	
	0 bis 6	über 6 bis 30	über 30 bis 100	über 100 bis 300	über 300 bis 1000	über 1000 bis 3000	über 3000 bis 4000					Remplacé par :			
Fein	± 0.05	± 0.1	± 0.15	± 0.2	± 0.3	± 0.5						Ersatz für :			
Mittel	± 0.1	± 0.2	± 0.3	± 0.5	± 0.8	± 1.2	± 2	± 3				Remplace :			
C - 25 / G2 / EM - 55										<div>Massstab Echelle</div> <div></div>		Gezeichnet Dessiné	N.S.	24.11.2004	
Accessories												Geprüft Contrôlé			
												Normgeprüft Conforme aux normes			
												Gesehen Vu			
										04.267/14					

Drawing: 04.267/14

Accessories P64101 - P64201

1	1	Adjustable male adapter Ø 6 - 1/4"	
2	1	Temperature probe union Ø 6 - 1/4"	
3	1	Male adaptor union Ø 6 - 1/4"	
4	1	T female Ø 1/4"	
5	1	Adjustable elbow union Ø 6	
6	1	Dual RTD's	
7	1	Suction strainer DN65	
8	2	Gasket Ø 115 x 77 x 2	
9	1	Flexible suction hose DN65 PN6	
10	1	Gasket Ø 115 x 77 x 2	
11	4	Washer M12	
12	4	Hexagon cap screw M12 x 40	
13	1	Flexible discharge hose DN50 PN40	
14	2	Gasket Ø 107 x 61 x 2	
15	4	Washer M16	
16	4	Hexagon cap screw M16 x 45	
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	1.12.2004





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 Schaltepunkte
Function	Sensor type	Shaft seal type	Recommended set point
Fonction	Type de sonde	Etanchéité type	Réglage recommandé

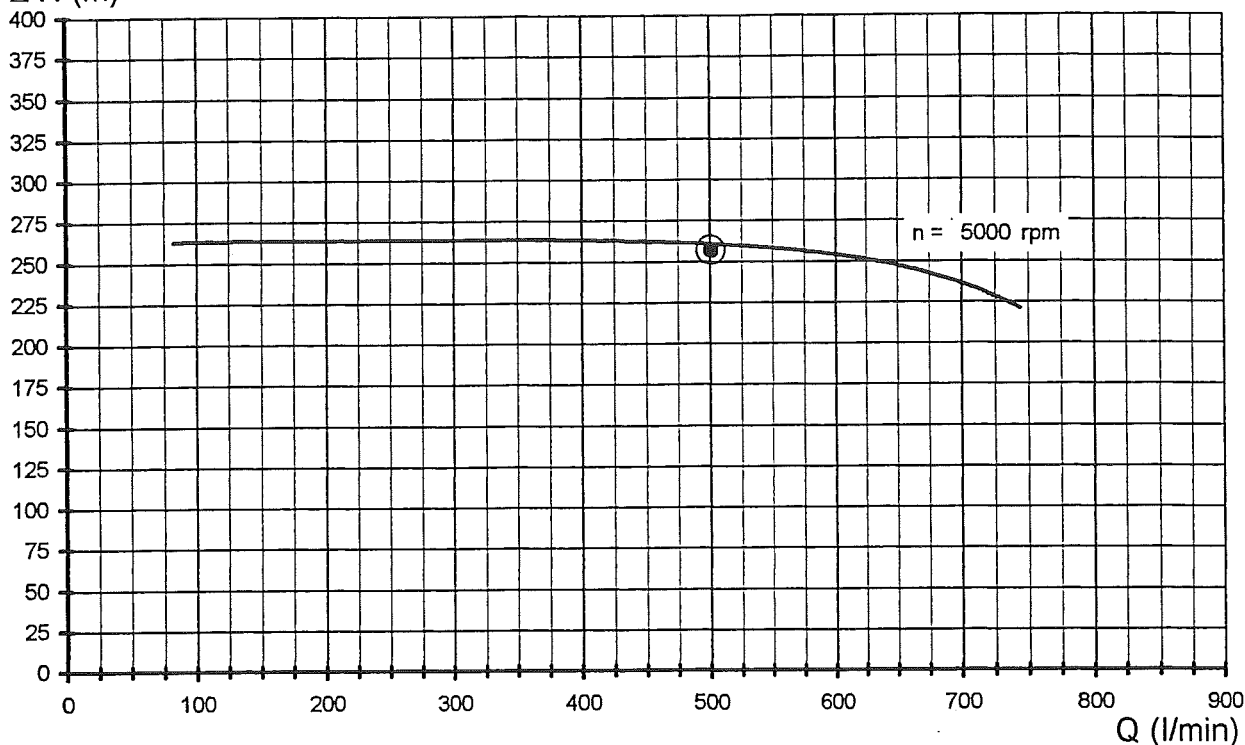
Kaltfahrüberwachung	PT100		-140°C
Cool down survey	RTD		
Contrôle de mise à froid	PT100		

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)	

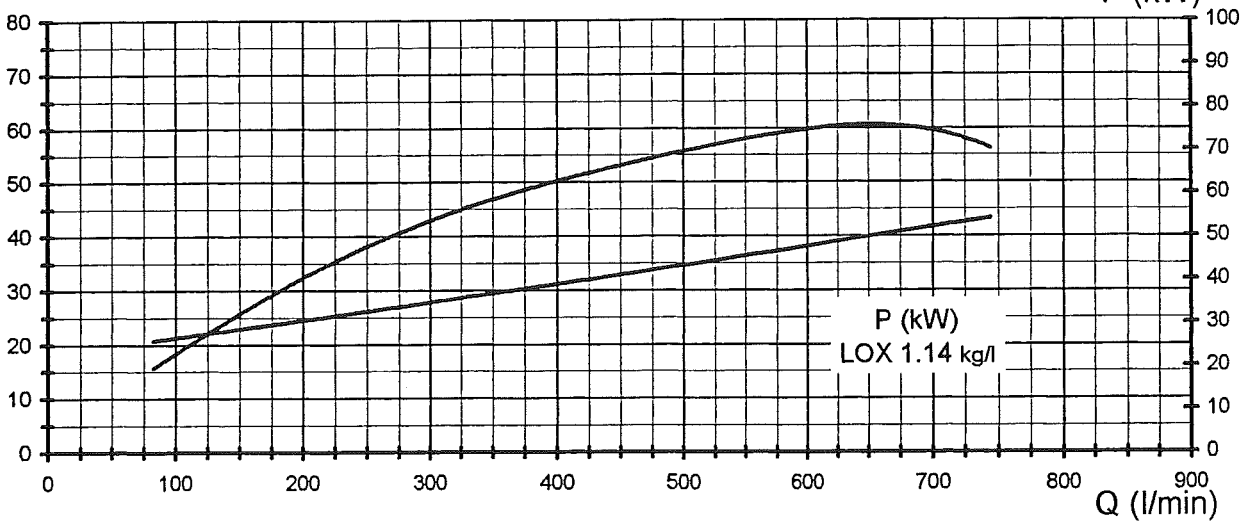
Impeller Ø 250 / 5.5 mm with Inducer , Blade-ring , Diffuser 550

ΔH (m)

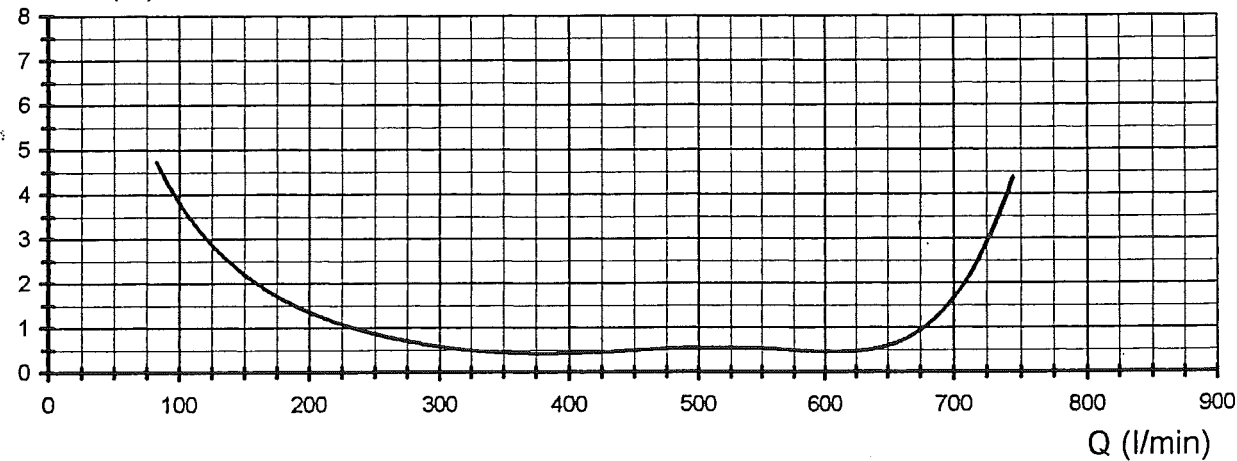


η (%)

P (kW)



NPSH (m)



Geprüft
Contrôle

Gezeichnet
Dessiné

Geprüft
Contrôle

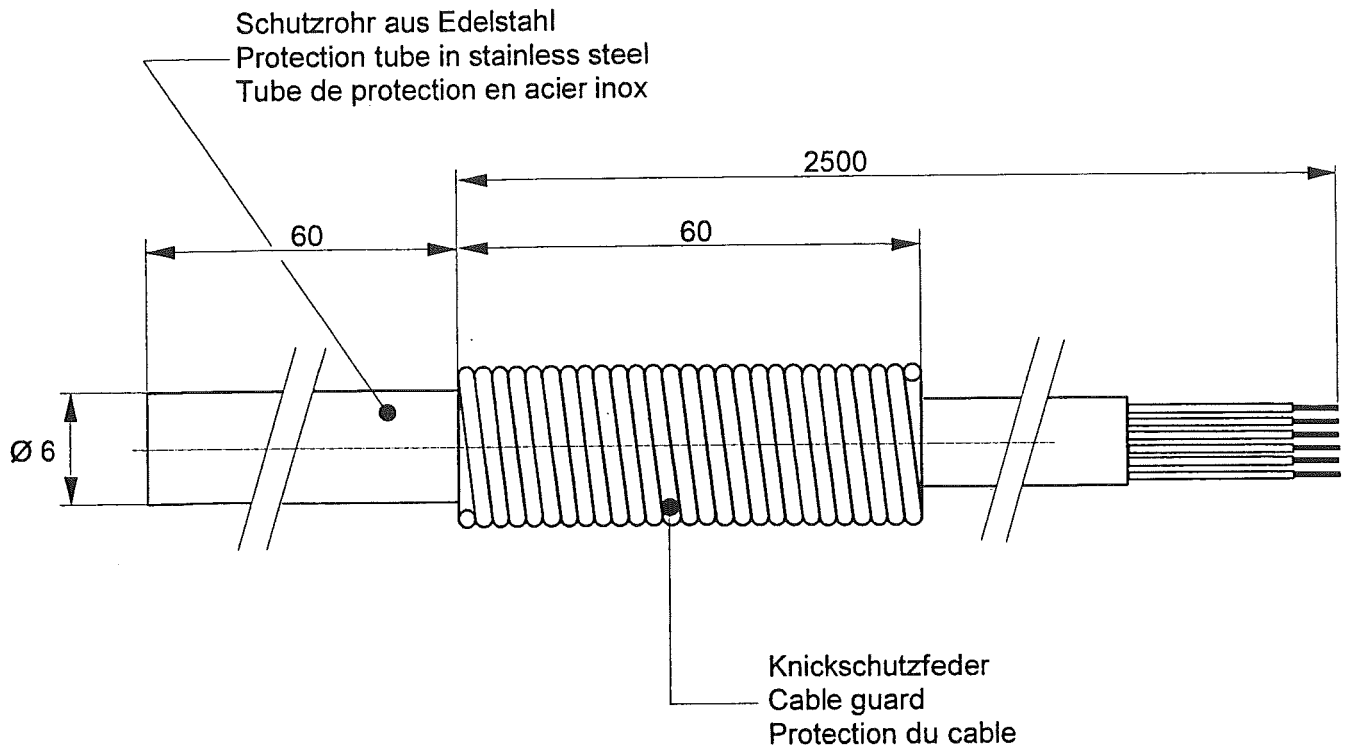
Gezeichnet
Dessiné

25.06.2004

29.06.2004

1

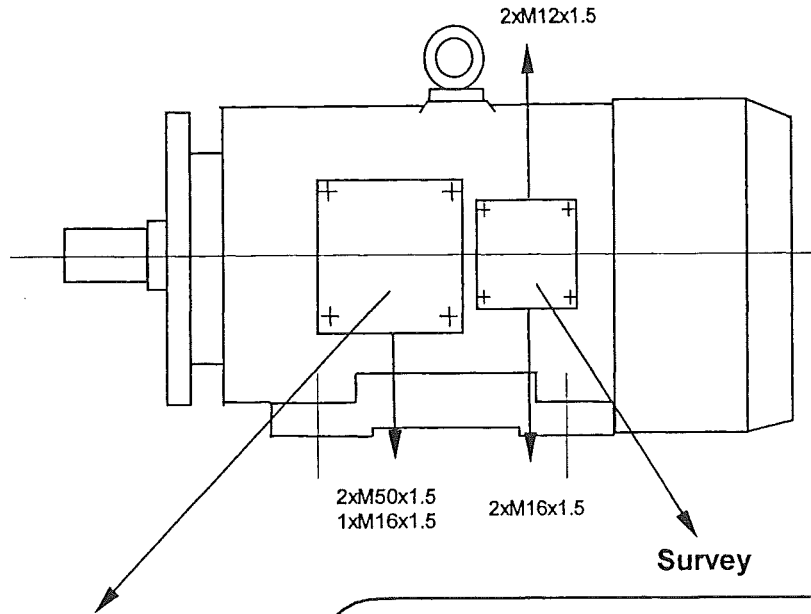
1

**Typ - Type**

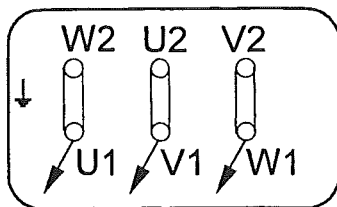
- Widerstandsfühler 2x PT100, 2x 3 Leiter Klasse B
- Temperature sensor 2x PT100 (dual RTD's), 2x 3 wires class B
- Sonde de température 2x PT100, 2x 3 conducteurs classe B

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

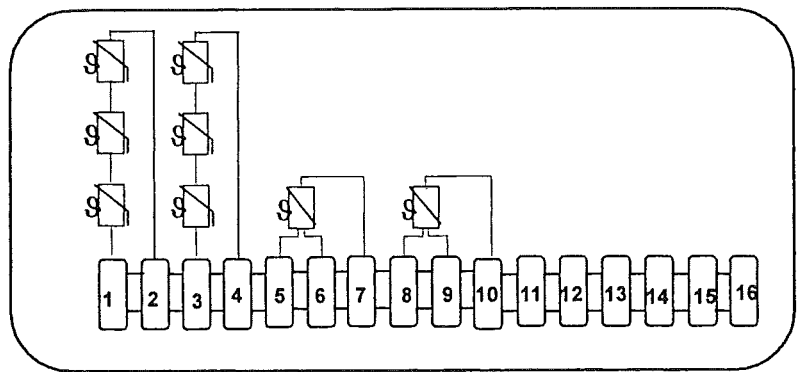
Messer AGS GmbH
 Order No.: Z11/4500023387
 Tag No.: P64101 - P64201
 Project Name: „ASU Kosice“



Motor 250 M



Δ-Connection 400V / 50Hz / 99A / 55KW



Wiring-Table

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

} dual RTD's

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

0	26.08.2004	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		

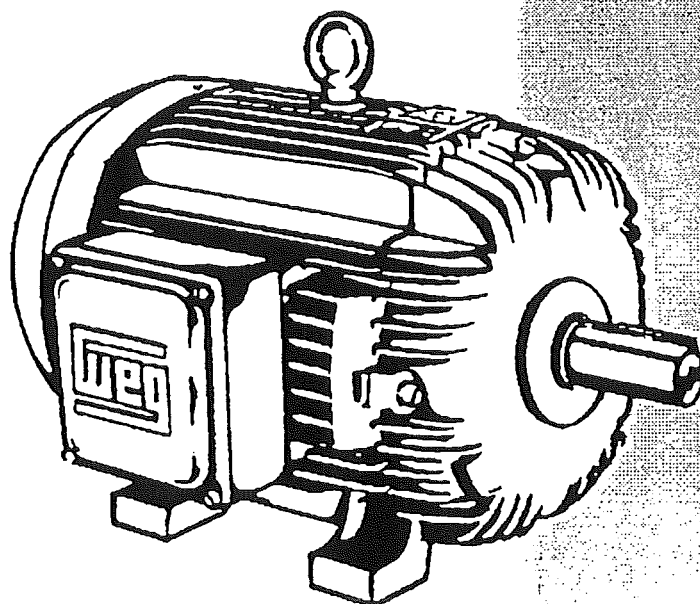
Wicklung	PTC	Isolationsklasse F Alarm : +130°C Abschaltung : +150°C	
Winding	Thermistor	Insulation class F Alarm : +130°C Trip : +150°C	
Bobinage	Thermistor	Isolation svt. F Alarmer : +130°C Arrêt : +150°C	

ENGLISH

**INSTALLATION AND
MAINTENANCE INSTRUCTIONS
FOR ELECTRIC MOTORS**



MOTORS AND DRIVERS



02830.1400

ENGLISH



**READ CAREFULLY THIS MANUAL
BEFORE INSTALLING THE MOTOR**

RECEIVING CHECK

Check if any damage has occurred during transportation.

- ✓ Check nameplate data.
- ✓ Remove shaft locking device (if any) before operating the motor.
- ✓ Turn the shaft with the hand to make sure it is turning freely.

HANDLING AND TRANSPORTATION

1 - General



**MOTORS MUST NOT BE LIFTED BY
THE SHAFT, BUT BY THE EYEBOLTS**

Lifting devices, when supplied, are designed only to support the motor. If the motor has two lifting devices then a double chain must be used to lift it.

Lifting and lowering must be done gently without any shocks, otherwise the bearings can get damaged.



**DURING TRANSPORTATION,
MOTORS FITTED WITH ROLLER OR
ANGULAR CONTACT BEARINGS
ARE PROTECTED AGAINST
BEARING DAMAGES WITH A
SHAFT LOCKING DEVICE.**



**THIS LOCKING DEVICE MUST BE
USED ON ANY FURTHER MOTOR
TRANSPORTATION, EVEN WHEN
THIS MEANS TO UNCOUPLE
THE MOTOR FROM THE DRIVEN
MACHINE.**

STORAGE

If motors are not immediately installed, they must be stored in dry places, free of dust, vibrations, gases, corrosive smokes, under constant temperature and in normal position free from other objects.

Motor storage temperature must remain between 5°C to 60°C, with relative humidity not exceeding 50%.

In case the motors are stored for more than two years, the bearings must be replaced or the lubrication grease must be totally removed after cleaning.

Single phase motors when kept in stock for 2 years or more must have their capacitors replaced (if any).

We recommend to turn the shaft (by hands) at least once a month, and to measure the insulation resistance before installing it, in cases of motors stored for more than 6 months or when subject to high humidity areas.

If motor is fitted with space heaters, these should be switched on.

Insulation Resistance Check

Measure the insulation resistance before operating the motor and/or when there is any sign of humidity in the winding.

The resistance measured at 25°C must be:

$$R_i \geq (20 \times U) / (1000 + 2P) \text{ [M}\Omega\text{]}$$

(measured with a MEGGER at 500 V d.c.)
where U = voltage (V); P = power (kW).

If the insulation resistance is less than 2 megaohms, the winding must be dried according to the following:

Warm it up inside an oven at a minimum temperature of 80°C increasing 5°C every hour until 105°C, remaining under this temperature for at least one hour.

Check if the stator insulation resistance remains constant within the accepted values. If not, stator must be reimpregnated.

INSTALLATION

1 - Safety

All personnel involved with electrical installations, either handling, lifting, operation or maintenance must be well informed and updated concerning safety standards and principles that govern the work and carefully follow them.

We strongly recommend that these jobs are carried out by qualified personnel.



MAKE SURE THAT ELECTRIC MOTORS ARE SWITCHED OFF BEFORE STARTING ANY MAINTENANCE SERVICE.

Motors must be protected against accidental starts.

When performing any maintenance service, disconnect the motor from the power supply. Make sure all accessories have been switched off and disconnected.

In order to prevent from penetrating dust and/or water into the terminal box, cable glands or threaded pipe in the lead holes must be installed.

Do not change the regulation of the protecting devices to avoid damaging.

2 - Operating Conditions

Electric motors, in general, are designed for operation at an altitude of 1000m above sea level for an ambient temperature between 0°C and 40°C. Any variation is stated on the nameplate.



COMPARE THE CURRENT, VOLTAGE, FREQUENCY, SPEED, OUTPUT AND OTHER VALUES DEMANDED BY THE APPLICATION WITH THE DATA GIVEN ON THE NAMEPLATE.

Motors supplied for hazardous locations must be installed in areas that comply with that specified on the motor nameplate.



KEEP AIR INLET AND OUTLET FREE AND CLEAN. THE AIR BLOWN OUT BY THE MOTOR SHALL NOT ENTER AGAIN. THE DISTANCE BETWEEN THE AIR INLET AND THE WALL MUST BE AROUND 1/4 OF THE INLET OPENING DIAMETER.

3 - Foundation

Motors provided with feet must be installed on solid foundations to avoid excessive vibrations.

The purchaser is fully responsible for the foundation.

Metal parts must be painted to avoid corrosion.

The foundation must be uniform and sufficiently tough to support any shock. It must be

designed in such a way to stop any vibration originated from resonance.

4 - Drain Holes

Make sure the drains are placed in the lower part of the motor when the mounting configuration differs from that specified on the motor purchase order.

5 - Balancing



WEG MOTORS ARE DYNAMICALLY BALANCED WITH HALF KEY, AT NO LOAD AND UNCOUPLED.

Transmission elements such as pulleys, couplings, etc must be dynamically balanced with half key before installation.

Use always appropriate tools for installation and removal.

6 - Alignment



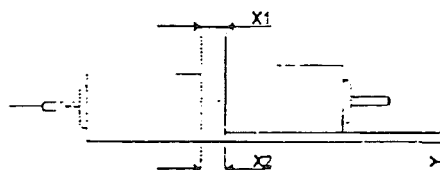
ALIGN THE SHAFT ENDS AND USE FLEXIBLE COUPLING, WHENEVER POSSIBLE.

Ensure that the motor mounting devices do not allow modifications on the alignment and further damages to the bearings.

When assembling a half-coupling, be sure to use suitable equipment and tools to protect the bearings.

Suitable assembly of half-coupling:

Check that clearance Y is less than 0.05 mm and that the difference X1 to X2 is less than 0.05 mm, as well.



Note: Dimension X1 and X2 must be 3mm minimum

Figure and alignment tolerances

7 - Belt Drive

When using pulley or belt coupling, the following must be observed:

Belts must be tighten just enough to avoid slippage when running, according to the

specifications stated on the belt supplier recommendation.

WARNING:

Excessive tension on the pulleys will damage the bearings and lead to a probable shaft rupture.

8 - Connection

WARNING:

Voltage may be connected at standstill inside the terminal box for heating elements or direct winding heating.

WARNING:

The capacitor on single-phase motors can retain a charge which appears across the motor terminals, even when the motor has reached standstill.



A WRONG CONNECTION CAN BURN THE MOTOR.

Voltage and connection are indicated on the nameplate. The acceptable voltage variation is $\pm 10\%$; the acceptable frequency variation is $\pm 5\%$ and the total acceptable variation is $\pm 10\%$.

9 - Starting Methods

The motor is rather started through direct starting. In case this is not possible, use compatible methods to the motor load and voltage.

The rotation direction is clockwise if the motor is viewed from DE side and if the phases are connected according to the sequence L1, L2, L3.

To change the rotation direction, interchange two of the connecting leads.



THE CONNECTION TO THE POWER SUPPLY MUST BE DONE BY QUALIFIED PERSONNEL AND WITH FULL ATTENTION TO ASSURE A SAFE AND PERMANENT CONNECTION. AFTER CONNECTING THE MOTOR, CHECK FOR ANY STRANGE BODY INSIDE THE TERMINAL BOX. THE CABLE INLETS NOT IN USE MUST BE CLOSED.

Make sure to use the correct cable dimension, based on the rated current stamped on the motor nameplate.



BEFORE ENERGIZING THE TERMINALS, CHECK IF THE GROUNDING IS MADE ACCORDING TO THE CURRENT STANDARDS. THIS IS ESSENTIAL AGAINST ACCIDENT RISKS.

When the motor is supplied with protective or monitor temperature device such as thermostats, thermistors, thermal protector, etc, connect their terminals to the corresponding devices on the control panel.

10 - Start-Up



THE KEY MUST BE FASTENED OR REMOVED BEFORE STARTING THE MOTOR.

a) The motor must start and operate smoothly. In case this does not occur, turn it off and check the connections and the mounting before starting it again.

b) If there is excessive vibration, check if the fastening screws are correctly fastened. Check also if the vibration comes from a neighbour machine. Periodical vibration checks must be done.

c) Run the motor under rated load for a short period of time and compare if the running current is equal to that stamped on the nameplate.

MAINTENANCE



**WARNING:
SAFETY CHECK LIST**

1 - General Inspection

- ✓ Check the motor periodically.
- ✓ Keep the motor clean and assure free air flow.
- ✓ Check the seals or V Ring and replace them, if required.
- ✓ Check the connections as well as supporting screws.
- ✓ Check the bearings and observe: Any excessive noise, vibration, bearing temperature and grease condition.
- ✓ When a change, under normal conditions, is detected, check the motor and replace the required parts.

The frequency of the inspections depends on the motor type and on the application conditions.

LUBRICATION



FOLLOW THE REGREASING INTERVALS. THIS IS FUNDAMENTAL FOR PROPER MOTOR OPERATION.

1 - Machines without Grease Nipples

Motors up to frame 200 are normally fitted without grease nipples. In these cases the regreasing shall be done at the preventive maintenance job observing the following aspects:

- ✓ Disassemble carefully the motors.
- ✓ Take all the grease out.
- ✓ Wash the bearing with querosene or diesel.
- ✓ Regrease the bearing immediately.

2 - Machines Fitted with Grease Nipples

It is strongly recommended to grease the machine while running. This allows the grease renewal in the bearing housing. When this is not possible due to turning parts by the grease device (pulleys, bushing, etc) that offer some risk to the physical integrity of the operator, proceed as follows:

- ✓ Clean the area near the grease nipple.
- ✓ Put approximately half of the total grease and run the motor for 1 minute at full speed.
- Then turn off the motor and insert the rest of the grease.
- ✓ The injection of all the grease with the motor in standstill can make the grease penetrate into the motor, through the inner seal of the bearing housing.



FOR LUBRICATION USE ONLY MANUAL GREASE GUN.

RELUBRICATION INTERVALS

TABLE 1 - BALL BEARINGS - Series 62/63

Relubrication intervals (running hours – horizontal position)													
	II pole		IV pole		VI pole		VIII pole		X pole		XII pole		Grease
Serie 62													
Bearing	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	(g)
6209	18400	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	9
6211	14200	16500	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	11
6212	12100	14400	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	13
Serie 63													
Bearing	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	(g)
6309	15700	18100	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	13
6311	11500	13700	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	18
6312	9800	11900	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	21
6314	3500	4500	9700	11600	14200	16400	17300	19700	19700	20000	20000	20000	27
6316	-	-	8500	10400	12800	14900	15900	18700	18700	20000	20000	20000	34
6319	-	-	7000	9000	11000	13000	14000	17400	17400	18500	18600	20000	45
6322	-	-	5100	7200	9200	10800	11800	15100	15100	15500	15500	19300	60

TABLE 2 - ROLLER BEARINGS - Series NU 3

Relubrication intervals (running hours - horizontal position)													
	II pole		IV pole		VI pole		VIII pole		X pole		XII pole		Grease
Bearing	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	60Hz	50Hz	(g)
NU 309	9800	13300	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	13
NU 311	6400	9200	19100	20000	20000	20000	20000	20000	20000	20000	20000	20000	18
NU 312	5100	7600	17200	20000	20000	20000	20000	20000	20000	20000	20000	20000	21
NU 314	1600	2500	7100	8900	11000	13100	15100	16900	16900	19300	19300	20000	27
NU 316	-	-	6000	7600	9500	11600	13800	15500	15500	17800	17800	20000	34
NU 319	-	-	4700	6000	7600	9800	12200	13700	13700	15700	15700	20000	45
NU 322	-	-	3300	4400	5900	7800	10700	11500	11500	13400	13400	17300	60
NU 324	-	-	2400	3500	5000	6600	10000	10200	10200	12100	12100	15000	72

Note:

- ✓The ZZ bearings from 6201 to 6307 do not require relubrication as its life time is about 20,000 hours.
- ✓Tables 1 and 2 are intended for the lubrication period under bearing temperature of 70°C (for bearings up to 6312 and NU 312) and temperature of 85°C (for bearings 6314 and NU 314 and larger).
- ✓For each 15°C of temperature rise, the relubrication period is reduced by half.
- ✓The relubrication periods given above are for those cases applying Polyrex® EM grease.
- ✓When motors are used on the vertical position, their relubrication interval is reduced by half if compared to horizontal position motors.



WE RECOMENDED TO USE BALL BEARINGS FOR MOTORS DIRECTLY COUPLED TO THE LOAD.



**WARNING:
EXCESS OF GREACE CAN CAUSE BEARNING OVERHEATING RESULTING IN COMPLETE DAMARGE.**

Compatibility of Polyrex® EM grease with other types of grease:

Containing polyurea thickener and mineral oil, the Polyrex® EM grease is compatible with other types of grease that contain:

- ✓Lithium base or complex of lithium or polyurea and highly refined mineral oil.
- ✓Inhibitor additive against corrosion, rust and anti-oxidant additive.

Notes:

- ✓Although Polyrex® EM is compatible with types of grease given above, we do not recommended to mix it with any other greases.
- ✓If you intend to use a type of grease different than those recommended above, first contact WEG.
- ✓On applications (with high or low temperatures, speed variation, etc), the type of grease and relubrication interval are given on an additional nameplate attached to the motor.



THE USE OF STANDARD MOTORS IN SPECIFIC AREAS OR SPECIAL APPLICATIONS MUST BE DONE BY CONSULT TO THE GREASE MANUFACTURER OR WEG

DISASSEMBLY AND ASSEMBLY

Disassembly and assembly must be done by qualified personnel using only suitable tools and appropriated methods.

The stator grips must be applied over the side face of the inner ring to be disassembled or over an adjacent part.

It is essential that bearings assembly be done under cleanning conditions to ensure good operation and to avoid damages. New bearings shall only be taken out from their cases when assembling them.

Before installing a new bearing it is required to check the shaft fitting for any sharp edge or strike signals.

For bearing assembly warm their inner parts with suitable equipment - inductive process - or use suitable tools.

SPARE PARTS

When ordering spare parts, please specify the full type designation and product code as stated on the motor nameplate. Please also inform the motor serial number stated on the nameplate.

MOTORS FOR HAZARDOUS LOCATIONS

Besides the recommendations given previously, these ones must be also followed:



THE SPECIFICATION OF THE MOTOR INSTALLATION PLACE IS FOR CUSTOMER'S RESPONSIBILITY, WHO WILL ALSO DETERMINE THE ENVIRONMENT CHARACTERISTICS.

Motors for hazardous locations are manufactured according to specific standards for such environments and they are certified by worldwide certifying entities.

1 - Installation

The complete installation must follow procedures given by the local legislation in effect.



THE INSTALLATION OF HAZARDOUS LOCATION MOTORS MUST BE CARRIED OUT BY SKILLED PEOPLE, AND THE THERMAL PROTECTION MUST BE ALWAYS INSTALLED, EITHER INSIDE OR OUTSIDE THE MOTOR, OPERATING AT THE RATED CURRENT.

2 - Maintenance

Maintenance must be carried out by repair shops authorized by WEG.

Repair shops and people without WEG's authorization who will perform any service on hazardous location motors will be fully responsible for such service as well as for any consequential damage.



**ANY ELECTRICAL OR MECHANICAL
MODIFICATION MADE ON
HAZARDOUS LOCATION MOTORS
WILL VOID THE CERTIFICATION.**

When performing maintenance, installation or relubrication, follow these instructions:

- ✓ Check if all components are free of edges, knocks or dirt.
- ✓ Make sure all parts are in perfect conditions.
- ✓ Lubricate the surfaces of the endshield fittings with protective oil to make the assembly easier.
- ✓ Use only rubber hammer to fit the parts.
- ✓ Check for correct bolts tightening.
- ✓ Use clearance calibrator for correct T-box fitting (smaller than 0.05mm).



**DO NOT REUSE DAMAGED OR
WORN PARTS. REPLACE THEM BY
NEW ONES SUPPLIED BY THE
FACTORY.**

MOTORS DRIVEN BY VFD

Applications using VFD's without filter can affect motor performance as follows:

- ✓ Lower efficiency.
- ✓ Higher vibration.
- ✓ Higher noise level.
- ✓ Higher rated current.
- ✓ Higher temperature rise.
- ✓ Reduced motor insulation.
- ✓ Reduced bearing life.

1- Standard Motors

- ✓ Voltages lower than 440V do not require filter.
- ✓ Voltages equal or higher than 440V or lower than 575V require filter for motor power supply cables longer than 20 meters.
- ✓ Voltages equal or higher than 575V require filter for any size of power supply cables.



**IF SUCH RECOMMENDATIONS ARE
NOT FOLLOWED ACCORDINGLY,
MOTOR WARRANTY WILL BE VOID.**

2- Inverter Duty Motors:

- ✓ Check power supply voltage of the forced cooling set.
- ✓ Filters are not required.

WARRANTY TERMS

Weg warrants its products against defects in workmanship and materials for twelve (12) months from the invoice date issued by the factory, authorized distributor or agent limited to eighteen (18) months from manufacturing date independent of installation date as long as the following items are fulfilled accordingly:

- Proper transportation, handling and storage;
- Correct installation based on the specified ambient conditions and free of corrosive gases;
- Operation under motor capacity limits;
- Observation of the periodical maintenance services;
- Repair and/or replacement effected only by personnel duly authorized in writing by Weg;
- The failed product be available to the supplier and/or repair shop for a required period to detect the cause of the failure and corresponding repair;
- Immediate notice by the purchaser about failures accrued and that these are accepted by Weg as manufacturing defects.

This warranty does not include disassembly services at the purchaser facilities, transportation costs with product, tickets, accommodation and meals for technical personnel when requested by the customer. The warranty service will be only carried out at Weg Authorized Repair Shops or at Weg's facilities.

Components whose useful life, under normal use, is shorter than the warranty period are not covered by these warranty terms.

The repair and/or replacement of parts or components, when effected by Weg and/or any Weg Authorized Repair Shop, will not give warranty extension.

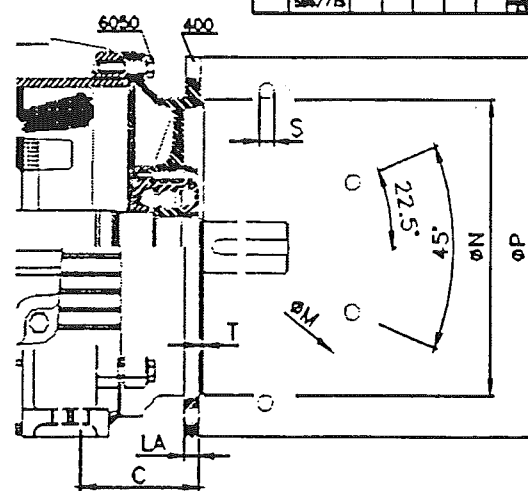
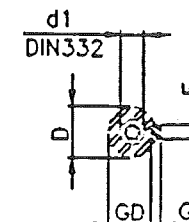
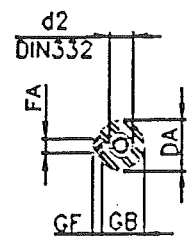
This constitutes Weg's only warranty in connection with this sale and the company will have no obligation or liability whatsoever to people, third parties, other equipment or installations, including without limitation, any claims for consequential damages or labor costs.



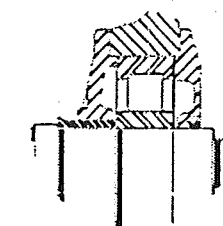


WEG EXPORTADORA S.A.
AV. PREF. WALDEMAR GRUBBA, 3000
89256-900 JARAGUÁ DO SUL, SC - BRAZIL
PHONE (55) (47) 372-4002
FAX (55) (47) 372-4060
<http://www.weg.com.br>

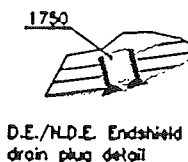
FOR FURTHER INFORMATION PLEASE CONTACT YOUR NEAREST WEG SALES OFFICE



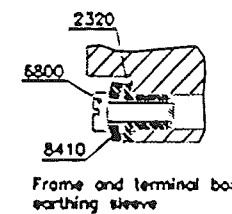
Frame	TT Range dimensions								N° of Motors
	FLANGE	C	LA	EM	EN	EP	S	T	
2255/14	FT-400	149		400	350	430			
2505/18		149	18						
2805/14	FT-500	190		500	450	500	18	5	
3155/14		190							
3155/14	FT-800	218		800	550	680			
3555/14	FT-740	235	22	740	680	800	18	6	



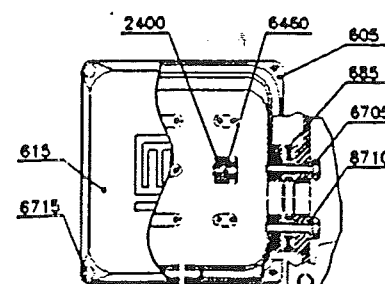
ROL BEARING DETAIL



D.E./N.D.E. Endshield
drain plug detail




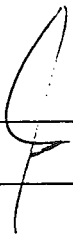
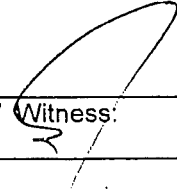
Frame and terminal box
earthing sleeve



Auxiliary terminal box detail

PCS.	DESCRIPTION
100	Additional nameplate bearings
105	Inmetro log
110	Frame
115	D.E. Endshield
120	N.D.E. Endshield
125	Terminal box
130	Auxiliary terminal box
135	Intermediary base
140	Terminal box cover
145	Auxiliary terminal box cover
150	Intermediary base to auxiliary terminal box
155	IFan cover
160	D.E. Internal bearing cap
165	N.D.E. Internal bearing cap
170	D.E. External bearing cap
175	N.D.E. External bearing cap
180	II poles fan
185	IV/V/VIII poles fan
190	IV poles fan
195	VI poles fan
200	VIII poles fan
205	D.E. Bearing circlip
210	Fan fixation bearing circlip
215	N.D.E. Bearing circlip on shaft
220	D.E. key
225	N.D.E. key
230	Fan fixation key
235	Frame 586/77 rotor fixation key
240	Cable gland
245	Threaded plug
250	Terminal block
255	Packing
260	Exportation packing
265	D.E. Bearing
270	N.D.E. Bearing
275	Drain plug
280	D.E. Grease device
285	N.D.E. Grease device
290	Foam
295	Motor painting
300	Protective oil on shaft and flange
305	Earth studs
310	Sinhal connector
315	Grease outlet
320	Grease inlet protection
325	D.E. Bearing seal
330	N.D.E. Bearing seal
335	Shaft locking device
340	D.E. Tacanite labyrinth
345	D.E. Tacanite labyrinth fixation steel ring
350	D.E. Tacanite labyrinth fixation wire ring
355	N.D.E. Tacanite labyrinth
360	N.D.E. Tacanite labyrinth fixation steel ring
365	N.D.E. Tacanite labyrinth fixation wire ring
370	Spring
375	Fan cover fixation screw
380	D.E. Endshield fixation screw
385	N.D.E. Endshield fixation screw
390	D.E. Bearing cap fixation screw
395	N.D.E. Bearing cap fixation screw
400	Terminal block fixation screw
405	Sinhal connector fixation screw
410	Eyeball
415	Terminal box fixation screw
420	Auxiliary terminal box fixation screw
425	Terminal box cover fixation screw
430	Auxiliary terminal box cover fixation screw
435	Earthing sleeve screw
440	D.E./N.D.E. Tacanite labyrinth fixation screw
445	Fan cover fixation spring washer
450	D.E./N.D.E. Endshield fixation spring washer
455	D.E. Bearing cap fixation brass washer
460	N.D.E. Bearing cap fixation brass washer
465	Earthing sleeve cup washer
470	Terminal box fixation spring washer
475	Auxiliary terminal box fixation spring washer
480	Terminal box cover fixation spring washer

[illegible]

	Test Report		No: 2110	
	Three Phase Induction Motors		Date: 17.07.04	
Customer: HS Order: Mounting: B35R Approx. weight: 470 kg				
Identification				
Model: TE 250 SM2 Power: 55.0 kW Insulation class: F Enclosure: IP 55 Service: S1 DT (K): 77 K				
Voltage (V)	Power (kW)	Frequency (Hz)	Current (A)	Speed (rpm) cos Phi
400	55.0	50	90.7	2960
Tests				
No load test				
Voltage:	400 V	Current:	27.1 A	Losses: -
Locked rotor test				
Voltage:	400 V	Frequency:	50 Hz	Current: -
TI/Tn:	2.6	Full load torque:	179 Nm	
Load test				
% of full load	-	50	75	100
Current (A)	-	49.5	69.2	90.7
Speed (rpm)	-	2970	2963	2960
Efficiency (%)	-	92.1	93.5	94.1
Power factor	-	0.87	0.92	0.93
Test condition	Voltage:	400 V	Frequency:	50 Hz
High voltage 2500 V				
Temperature rise by resistance 100% of full load: 77 K				
Notes:				
Approved / Laboratory: 			Approved / Witness: 	

Certificates



DECLARATION OF CONFORMITY

Manufacturer's name and Address: WEG INDÚSTRIAS S.A. - MOTORES
Rua Joinville 3000
BR-89256-900 Jaraguá do Sul – Brazil

We declare under sole responsibility that the products:

- * Three-phase induction motor
IEC frame 63 up to 355M/L
- * Three-phase aluminum frame motor
IEC frame 63 up to 132M

To which this declaration relates are in conformity with the following standards:

- * IEC 60034-1/2 / 2A/5/6/7/8/9/11/12/14
- * IEC 60072 - 1/2

<u>European Standard</u>	<u>German Standard</u>	<u>VDE -Classification</u>
EN 55014-1:1993+A1:1997+A2:1999	DIN EN 55014-1:1999-10	VDE 0875 Part 14-1:1999-10
EN 61000-6-2:1999	DIN EN 61000-6-2:2000-03	VDE 0839 Part 6-2:2000-03
EN 61000-3-2:1995+Corr.:1997+A1:1998 + A2:1998	DIN EN 61000-3-2:1998-10	VDE 0838 Part 2:1998-10
EN 61000-3-2:1995/A14:2000	DIN EN 61000-3-2/A14:2001-01	VDE 0838 Part 2/A14:2001-01

and comply with the requirements of the Low Voltage Directive 73/23/EEC of February 19th, 1973 amended by Directive 93/68/E EC of July 22nd, 1993.

Additional information:

The motors are provided with a CE mark, since January 1st, 1996.

By design, the motors, considered as components, comply with the requirements of:

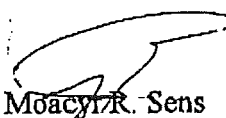
* EEC Directive 89/336/EEC, including amendments, regarding to the intrinsic characteristics to emission and immunity levels and

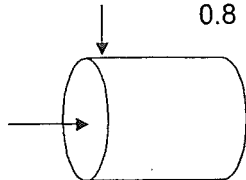
* Machinery Directive 89/392/EEC amended by 91/368/EEC, 93/44/EEC and 93/68/EEC, in accordance with article 4(2) and annex IIB, provided that the motors are installed according to our Installation and Maintenance Instructions.

Certificate of Incorporation:

The above products can not be put into service until the machinery into which they are incorporated has been declared to be in conformity with the Machinery Directive.

Jaraguá do Sul, September 11th, 2002


Moacyr R. Sens
Direttore Tecnico

sefco		Delivery Certificate				Ref. No.: 04.267/1				
Customer:		Air Liquide AGS GmbH - Z11/4500023387 - ASU Kosice						P64101		
Pump Type:		C-25/G2/EM-55								
Motor:		Manufacture : WEG		Type: 250SM2 0904		No.: 0412223201				
		P: 55 [KW]		U: Δ 400 [V]		I: 91 [A]				
		n _{range} : 2960		/ f _{range} : [Hz]		f _{field weakening point} : 50 [Hz]				
Gearbox:		Manufacture : Sefco		Type: G2		Nr: 04.267/1		i: 1.6923:1		
Pressure Test (EN 13275:2000/§5.2.2)		Hydraulic pressure test of pump casing completed at 60 bar for 5 min								
		Date: 03.11.04				Signature: AK				
Degreasing (EN 12300:1999)		Pump cold end has been degreased with Trichlorethylene for LOX Operation.								
		Date: 03.12.04				Signature: GB				
LIN-Test										
γ		0.7756 [daN/l]								
Q	P_{suct}	P_{del}	Δp	ΔH	P_{el}¹⁾	P_{mech.}	η_{pump}	T	n	f_{Converter at operation}
[l/min]	[barg]	[barg]	[bar]	[m]	[kW]	[kW]	[%]	[°C]	[rpm]	[Hz]
300	1.20	21.95	20.75	267.5	29.2			-192.1	5053	50
400	1.15	22.35	21.20	273.3	33.1			-192.1	5053	50
450	1.12	22.25	21.13	272.4	35.1			-192.1	5053	50
501	1.11	22.10	20.99	270.6	36.9			-192.1	5053	50
550	1.10	21.80	20.70	266.9	38.9			-192.1	5053	50
600	1.09	21.40	20.31	261.9	41.0			-192.1	5053	50
650	1.05	21.00	19.95	257.2	42.8			-192.1	5053	50
1) P _{el} measured at converter inlet										
Mechanical shaft seal		Preloading by Lead - Bushing :				1.8 mm				
		Preloading by Rotating Sealring :				2.6 mm				
		Total Preloading :				4.4 mm				
		Date: 07.12.04				Signature: GB				
Remarks: Seal leakage RTD's, and motor winding PTC thermistors: functional check OK										
Impeller Ø at test: 250 mm Tip width: 5.5 mm With Inducer: yes With Blade- ring: yes Diffusor type: 550 Orifice Ø :					Vibrations: (at DE motorshield) : 0.8 [mm/s] (at operating point) 0.7 [mm/s]  Sound pressure level (at operating point) dB(A)					
Date : 15.12.04					Signature: JM Grieneisen					

sefco	Delivery Certificate				Ref. No.: 04.267/2					
Customer:	Air Liquide AGS GmbH - Z11/4500023387 - ASU Kosice					P64201				
Pump Type:	C-25/G2/EM-55									
Motor:	Manufacture :	WEG	Type:	250SM2 0904	No.:	0412223202				
	P:	55 [KW]	U:	Δ 400 [V]	I:	91 [A]				
	n _{range} :	2960	/ f _{range} :	[Hz]	f _{field weakening point} :	50 [Hz]				
Gearbox:	Manufacture :	Sefco	Type:	G2	Nr:	04.267/2				
					i:	1.6923:1				
Pressure Test	Hydraulic pressure test of pump casing completed at 60 bar for 5 min									
(EN 13275:2000/§5.2.2)	Date:		03.11.04		Signature: AK					
Degreasing	Pump cold end has been degreased with Trichlorethylene for LOX Operation.									
(EN 12300:1999)	Date:		03.12.04		Signature: GB					
LIN-Test										
γ	0.7819 [daN/l]									
Q	p_{suct}	p_{del}	Δp	ΔH	P_{el}¹⁾	P_{mech.}	η_{pump}	T	n	f_{Converter at operation}
[l/min]	[barg]	[barg]	[bar]	[m]	[kW]	[kW]	[%]	[°C]	[rpm]	[Hz]
300	1.24	22.00	20.76	265.5	28.8			-193.5	5036	50
400	1.22	22.00	20.78	265.8	32.6			-193.5	5036	50
450	1.21	22.25	21.04	269.1	34.5			-193.5	5036	50
501	1.20	22.05	20.85	266.7	36.6			-193.5	5036	50
550	1.19	21.75	20.56	262.9	38.7			-193.5	5036	50
600	1.18	21.35	20.17	258.0	40.7			-193.5	5036	50
650	1.18	20.85	19.67	251.6	42.5			-193.5	5036	50
1) P _{el} measured at converter inlet										
Mechanical shaft seal	Preloading by Lead - Bushing :					1.4 mm				
	Preloading by Rotating Sealing :					2.4 mm				
	Total Preloading :					3.8 mm				
	Date:		07.12.04		Signature:		GB			
Remarks:	Seal leakage RTD's, and motor winding PTC thermistors: functional check OK									
Impeller Ø at test:	250 mm				Vibrations: (at DE motorshield)			1.1 [mm/s]		
Tip width:	5.5 mm				(at operating point)					
With Inducer	yes				0.8 [mm/s]					
With Blade- ring	yes									
Diffusor type:	550				Sound pressure level (at operating point)					
Orifice Ø :					dB(A)					
	Date :		15.12.04		Signature:		JM Grieneisen			

Suction hose Item 9 on drawing
no. 04.267/14

Angst+Pfister AG
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Telefax +41 1 302 18 71

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Téléphone +41 22 979 28 00
Téléfax +41 22 979 28 78

Bankverbindung:
CS, 8050 Zürich, Kto. 570500-91, BC 4857
UBS, 8050 Zürich, Kto. 803.917.01J, BC 269

Customer No. 111219

Sefco AG
Herr F. Brodesser
Wuhrmattstr. 15

CH-4103 Bottmingen

Sefco AG
Maschinen-Anlagen
Wuhrmattstr. 15

CH-4103 Bottmingen

Official in Charge: Frau Ch. Schweri
Tel. direct: 01 306 64 05
24.11.04 14:01:15 /

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

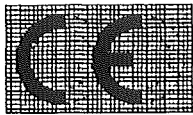
Your reference Herr F. Brodesser / Best.Nr. 04/2373		Our reference Frau Ch.Schweri													
Job No. FT-A04.202032	Order Date 14.10.2004	Delivery Date 18.11.2004	VS A+P Zürich												
<p>Order specification/acceptance requirements:</p> <p>Test item: Our part-no 80 0001 2943 Metal hose assembly ASSIWELL® 100 1.4541 DN 65, U1, NL 400 mm, PED Fitting 1: welding flange DN 65 PN 6 Fitting 2: welding flange DN 65 PN 6 Your part/drawing-no. 4 14769</p> <p>Quantity: 3 pieces</p> <p>Marking: SB/A+P C400854-01 PS6, DN 65, TS-196/+20° C, 11/04, 414769, 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>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>502744/E31602</td> </tr> </tbody> </table>				Element	Material	Ladle No.	Corrugated hose	1.4541	483669	Braid	1.4301	E43612	Welding Flange DN 65	1.4435	502744/E31602
Element	Material	Ladle No.													
Corrugated hose	1.4541	483669													
Braid	1.4301	E43612													
Welding Flange DN 65	1.4435	502744/E31602													

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

H. Birmele
ppa. H. Birmele

Ch. Schweri
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 4.00854-01	4 14 769	
max. zulässiger Druck PS:	6,00		bar
zulässige max./min. Temperatur TS:	+20/-196		°C
Nennweite DN:	65		
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, 11.11.2004

Unterschrift Geselle

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CH-8052 Zürich
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24.11.04 14:05:55 /

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

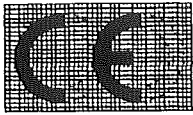
Your reference Herr F. Brodesser / Best.Nr. 04/2373		Our reference Frau Ch. Schweri	
Job No. FT-A04.202032	Order Date 14.10.2004	Delivery Date 18.11.2004	VS A+P Zürich
Order specification/acceptance requirements: Test item: Our part-no 80 0002 1517 Metal hose assembly ASSIWELL® 100 1.4541 DN 50, U1, NL 400 mm, PED Fitting 1: welding flange DN 50 PN 40 Fitting 2: welding flange DN 50 PN 40 Your part/drawing-no. 4 14825 Quantity: 2 pieces Marking: SB/A+P C400854-04 PS40, DN 50, TS-196/+20° C, 11/04, 414825 Test: Pressure and Tightness Test: 60 bar with pure tap water Duration: min. 1 min. Test result: The hose(s) meet(s) the requirements. Remarks:			
Material certificate			
Element	Material	Ladle No.	
Corrugated hose	1.4541	479212	
Braid	1.4301	E41403	
Welding Flange DN 50	1.4435	500256	

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. M. 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 - 414825 // C 4.00854-04	
max. zulässiger Druck PS:	40,00	bar
zulässige max./min. Temperatur TS:	+20/-196	°C
Nennweite DN:	50	
Herstelljahr:	2004	
Aufgebrachter Prüfdruck PT:	60	bar
Prüfmedium:	Wasser	

mit der Druckgeräterichtlinie 97/23/EG übereinstimmt.

Angewandte
Konformitätsbewertungsverfahren: Modul A1

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