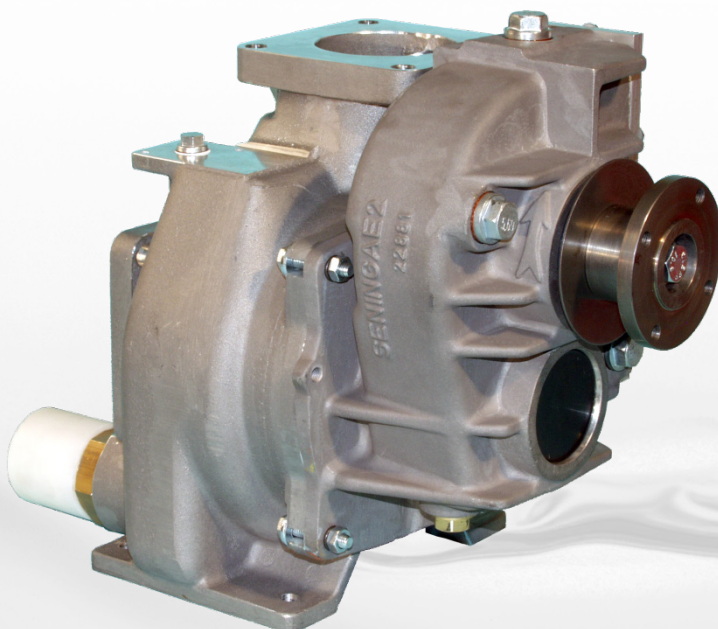


## Pump **Delta2**



Further Documentation for this Product:

Description	Order No.
Installation an Operating Instruction DZV-MB Speed Controller	DOK-322E
Installation an Operating Instruction DZV-EDC-A Speed Controller	DOK-329E

## History

Revision	Date	Editor	Status	Description
Rev. 1.00	February 2007	/ A.Jaacks / jp /	released	First Edition
Rev. 1.01	August 2012	/ HO / jp /	released	Modifications: - New Layout - Safety instructions - New chapter: "Mounting examples of Cardan shaft" - Drawings: 51.251820, 72.251820, 51.251830, 72.251830, 31.250115

## Important

All information and technical specifications in this documentation have been carefully checked and compiled by the author. However, we cannot completely exclude the possibility of errors. **F. A. Sening GmbH** is always grateful to be informed of any errors.

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# 1 General

## 1.1 Orientation aids for the manual

We have provided some orientation aids so that you can find the information you want in this manual easily.

The information in this manual ranges from imperative safety procedures and standardised guidelines through to concrete handling procedures and advice. To differentiate these more easily, the information is marked with corresponding pictograms in front of the relevant text.

These are intended not just to draw particular attention to these passages, but also to make it easier to find the information you want. Therefore the pictograms are symbolic of the underlying textual content.

**The following pictograms are used in this manual:**



### **Danger sign**

Danger of explosions caused by easily ignited gases and liquids here.



### **Risk of operating fault**

Actions that may damage the equipment.



### **Legal notice**

Actions that may have legal consequences.



### **Working step**

Concrete action statements, e.g.: *"Press the <Enter> key"*.



### **Input necessary**

e.g. via numeric or function keys.



### **Positive response message**

e.g. "The main menu now appears"



### **Negative response message**

e.g. "If a fault message appears now..."



### **Background information**

Short-Tip, e.g. "See more detailed information in Chapter XX".



### **Option**

Special case.



### **Function**

Functional description.



### **NOTE:**

indicates a special situation.



### **ATTENTION:**

particular attention is to be paid.

## 1.2 Safety instructions

**Caution:**

This information must be carefully read and observed before operating the unit.

### 1.2.1 Ex protection



The measuring systems are designed for flow measurements of highly flammable and flammable liquids (hazard classes AI and AII) on tank trucks. Sparks and naked flames must be strictly avoided.

## 1.3 Appropriate use



The "Delta2" pump is specifically designed for installation on tank trucks and for delivery of low-viscosity mineral oils. The appropriate safety regulations (e.g. explosion protection) must be complied with.



Any use above and beyond this is considered as being not in accordance with the intended purpose.



Appropriate use also includes compliance with the operation, installation and maintenance conditions specified by the manufacturer.



The pumps must only be installed, operated, serviced and repaired by persons who are familiar with the device and have been briefed about the risks.



The manufacturer is not liable for damage that results from modifications to the pumps which have been carried out without the manufacturers consent.



The operating instructions for Sening™ centrifugal pumps must be followed. (see service label 41.250115 / page 23)



Please read our warranty conditions in 27

## 1.4 Product description

☐ "Delta2" is a centrifugal pump that was specifically designed for tank truck applications:

- high output through wet or dry hose,
- low-wear and low-maintenance design,
- very quiet operation,
- low initial costs,
- self-priming centrifugal pump,
- centrifugal pump with maximum delivery rate of 800, 1000 or 1200 l/min,
- overflow valve for protection against excessive pump pressure,
- direction of drive rotation anti-clockwise (viewed in direction of travel).

☐ The pump is driven by cardan shaft from the auxiliary drive of the truck. Several gear ratios are available so that the most cost-effective auxiliary gearbox can be used.

☐ The "Delta2" pump is also available with hydraulic drive. In this case a hydraulic motor is directly connected to the impeller.

✍ Please refer to the following pages regarding pump design and adaptation to customer requirements.

§ The "Delta2" pump is designed for diesel, fuel oil, petrol and aviation fuel. During delivery of product the statutory requirements (ADR, explosion protection) must be observed and complied with.

## 1.5 Order numbers for pumps

The order number for the pump and the drive unit is structured as follows:

<b>Type:</b>	Designation, cast onto the pump housing
<b>Gear ratio:</b>	Stamped into each screw plug of the drive unit
<b>Delivery rate:</b>	Stamped into the pump housing below the type
<b>Flange:</b>	Number of drive flange holes

Type	Drive unit gear ratio	Delivery rate	Drive unit flange
			4 4 hole flange
			6 6 hole flange
		80 Q max. 800 l/min	
		100 Q max. 1000 l/min	
		120 Q max. 1200 l/min	
	2- i = 2,45		
	3- i = 3,87		
	3E- i = 3,1		
	4- i = 4,94		
	4E- i = 4,35		
	5- i = 5,69		
	6- i = 6,57		
	7- i = 7,21		
DELTA2-	Pump unit type "Delta2"		

### Example:

Delta2 pump unit with gear ratio  $i = 3.87$ , 1000 l/min, impeller and 6-hole flange.

These data result in the following order number:






**DELTA2-3-1006**

In exchange parts is the order number is preceded by " **AT-**"  
(for example: **AT-DELTA2-4-1006**)



## 2 Delta2 Pump

The "Delta2" tank truck pump is a centrifugal pump. It was specially designed for application on tank trucks. The design is compact and space-saving in order to enable installation on common vehicle frames.

-  The pump consists of an aluminium housing with a flange-mounted drive unit consisting of a helical gear unit and an impeller with slide ring seal. The drive unit must be maintained accordingly our instructions (see Section 6 "**Service**" / page 20).
-  The gear ratio of the drive unit is stamped onto all screw plugs.
-  The pump delivery rate is 800 l/min, 1000 l/min or 1200 l/min. The pump is driven via a cardan shaft that rotates anti-clockwise (viewed in direction of travel).
-  Electronic or pneumatic speed control should be provided for pressure relief when pumping against a close valve. (see Section 7 "**Speed reduction**" / page 21)
-  With the valves closed, the pump should only be operated very briefly without speed reduction (max. 1 min.). With speed reduction (pump pressure 3 to 4 bar) it can be operated for up to 10 min.



The speed reduction mentioned above is designed to ensure safe operation of the Sening<sup>TM</sup> tank truck pump. Violation of the above-mentioned requirements may lead to overheating and accidents.

A safety valve is provided in order to prevent the pump pressure exceeding 9 bar during operation.

The required motor speed for pump operation can be found in our datasheet 51.251903 / 51.251905 / 51.251907 / page 40.

$$n_{\text{motor}} = \frac{n_{\text{impeller}}}{(i_{\text{pump}} \times i_{\text{aux}})}$$



Exceedance of the maximum pump speed (e. g. operation with auxiliary drive engaged) can lead to excessive pressure and accidents.

## 2.1 Ejektor

An ejector can be fitted to the "Delta2" pump in order to achieve faster and better suction from tanks positioned at a low level.

- ☐ A flow of compressed air through the ejector generates a suction pressure at the smallest cross section of the ejector. This suction pressure is used to vent the suction system.
- ☐ When liquid is drawn in a valve closes the suction opening and prevents entrainment of liquid. ( see drawing 51.250327 / page 42)
- ☐ If the pump is tilted due to lack of space, the ejector must be removed and a sealing plate screwed in instead.

## 2.2 Hydraulic system

The "Delta2-HY" tank truck pump is a centrifugal pump. It was specially designed for application on tank trucks. The design is compact and space-saving in order to enable installation on common vehicle frames.

- ☐ The pump consists of an aluminium housing with a flanged on hydraulic motor with impeller and slide ring seal.
- ☐ The pump delivery rate is 800 l/min, 1000 l/min or 1200 l/min. The pump is driven via a hydraulic system Type F11-10.
  - ▶ **Power requirement at 5000 r / min:**
    - required drive power: ca. 20 kW
    - hydraulic system pressure: ca. 270 bar
    - displacement: ca. 50 l/min (10 cm<sup>3</sup>/U)
- ☐ In order to reduce the noise generated by the hydraulic motor we recommended limiting the motor speed to 4500 rpm. The feed and return hoses of the hydraulic motor should have adequate cross sections. (min 20 mm)

### 3 Calculation of the required pump power

The data for the required auxiliary drive can be found in the manufacturer manuals for the individual vehicle types.



Note the direction of rotation of the auxiliary drive.



"Delta2" pumps require auxiliary drives that rotate anti-clockwise when viewed in direction of travel.

#### Pump gear ratio

Once the gear ratio of the auxiliary drive ( $i_{aux}$ ) has been determined, the required pump gear ratio ( $i_{pump}$ ) and therefore the maximum pump pressure  $p$  [bar] against a closed valve ( $Q=0$  l/min) can be read from chart no.

51.251929 / page 33.

If two gear groups are possible according to the vehicle manufacturer, the auxiliary drive gear ratio for the faster group should be selected. ( $i_{aux} = 1$ , if possible)

#### Pump pressure

Based on the max. pump pressure or the impeller speed against the closed valve, the pump pressure at the required flow rate can be read from Q- $\Delta p$ -n chart no.

51.251903 / page 36  
(800 l/min)

"Delta2" pumps / 8 mm impeller

51.251905 / page 38  
(1000 l/min)

"Delta2" pumps / 12 mm impeller

51.251907 / page 40  
(1200 l/min)

"Delta2" pumps / 15 mm impeller

#### Motor speed

The motor speed can be calculated as follows :  $n_{motor} = \frac{n_{impeller}}{(i_{pump} \times i_{aux})}$

**Nominal hose diameters**

Based on the pump pressure determined in this way, the nominal hose diameters and lengths for the required flow rate can be read from graph nos.

51.18273 / page 34

51.18274 / page 35

**Low rate**

Based on the selected flow rate the pump power can be read from N-Q-n graph no.

51.251904 / page 37  
(800 l/min)

"Delta2" pumps / 8 mm impeller

51.251906 / page 39  
(1000 l/min)

"Delta2" pumps / 12 mm impeller

51.251908 / page 41  
(1200 l/min)

"Delta2" pumps / 15 mm impeller

**3.1 Calculation example**

**Desired: Vehicle: DB 1717**

Motor speed not exceeding 1000 rpm

Auxiliary drive NA 4/120-2b  $i = 0.93$

Pump type Delta2

Impeller 800 l/min

Wet hose 1 40 m and NW 40

Wet hose 2 50 m and NW 38

**From sheet 51.251929 / Page 33:**

From  $i_{aux} = 0,93$

$i_{pump} = \underline{5,69}$  u.  $p_{max.} = 8,8$  bar

against closed valve

for impeller  $n_{impeller} = 5000$  rpm

$$n_{motor} = \frac{5000 \text{ min}^{-1}}{(5,69 \times 0,93)} = 945 \text{ min}^{-1}$$

**From sheet 51.251903 / Page 36:**

1.)  $p$  at 550 l/min = 8,4 bar (top curve) or

2.)  $p$  at 430 l/min = 8,7 bar

**From sheet 51.18273 / Page 36 bzw. 51.18274 / Page 34:**

from hose 40 m with n.w. 40 and 8.4 bar: max. flow rate = 590 l/min

from hose 50 m with n.w. 38 and 8.7 bar: max. flow rate = 450 l/min

*The interrelationship is best illustrated by copying drawings 51.18273 / page 34 and 51.18274 / page 35 onto overhead film and placing them onto the Q- $\Delta p$ -n diagram.*

**From sheet 51.251904 / Page 35:**

pump power at 590 l/min = 10,5 KW

**From sheet 51.251903 / Page 37:**

For pumping against closed valve (Q=0 l/min) and idle speed








$$n_{\text{motor}} \text{ ca. } 650 \text{ min}^{-1}$$

$$n_{\text{impeller}} = 650 \text{ min}^{-1} \times 5,69 \times 0,93 = 3440 \text{ min}^{-1}$$

$$p_{\text{idle}} = \text{ca. } 4,2 \text{ bar}$$

## 4 Installation

The Sening® "Delta2" pump should be fixed in the frame. It should not be installed on elastic dampers. The connections between the piping and the pump terminals must be elastic.


-  The instructions of the vehicle and cardan shaft manufacturers must be followed for correct installation of the cardan shaft.
-  Self-priming pumps must be installed vertically.
-  The vehicle motor must be equipped with a R Q V controller.
-  Manual gas operating units should be avoided if they enable higher pump drive speeds to be set in order to prevent excessive pressure. An auxiliary drive interlock is required.
-  The dispensing unit must be equipped with a speed controller in order to prevent overheating when pumping against a closed dispensing system. (see Section 7 "**Speed reduction**" / page 21)
-  When pumping against a closed dispensing system the speed controller must limit the pump pressure to 3 to 4 bar.
-  With the valves closed, the pump should only be operated very briefly without speed reduction (max. 1 min.). With speed reduction (pump pressure 3 to 4 bar) it can be operated for up to 10 min.



---

The speed reduction mentioned above is designed to ensure safe operation of the Sening® tank truck pump. Violation of the above-mentioned requirements may lead to overheating and accidents.

---

-  The service label for the Sening® centrifugal pumps containing the operating instructions must be attached to the vehicle such that it is clearly visible for the driver. ( see drawing no. 31.250115 / page 43)

## 4.1 Drive unit

The drive unit is can be rotated through 4 x 90° in order to keep the inclination angle of the cardan shaft to a minimum.



By releasing the 4 M8 screws between the pump and drive unit the gearing can be pulled out until the O-ring is released.

### Important !



The pump should first be drained. Unscrew the screw plug R 1/2" between the pump feet, then rotate the gear unit into the required position and re-engage (Do not apply force! Only use gentle movements) and retighten the screw.



When changing the cardan shafts flange the flange should be warm.

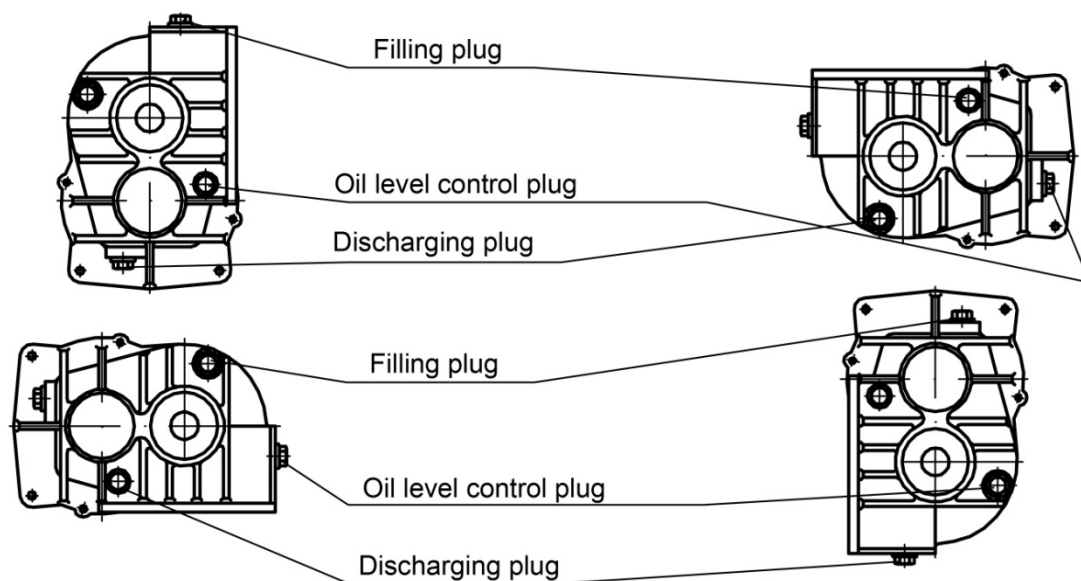



Figure 1: Oil level control



Check the oil level every six months and top up with gear oil (S A E 90 Hypoid / 0.35 litres). Check the oil level if the mounting position of the gear unit is changed.

## 4.2 Cardan shaft

The instructions of the vehicle and cardan shaft manufacturers must be followed for the installation of the cardan shaft.

 To ensure long service life and quiet operation parallel positioning of the two cardan shaft flanges (pump and auxiliary drive) is important.

Unless specified otherwise by the cardan shaft manufacturer, we recommend keeping the inclination angles of the cardan shaft as low as possible. Please use the option of rotating gear unit at the pump!



The inclination angle for each joint should not exceed 7°.

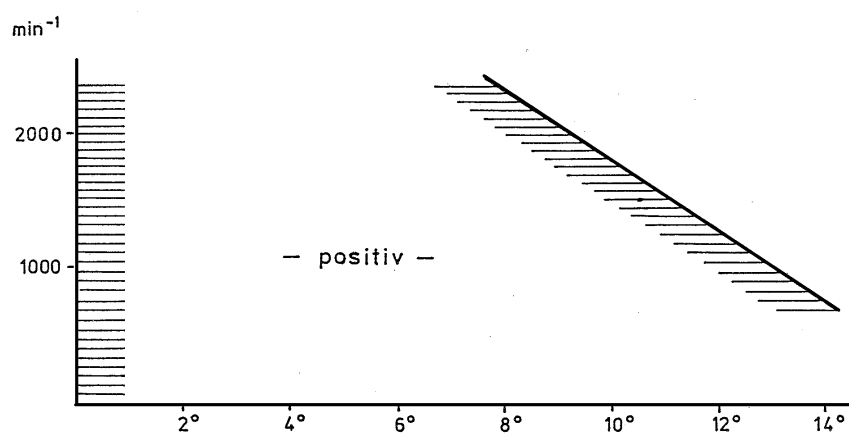


Figure 2: Total diffraction angle of the cardan shaft.



The cardan shaft should be lubricated regularly to the manufacturer's instructions. We necessarily recommend using cardan shafts with length compensation.

#### 4.2.1 Mounting examples the cardan shaft.

The correct connection of the cardan shaft is shown here in three examples:

1.)

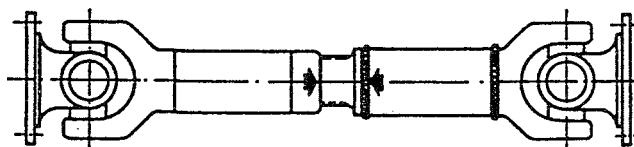


Figure 3: Position of the joint heads and length compensation



2.)

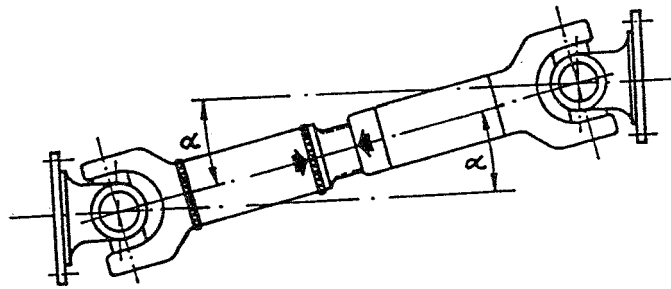


Figure 4: Diffraction angle and length compensation.

3.)

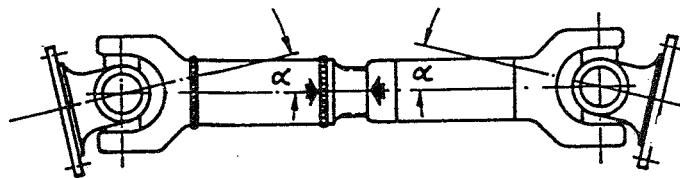


Figure 5: Diffraction angle and length compensation.



Please use only balanced cardan shafts !

## 4.3 Hydraulic system

In order to reduce the noise generated by the hydraulic motor we recommended limiting the motor speed to 4500 rpm. The feed and return hoses of the hydraulic motor should have adequate cross sections. (min 20 mm)



For thermal reasons the oil quantity in the hydraulic system should not fall below 90 litres.



The hydraulic pump is configured according to the respective speed of the auxiliary drive and the speed of the "Delta2" pump.



**Example:** The hydraulic motor is to be operated with 4500 rpm at 10 cm<sup>3</sup> / rev. If an F12-60 motor (60 cm<sup>3</sup> / rev.) is used, the resulting gear ratio is 1:6, resulting in a drive speed of 750 rpm (4500/6 = 750).



The hydraulic system must be equipped with a GAHYPN pressure valve for speed reduction when the discharge valve is closed. This valve

connects the pressure line with the return line in the absence of medium flow.

## 5 Pump operation

- With the valves closed, the pump should only be operated very **briefly** without speed reduction (max. 1 min.). With speed reduction (pump pressure 3 to 4 bar) it can be operated for up to 10 min.
- Release the clutch slowly when engaging the auxiliary gear.
- When the discharge valves are opened pump speed should automatically set itself to the required value.
- With the discharge valves closed the pump pressure should not exceed 9 bar.
- With active speed reduction the pump should not be operated for more than 10 minutes against closed discharge valves.
- With closed discharge valves the pump should not be operated with a higher speed than the idle speed (pump pressure 3 to 4 bar) of the truck engine.
- After discharge is complete keep the clutch engaged for 3 to 4 seconds when disengaging the auxiliary gear.

## 6 Service

### 6.1 Pump

For normal operation the gear oil should be changed every six months.



(SAE 90 Hypoid / 0.35 litres)

The fill, drain and oil level plugs are shown on the diagram.

(See also "**Figure 1: Oil level control**" / p. 15)



The pump housing has a drain hole at the gear flange. If the slide ring seal of the impeller or the sealing ring of the gear shaft starts leaking, liquid will emerge from this opening.



The fault should be repaired immediately by a specialist workshop.

### 6.2 Cardan shaft



The tothing and the joints of the cardan shaft must be lubricated during each service.



The manufacturer specifications must be followed.

## 7 Speed reduction

### 7.1 Pneumatic speed reduction

Through pneumatic speed control the Sening® "Delta2" pump can be adjusted for any required output.

#### Operating principle

- ☐ The actual operating cylinder is equipped with dual pistons. The motor speed for wet or dry hose delivery is determined by one piston. The two pistons operate independent of each other. The stroke is adjustable. It is advisable to install the operating cylinder such that no fixed connection with the throttle linkage is required (speed increased through pressure on the linkage components). If possible a working point should be selected such that the reverse stroke for switching off the motor is omitted.

#### With wet hose

- ☐ Actuation of the pneumatic sensor causes the discharge valve to open. When the dispenser is opened compressed air is applied to the first piston of the operating cylinder. The piston stroke can be adjusted to the required output.

#### For dry hose

- ☐ Actuation of the pneumatic sensor causes the discharge valve to open. Depending on the configuration of the system, compressed air is applied to the second piston either directly or via a dual non-return valve. This piston stroke can also be adjusted according to required dry hose output.

#### With wet hose for container filling

- ☐ The stroke of the second piston can be adjusted via the compressed air control valve. Due to the steep spring characteristics of the operating cylinder any required intermediate setting can be set by changing the air pressure, such that the pump pressure can be reduced for filling containers.

## 7.2 Electronic speed reduction

Through electronic speed control the Sening® "Delta2" pump can be adjusted for any required output.

### Operating principle

- ☐ The electronic speed control units DZV-MB (for Mercedes Benz) or DZV-EDC-A (for MAN, Volvo, Iveco Magirus and Scania) replace the operating cylinder of the pneumatic speed control.
- ☐ The motor speed for wet hose or dry hose delivery is determined via a pressure switch that controls the EDC systems.
- ☐ Detailed information can be found in the speed controller documentation. (see DOK-322 und DOK-329)

### With wet hose

- ☐ Actuation of the pneumatic sensor causes the discharge valve to open. When the dispenser is opened compressed air is applied to the wet hose pressure switch of the DZV unit. The motor speed can be adjusted to the required output.

### For dry hose

- ☐ Actuation of the pneumatic sensor causes the discharge valve to open. Depending on the configuration of the system, compressed air is applied to the dry hose pressure switch of the DZV unit either directly or via a dual non-return valve. This motor speed can also be adjusted according to required dry hose output.

### With wet hose for container filling

- ☐ The motor speed can be adjusted via the control knob of the DZV unit such that the pump pressure can be reduced for filling containers.

## 8 Warranty and service

The following conditions apply in respect of a warranty to the end user for this equipment - in addition to the dealer's legal warranty in the purchase contract:

1. The warranty period is 12 months and starts at the time of delivery of the device by F. A. Sening. For electronic products the registration forms must be fully completed and must arrive at Sening signed off by the installation organisation.
2. The warranty includes the correction of all damage to or faults in the equipment arising during the warranty period that demonstrably relate to material or manufacturing defects.

Not covered under the warranty:

- Small deviations from the desired quality that are not significant for the value or the suitability for use of the equipment
  - Damage or defects arising from connection other than to specification, improper handling and non-observance of the installation specification and instructions for use
  - Damage from chemical and electrochemical effects of water or other liquids, electrical or electromagnetic influences, as well as generally from extremely ambient conditions.
  - Damage arising from external effects such as transport damage, damage by shock or impact, damage by weather effects or other natural phenomena.
3. The warranty claim is void if repairs or interventions are undertaken by persons that are not authorised by us or if our equipment is provided with amendments or accessories that are not suitable for our equipment and are not passed by us for the equipment.
  4. Warranty work is performed in the manner that faulty parts are repaired by us free of charge or replaced with correct parts at our choice. Replaced parts become our property.
  5. Warranty work is carried out free of charge in the first six months of the warranty period. Thereafter travelling time, travel costs and labour of the service personnel as well as any transport costs arising are charged or not reimbursed.
  6. Warranty work neither causes an extension of the warranty period nor sets a new warranty period in progress. The warranty period for fitted replacement parts ends with the warranty period for the entire equipment.
  7. On-going or other claims, especially those for replacement of damages or consequential damages arising outside the equipment, insofar as an obligation is not mandatory in law, are explicitly excluded.

## 9 Address and contact details

### Important note

All explanations and technical details given in this documentation have been produced and edited by the author with the greatest care. However the possibility of errors cannot be completely eliminated. We are always very grateful for notification of any errors found.

Our service department will be happy to assist and can be contacted as follows:



### Measurement Solutions

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D-25474 Ellerbek

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Web: [www.fmctechnologies.com/seningttp](http://www.fmctechnologies.com/seningttp)



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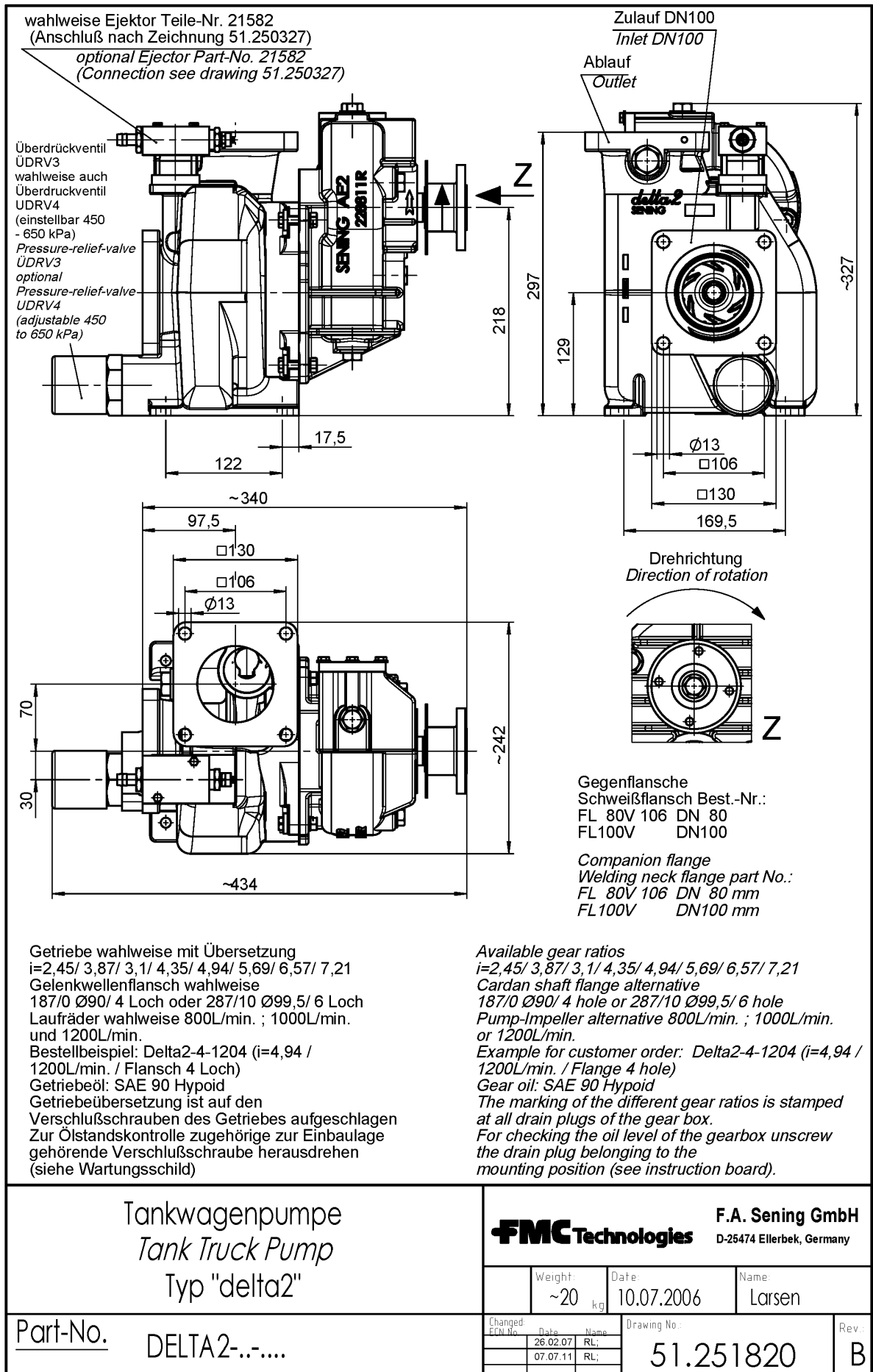
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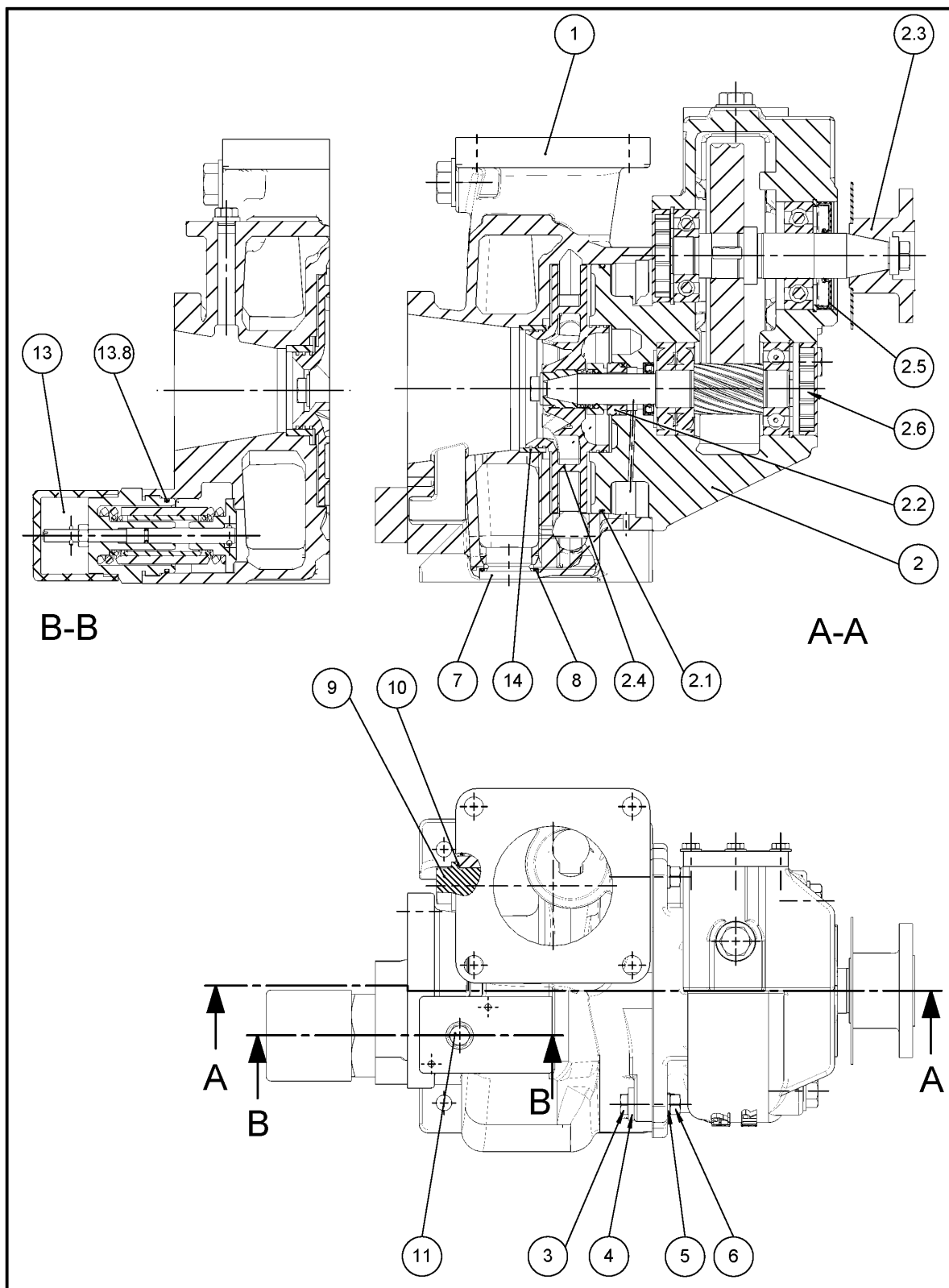
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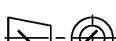
## Drawings

### 51.251820 - Tank Truck Pump Type „delta2“



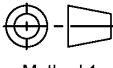

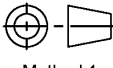

# 72.251820 - Tank Truck Pump Type „delta2“



ALL TOLERANCED DIMENSIONS ARE FOR INSTALLATION ONLY. ALL OTHER DIMENSIONS ARE FOR REFERENCE ONLY.				<div>FMC Technologies</div> F.A. Sening GmbH, Regentstr. 1, 25474 Ellerbek, Germany			
			Date / Datum	Name		Item name / Benennung	
Method 1	Method 3		Drawn	11.07.2006	Larsen	Tankwagenpumpe / Tank truck pump	
			Checked			made for / zugehörig zu	
Scale / Maßst. 1:3.5		Item-No. / Teile-Nr.		Drawing No. / Zeichnungs-Nr.		Rev.	Sheet / Blatt 1
Size / Format ISO-A4		DELTA2-...-....		251820_72		00A.01	of / von 2
Weight / Gewicht kg							

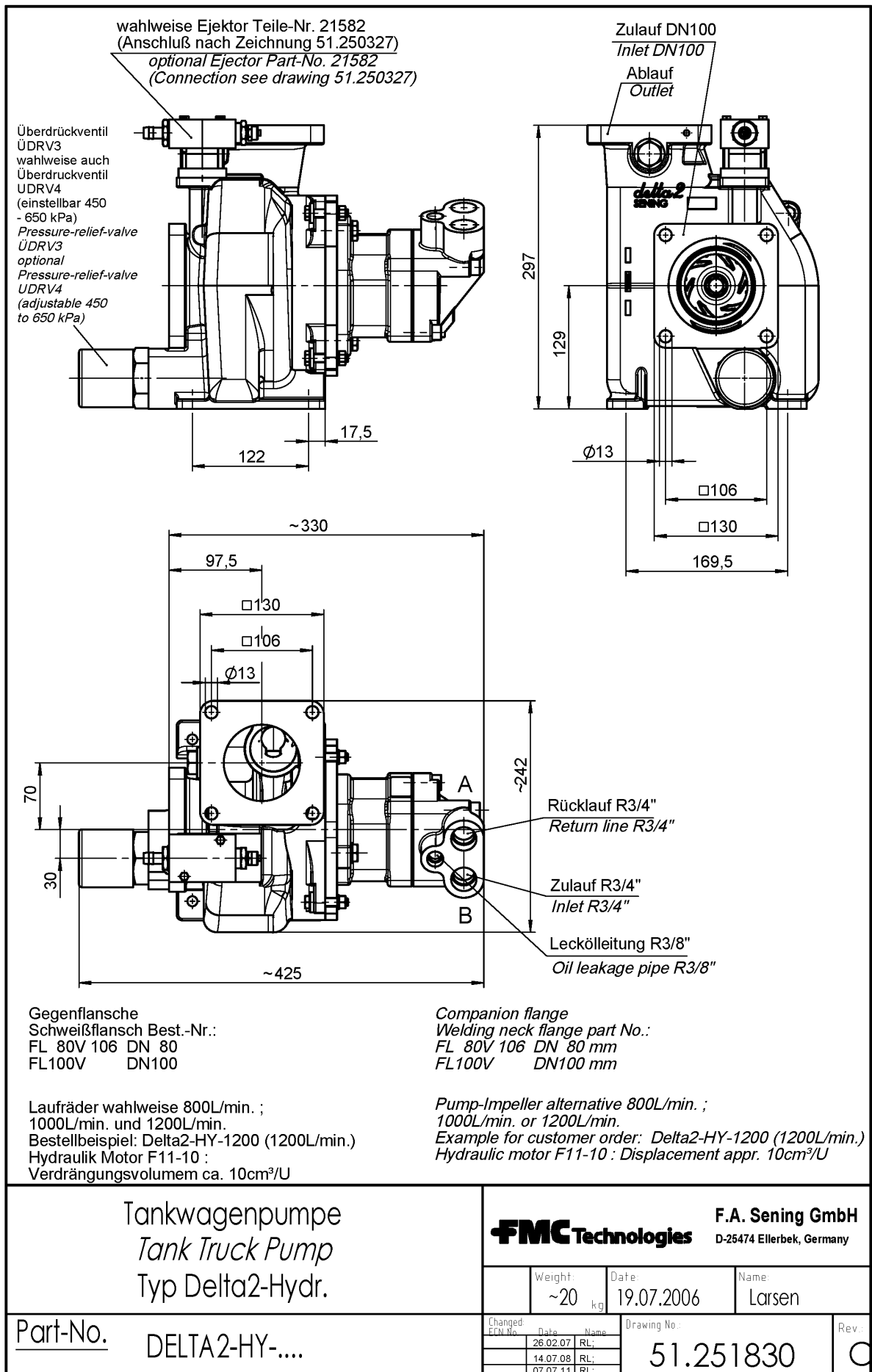
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## 72.251820 - Parts List Tank Truck Pump Type „delta2“

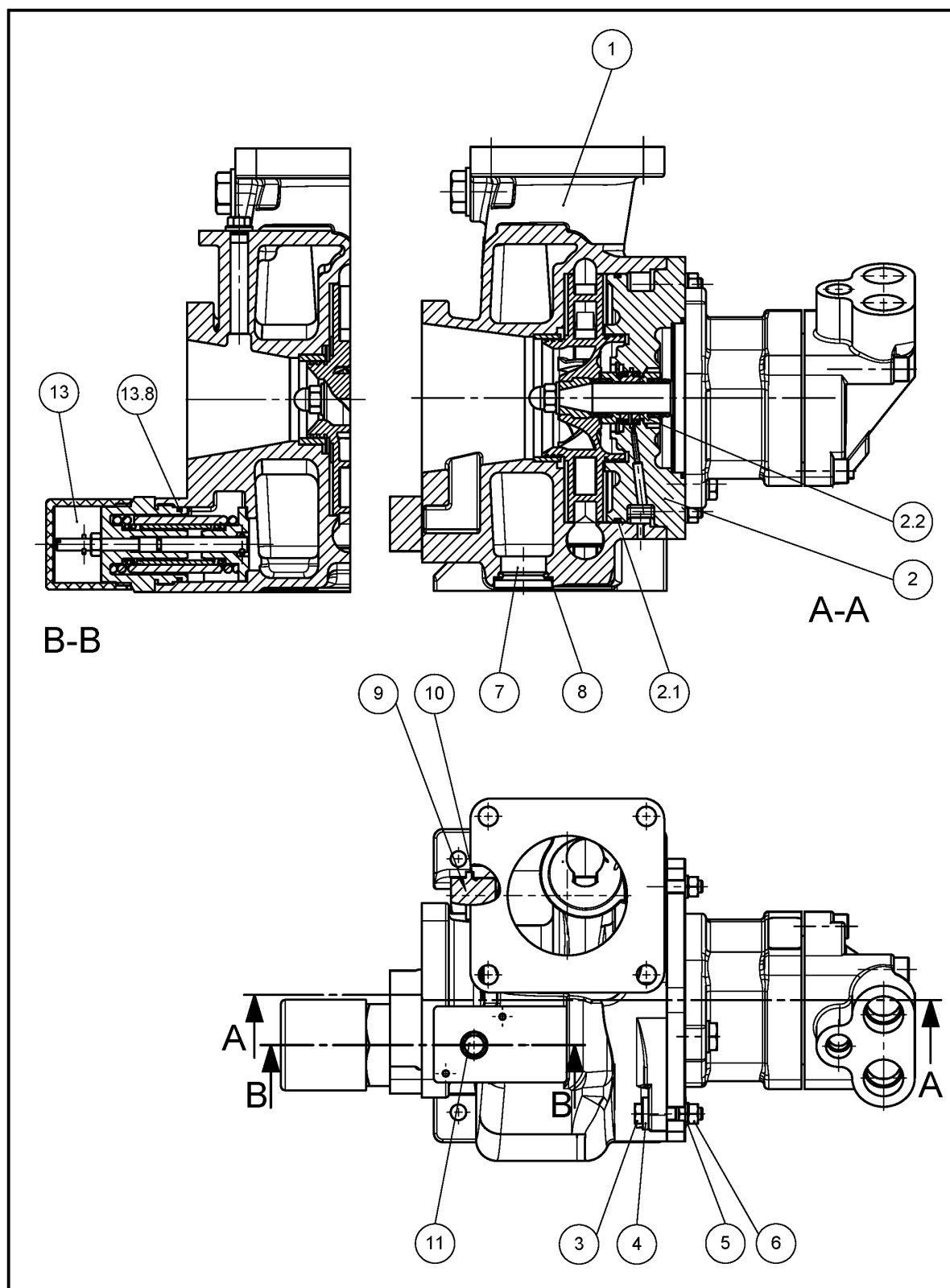
14	18572 A	1	Buchse	Bush
13.8	6000083	1	O-Ring 42x3 NBR	O-Ring 42x3 NBR
13	UDRV4	1	Überdruckventil, einstellbar	Pressure-relief-valve, adjustable
13	ÜDRV3	1	Überdruckventil	Pressure-relief-valve
12	250115	1	Wartungsschild	Label
11	4100473	1	Verschlußschraube	Drain plug
10	6300085	1	Dichtring A27x32x1 NBR	Sealing ring A27x32x1 NBR
9	4100094	1	Verschlußschraube	Drain plug
8	6200088	1	Dichtring B33x39x2 NBR	Sealing ring B33x39x2 NBR
7	4100086	1	Verschlußschraube G1"	Drain plug G1"
6	4200040	4	Sechskantmutter M8	Hexagon nut M8
5	4300040	4	Federring A8	Split ring A8
4	4300165	4	Scheibe 8,4	Washer 8,4
3	4100245	4	Sechskantschraube M8x35	Hexagon head screw M8x35
2.6	8200007	1	Deckel GC 62x12	Bearing cap GC 62x12
2.5	6100053	1	Simmerring BAD 30-72-10	Radial packing ring
2.4	250166	1	Laufrad 1200 Ltr.	Running wheel 1200 Ltr.
	18523 G	1	Laufrad 1000 Ltr.	Running wheel 1000 Ltr.
	17418 G	1	Laufrad 700 Ltr.	Running wheel 700 Ltr.
2.3	250316	1	Kupplungsnahe	Clutch fork
	19811	1	Gelenkwellenflansch 6-Loch	6 hole cardan drive
	17832 E	1	Gelenkwellenflansch 4-Loch	4 hole cardan drive
2.2	6200001	1	Gleitringdichtung	Axial face seal
2.1	6000236	1	O-Ring 160x3 NBR	O-Ring 160x3 NBR
2	AE2-...-....	1	Antriebseinheit AE2-...	Gearbox AE2-...
1	251813	1	Pumpengehäuse, komplett für 800 + 1000l/min.	Pump housing, complete for 800 + 1000l/min.
1	251812	1	Pumpengehäuse, komplett für 1200l/min.	Pump housing, complete for 1200l/min.
Pos./Item	Teile-Nr./Part-No.	Stück Quant.	Benennung	Description
			ALL TOLERANCED DIMENSIONS ARE FOR INSTALLATION ONLY. ALL OTHER DIMENSIONS ARE FOR REFERENCE ONLY.	<b>FMC Technologies</b> F.A. Sening GmbH, Regentstr. 1, 25474 Ellerbek, Germany
 Method 1		 Method 3		Date / Datum 11.07.2006
 Method 1		 Method 3		Name Larsen
Scale / Maßst. 1:3.5 Size / Format ISO-A4 Weight / Gewicht kg		Item-No. / Teile-Nr. DELTA2-...-....		Item name / Benennung <b>Tankwagenpumpe / Tank truck pump</b> made for / zugehörig zu 251813, 13.11.08 RL;
		Drawing No. / Zeichnungs-Nr. <b>251820_72</b>		Rev. <b>00A.01</b>
		Sheet / Blatt 2 of / von 2		

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# 51.251830 - Tank Truck Pump Type Delta2-Hydr.



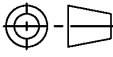

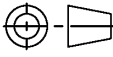

"Protective note according to DIN ISO 16016"



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 Method 1	 Method 3		Date / Datum	Name	Item name / Benennung <b>Tankwagenpumpe / Tank truck pump</b> made for / zugehörig zu		
		Drawn	19.07.2006	Larsen			
		Checked			Drawing No. / Zeichnungs-Nr. <b>251830_72</b>		
Scale / Maßst.	1:3.5	Item-No. / Teile-Nr.			Rev.	Sheet / Blatt	1
Size / Format	ISO-A4	DELTA2-HY-....			<b>000.01</b>	of / von	2
Weight / Gewicht	kg						

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 "Schutzvermerk nach DIN ISO 16016 beachten"

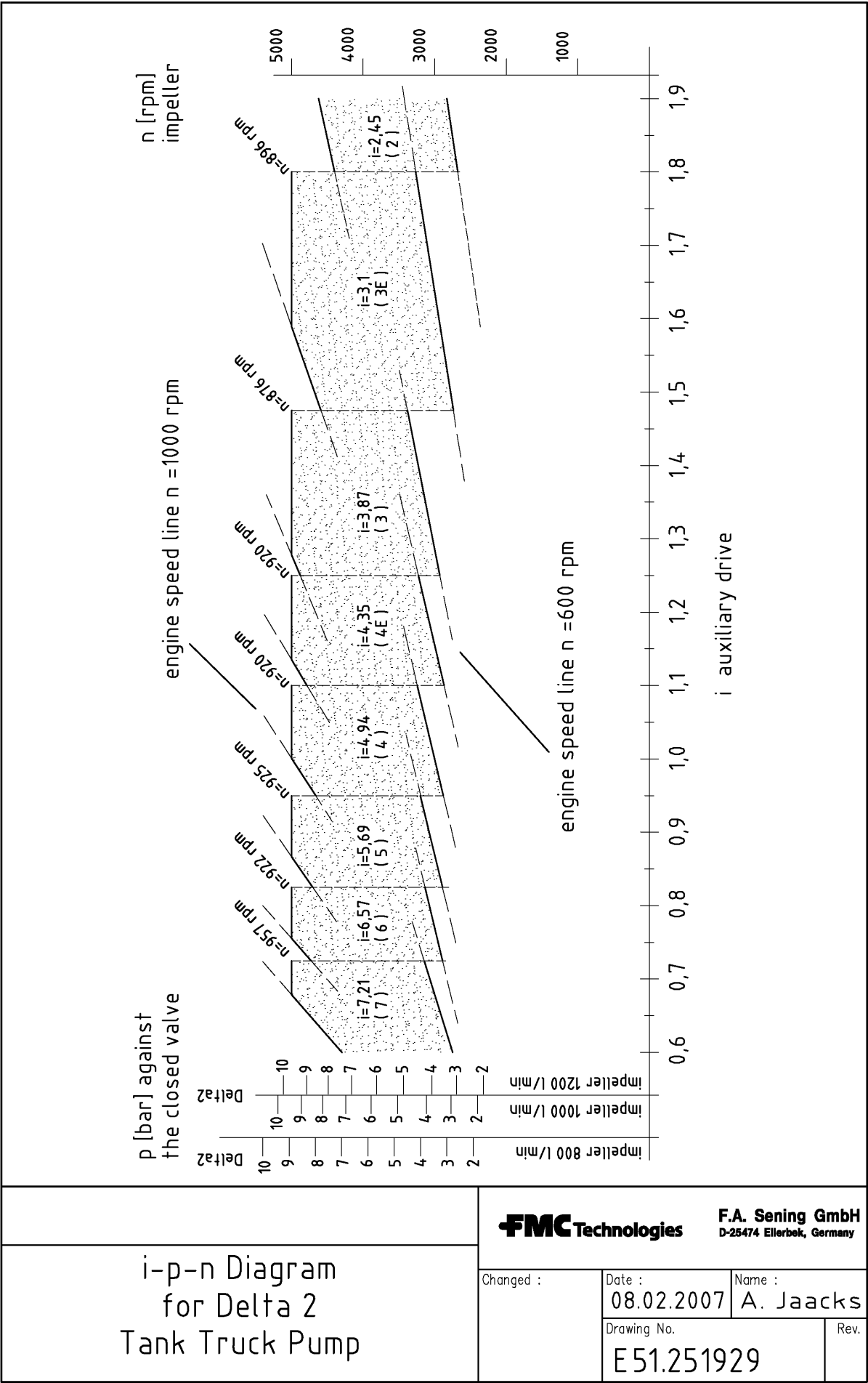
# 72.251830 - Parts List Tank Truck Pump Type Delta2-Hydr.

13.8	6000083	1	O-Ring 42x3 NBR	O-Ring 42x3 NBR
13	UDRV4	1	Überdruckventil, einstellbar	Pressure-relief-valve, adjustable
13	ÜDRV3	1	Überdruckventil	Pressure-relief-valve
12	250115	1	Wartungsschild	Label
11	4100473	1	Verschlußschraube	Drain plug
10	6300085	1	Dichtring	Sealing ring
9	4100094	1	Verschlußschraube	Drain plug
8	6200088	1	Dichtring A27x32x1 NBR	Sealing ring A27x32x1 NBR
7	4100086	1	Verschlußschraube G1"	Drain plug G1"
6	4200040	4	Sechskantmutter M8	Hexagon nut M8
5	4300040	4	Federring A8	Split ring A8
4	4300165	4	Scheibe 8,4	Washer 8,4
3	4100246	4	Sechskantmutter M8	Hexagon head screw M8x40
2.2	6200002	1	Gleitringdichtung	Axial face seal
2.1	6000236	1	O-Ring 160x3 NBR	O-Ring 160x3 NBR
2	250137-700	1	Hydr.Antriebseinheit 700l/min.	Hydraulic gearbox 700l/min.
	250137-1000	1	Hydr.Antriebseinheit 1000l/min.	Hydraulic gearbox 1000l/min.
	250137-1200	1	Hydr.Antriebseinheit 1200l/min.	Hydraulic gearbox 1200l/min.
1	251813	1	Pumpengehäuse, komplett für 800 + 1000l/min.	Pump housing, complete for 800 + 1000l/min.
1	251812	1	Pumpengehäuse, komplett für 1200l/min.	Pump housing, complete for 1200l/min.
Pos./ Item	Teile-Nr./ Part-No.	Stück/ Quant.	Benennung	Description
ALL TOLERANCED DIMENSIONS ARE FOR INSTALLATION ONLY. ALL OTHER DIMENSIONS ARE FOR REFERENCE ONLY.			<b>FMC Technologies</b> F.A. Sening GmbH, Regentstr. 1, 25474 Ellerbek, Germany	
 Method 1		 Method 3		Date / Datum 19.07.2006
 Method 1		 Method 3		Name Larsen
Scale / Maßst. 1:5 Size / Format ISO-A4 Weight / Gewicht kg		Item-No. / Teile-Nr. DELTA2-HY-....		Item name / Benennung Tankwagenpumpe / Tank truck pump made for / zugehörig zu
		Drawing No. / Zeichnungs-Nr. 251830_72		Rev. 000.01
				Sheet / Blatt 2 of / von 2

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“Schutzvermerk nach DIN 34 beachten”



**FMC Technologies**

**F.A. Sening GmbH**  
D-25474 Ellerbek, Germany

Changed :

Date :

08.02.2007

Name :

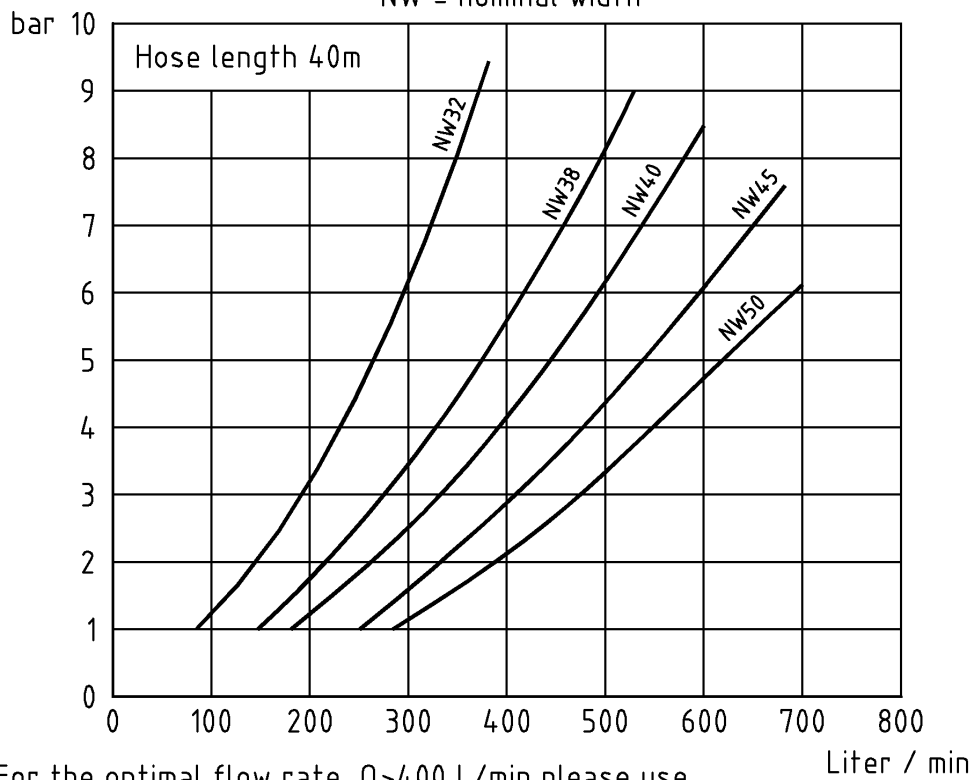
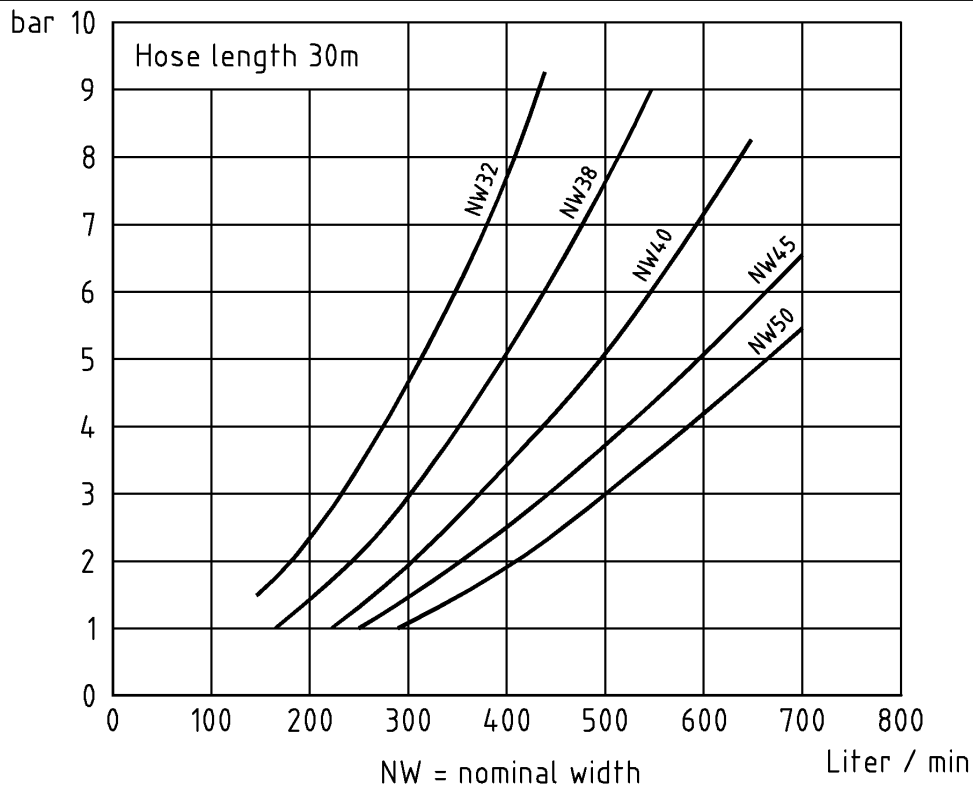
A. Jaacks

Drawing No.

E51.251929

Rev.

complete pressure drop of the tank truck



For the optimal flow rate  $Q > 400$  L/min please use the hose with the maximal nominal width

## Approachable Flow Rate for F.A. Sening Centrifugal Pump

**FMC Technologies**

**F.A. Sening GmbH**  
D-25474 Ellerbek, Germany

Geänd. am :

Datum :

20.02.2007

Name :

A. Jaacks

Zeichnungs-Nr.

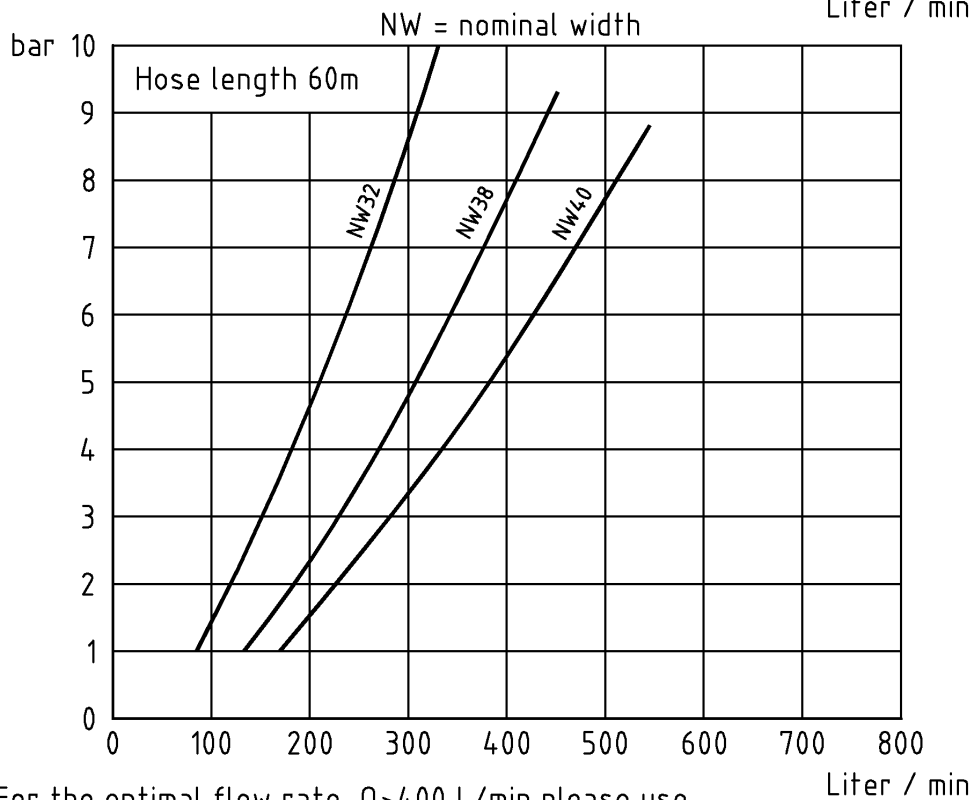
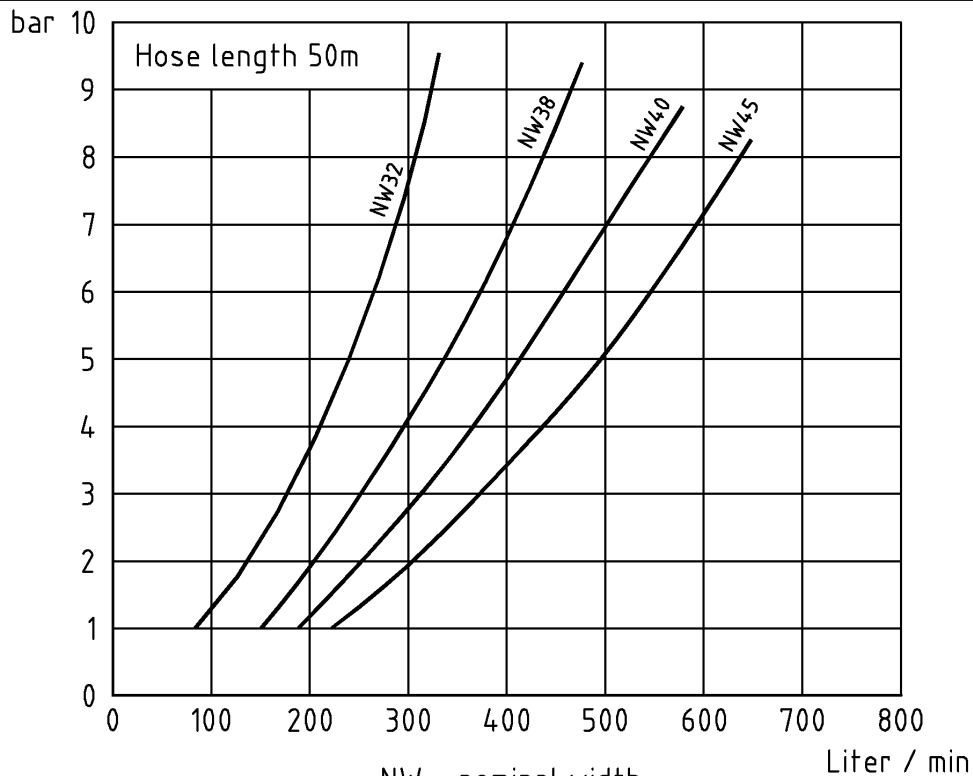
E51.18273

Rev.

A

"Schutzvermerk nach DIN 34 beachten"

complete pressure drop of the tank truck



For the optimal flow rate  $Q > 400$  L/min please use the hose with the maximal nominal width

Approachable Flow Rate  
for F.A. Sening Centrifugal Pump

**FMC Technologies**

**F.A. Sening GmbH**  
D-25474 Ellerbek, Germany

Geänd. am :

Datum :

Name :

20.02.2007

A. Jaacks

Zeichnungs-Nr.

Rev.

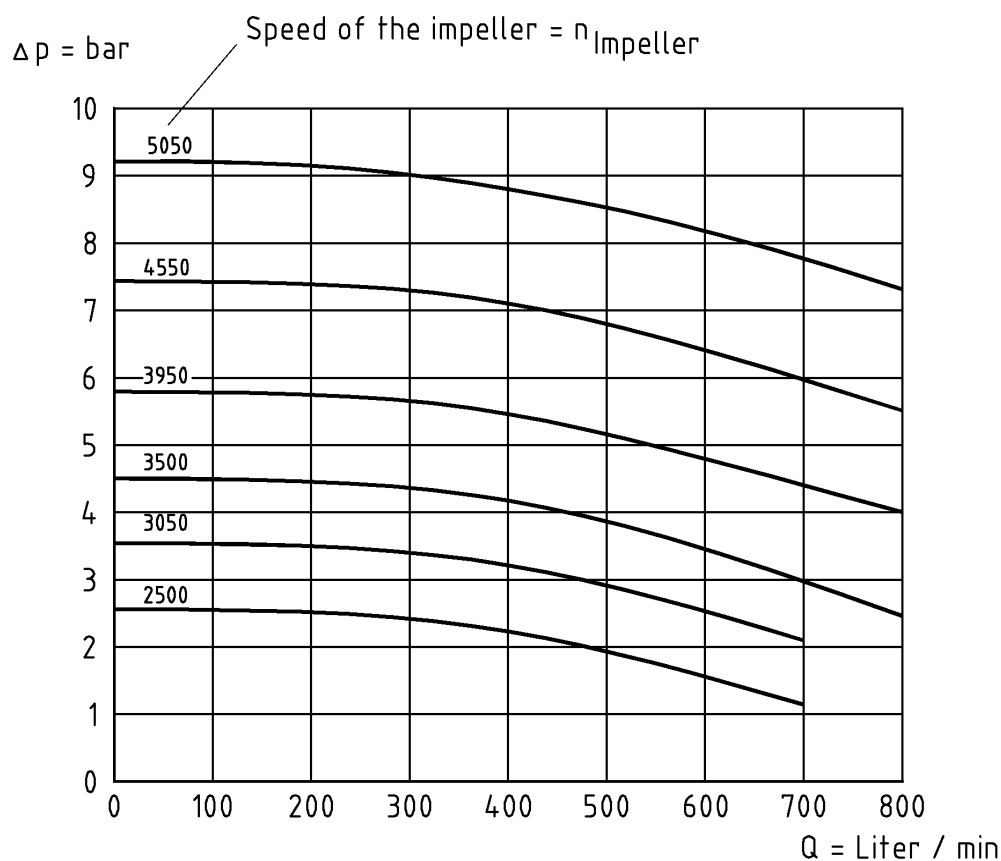
E51.18274

A

"Schutzvermerk nach DIN 34 beachten"

Optional gear ratio of the pump =  $i_{\text{Pump}}$

$i = 7,21$	$i = 4,35$
$i = 6,57$	$i = 3,87$
$i = 5,69$	$i = 3,1$
$i = 4,94$	$i = 2,45$



$$n_{\text{Motor}} = \frac{n_{\text{Impeller}}}{i_{\text{Pump}} \times i_{\text{Auxiliary drive}}}$$

"Schutzvermerk nach DIN 34 beachten"

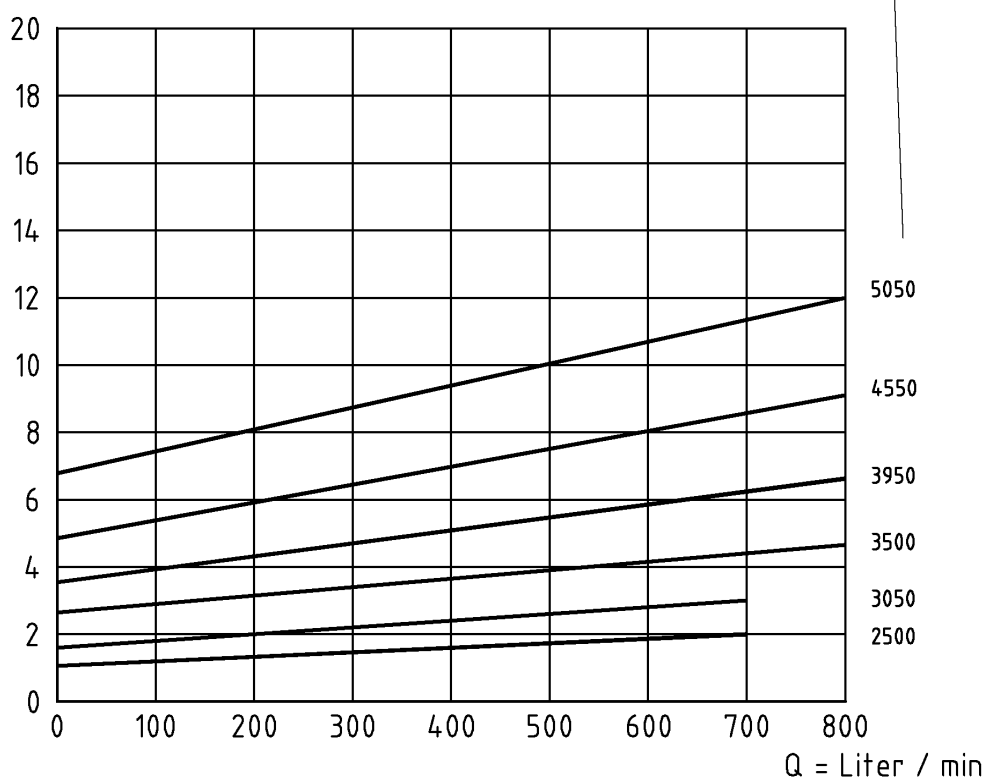
<p>Q-Δp-n Diagram for Pump Type "delta2" Impeller width = 8 mm</p>		<p><b>FMC Technologies</b> <b>F.A. Sening GmbH</b> D-25474 Ellerbek, Germany</p>	
		<p>Changed : _____</p>	<p>Date : 12.12.2006 Name : A. Jaacks Drawing No. E51.251903 Rev. _____</p>

Optional gear ratio of the pump =  $i_{\text{Pump}}$

$i = 7,21$	$i = 4,35$
$i = 6,57$	$i = 3,87$
$i = 5,69$	$i = 3,1$
$i = 4,94$	$i = 2,45$

N = KW

Speed of the impeller =  $n_{\text{Impeller}}$



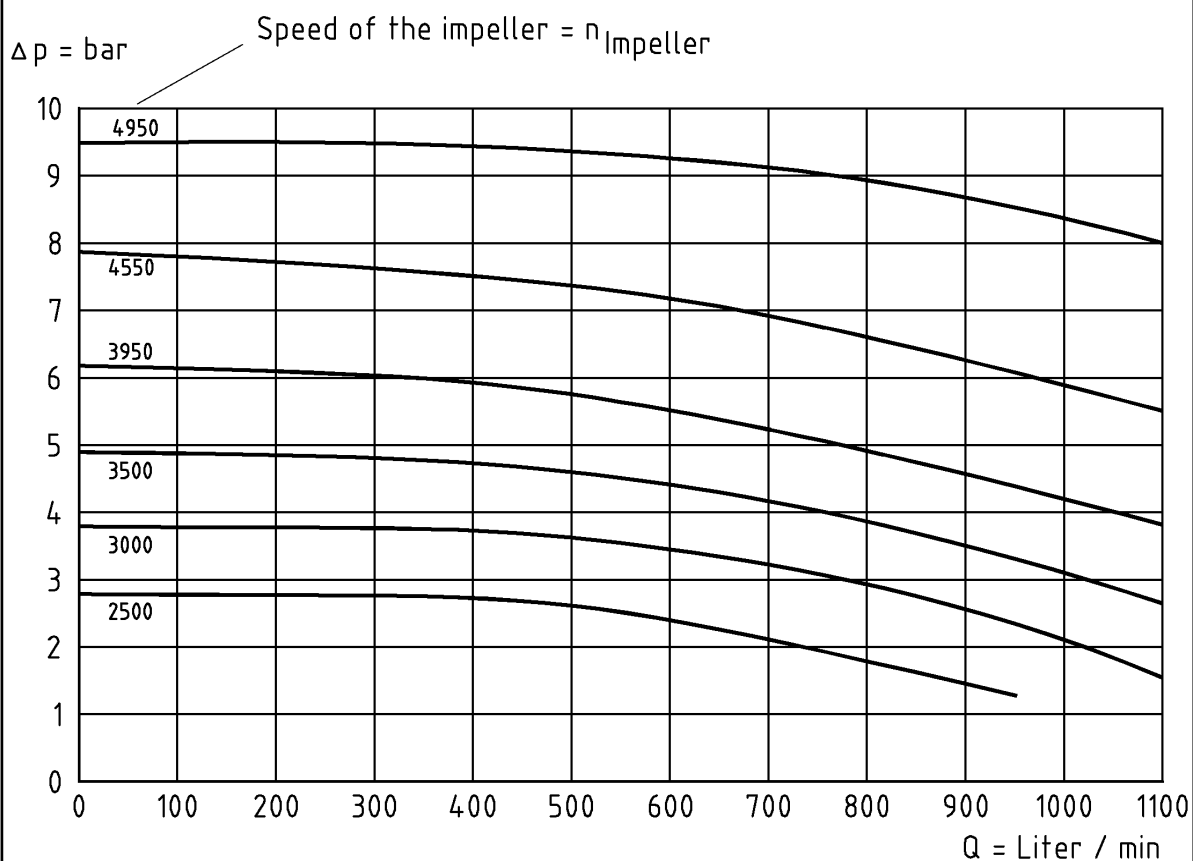
$$n_{\text{Motor}} = \frac{n_{\text{Impeller}}}{i_{\text{Pump}} \times i_{\text{Auxiliary drive}}}$$

"Schutzvermerk nach DIN 34 beachten"

		<b>FMC Technologies</b>		<b>F.A. Sening GmbH</b> D-25474 Ellerbek, Germany	
N-Q-n Diagram for Pump Type "delta2" Impeller width = 8 mm		Changed :	Date : 12.12.2006		Name : A. Jaacks
			Drawing No. E 51.251904		Rev.

Optional gear ratio of the pump =  $i_{\text{Pump}}$

$i = 7,21$	$i = 4,35$
$i = 6,57$	$i = 3,87$
$i = 5,69$	$i = 3,1$
$i = 4,94$	$i = 2,45$



$$n_{\text{Motor}} = \frac{n_{\text{Impeller}}}{i_{\text{Pump}} \times i_{\text{Auxiliary drive}}}$$

"Schutzvermerk nach DIN 34 beachten"

Q-Δp-n Diagram for Pump  
Type "delta2"  
Impeller width = 12 mm

**FMC Technologies**

**F.A. Sening GmbH**  
D-25474 Ellerbek, Germany

Geänd. am :

Datum :

Name :

12.12.2006

A. Jaacks

Zeichnungs-Nr.

Rev.

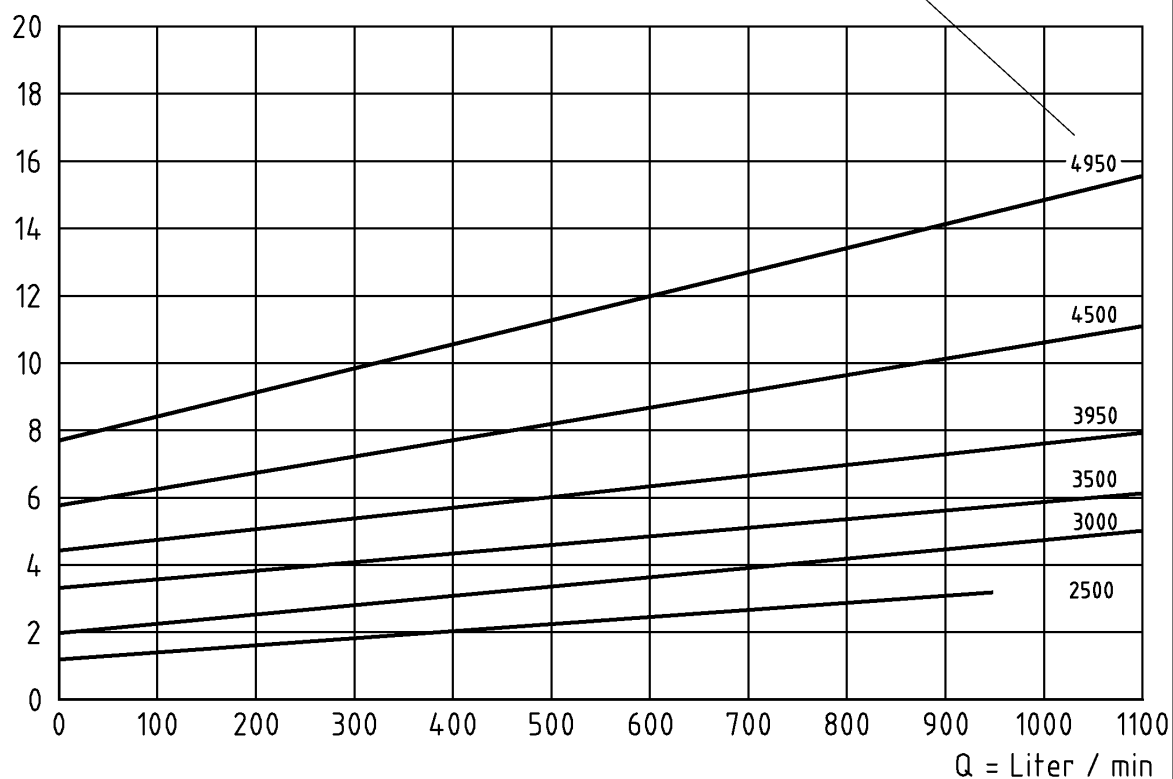
E51.251905

Optional gear ratio of the pump =  $i_{\text{Pump}}$

$i = 7,21$	$i = 4,35$
$i = 6,57$	$i = 3,87$
$i = 5,69$	$i = 3,1$
$i = 4,94$	$i = 2,45$

N = KW

Speed of the impeller =  $n_{\text{Impeller}}$



$$n_{\text{Motor}} = \frac{n_{\text{Impeller}}}{i_{\text{Pump}} \times i_{\text{Auxiliary drive}}}$$

"Schutzvermerk nach DIN 34 beachten"

N-Q-n Diagram for Pump  
Type "delta2"  
Impeller width = 12 mm

**FMC Technologies**

**F.A. Sening GmbH**  
D-25474 Ellerbek, Germany

Changed :

Date :

12.12.2006

Name :

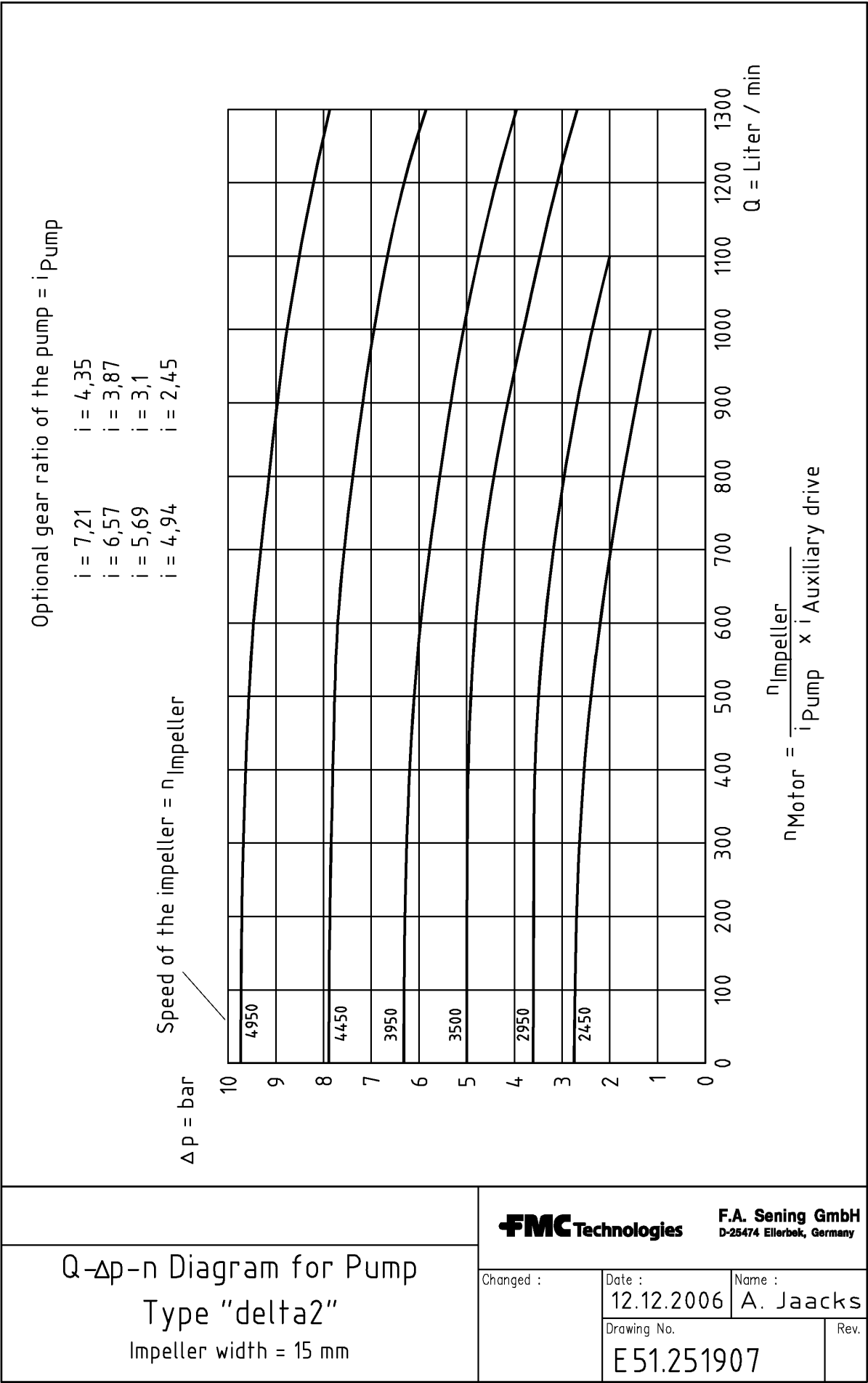
A. Jaacks

Drawing No.

E51.251906

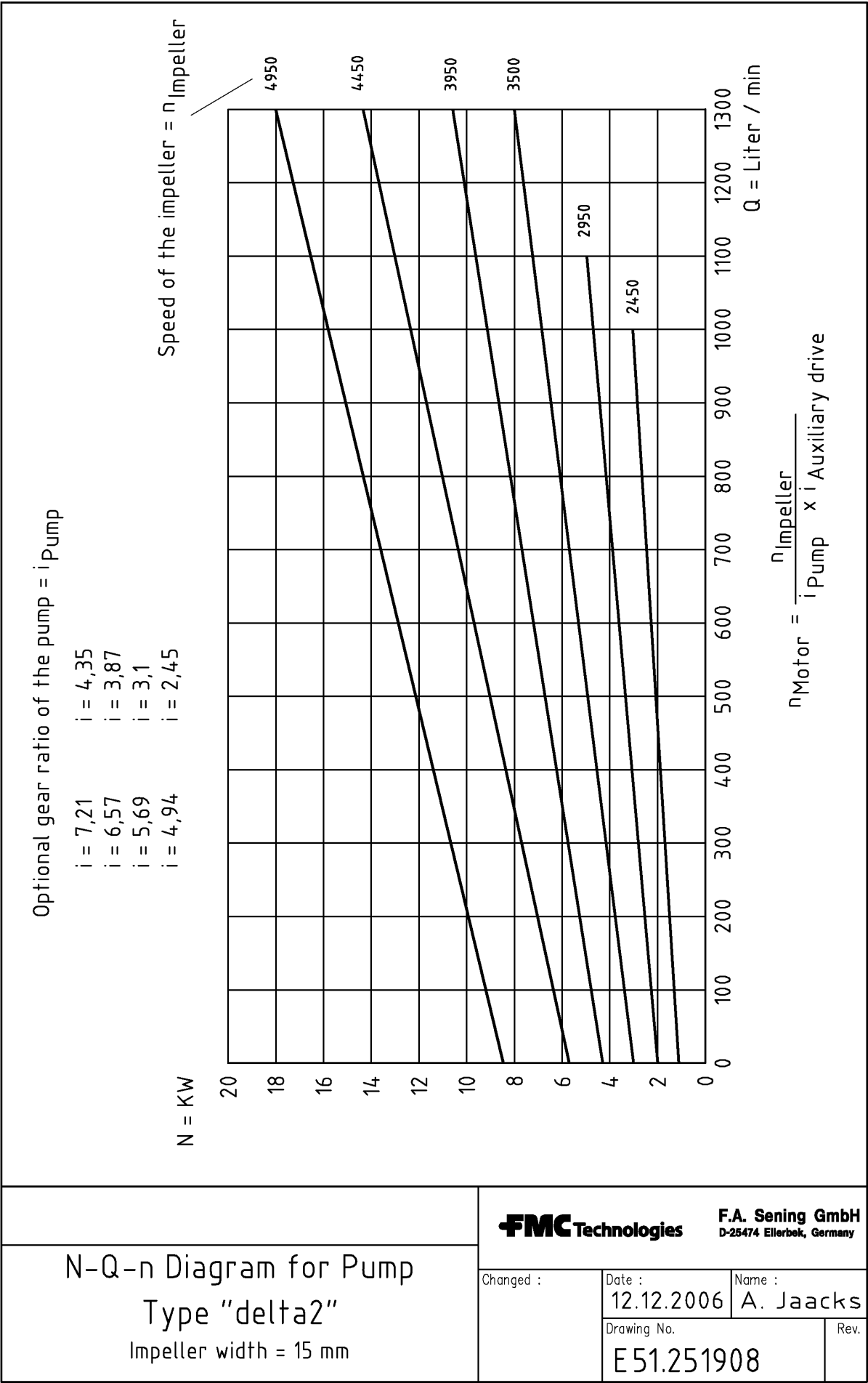
Rev.

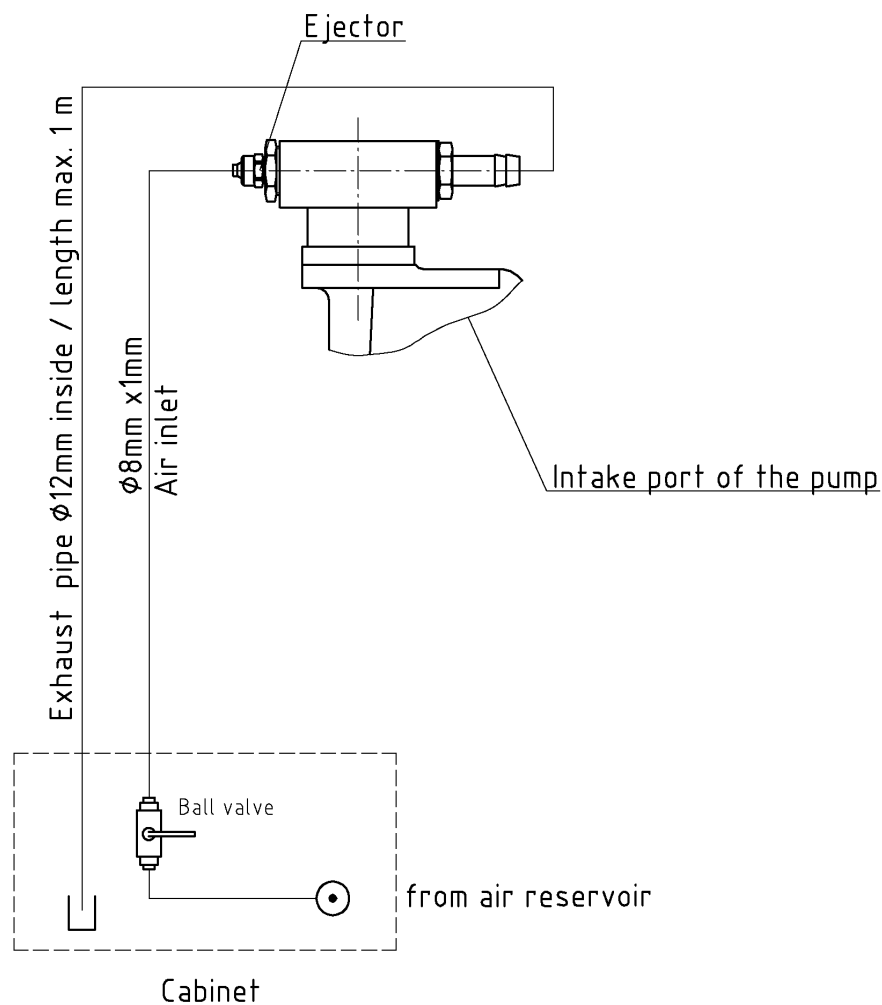
“Schutzvermerk nach DIN 34 beachten”





“Schutzvermerk nach DIN 34 beachten”

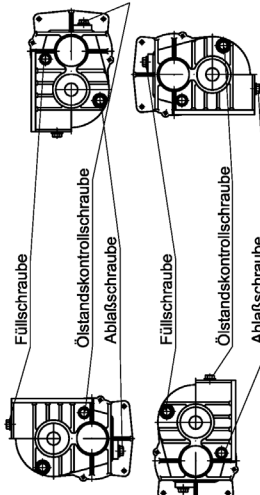
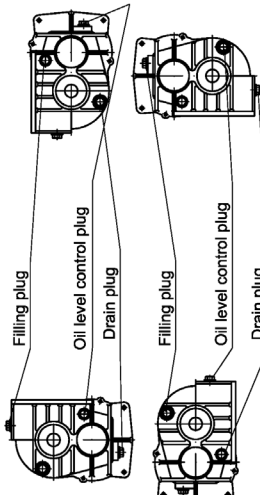




If the exhaust pipe is longer than 1 m, than the inside diameter has to be extended. Otherwise the dynamic pressure in the pipe is high and the ejector does not work faultlessly.

"Schutzvermerk nach DIN ISO 16016 beachten"

Connection Diagram for Ejector	<b>FMC Technologies</b> <b>F.A. Sening GmbH</b> D-25474 Ellerbek, Germany		
	Changed :	Date : 21.02.2007	Name : A. Jaacks
		Drawing No. E51.250327	Rev. A

Vorderseite		Rückseite																																															
<p><b>Bedienungshinweise zur Sening™-Kreiselpumpe</b></p> <p>Die Pumpe darf nicht trocken laufen, da sonst die Gleitringdichtung zerstört wird.</p> <p>Zum Fördern muß die Pumpe mit Flüssigkeit gefüllt sein, gegebenenfalls falls Luft aus der Saugleitung mit dem Ejektor entfernen.</p> <p>Bei geschlossenen Ventilen darf die Pumpe ohne Drehzahlabsenkung nur kurzfristig (1 min.), mit Drehzahlabsenkung (Pumpendruck 3 bar) maximal 10 min., laufen.</p> <p>Nur bei "beta2": Die pneumatischen Steuerblöcke (SA, SB) dürfen nur betätigt werden, wenn der Nebenantrieb nicht eingelegt ist.</p> <p>Wartung der Sening-Kreiselpumpe</p> <p>Bei normalem Betrieb halbjährlich das Getriebeöl wechseln (SAE 90 Hypoid). Einfüll-, Abfäll- und Ölstandkontrollschraube sind auf der Skizze zu erkennen. Die Gelenkwelle ist jeweils nach 100 Betriebsstunden abzuschrämen.</p>  <p><b>F.A. Sening GmbH</b> D-25474 Ellerbek, Germany</p>		<p><b>Operating and maintenance instructions for Sening™ centrifugal pumps</b></p> <p>Prior to first operation the pump must be filled with liquid, otherwise the pump will not generate suction capability.</p> <ul style="list-style-type: none"> <li>- Open footvalve of filled compartment.</li> <li>- Use ejector to increase the pumps priming capacity (optional).</li> </ul> <p>To prevent demaging the mechanical seal, the pump shall not be operated without liquid.</p> <p>The pump shall not be operated against closed valve with max. speed for more than 1 minute.</p> <p>The pump may be operated against closed valve at idle speed at max. 3 bar pressure for max. 10 minutes.</p> <p>BETA2-Pump: The pneumatic control switches (SA-SB) for the integrated 3-way-valve shall only be operated when the PTO-drive is not engaged.</p> <p>Maintenance of the F.A. Sening centrifugal pump</p> <p>Under normal operating conditions gear oil shall be changed every 6 months (Quality: SAE90 hypoid oil).</p> <p>Filling plug, drain plug and oil level control plug are shown on below drawing.</p> <p>Cardan drive shaft maintenance must be performed in accordance with the manufactures recommendation.</p>  <p><b>F.A. Sening GmbH</b> D-25474 Ellerbek, Germany</p>																																															
<p>155</p> <p>3</p> <p>5</p> <p>14,8</p> <p>Schrift: Arial Font: Arial</p> <p>FMC-Logo: Datei FMCTECH.eps FMC-Logo: File FMCTECH.eps</p>		<p>Hintergrund : Al eloxiert Schrift : Schwarz</p> <p>Ersatz für : 41.19001</p> <p>Oberflächenzeichen nach ISO 1302 Allgemeintoleranzen nach DIN ISO 2768-mK Allgemeine Werkstückkanten nach ISO 13715</p> <table border="1"> <thead> <tr> <th>Übernommen in:</th> <th>Geänd. am:</th> <th>Geänd. von:</th> <th>Name</th> </tr> </thead> <tbody> <tr> <td>21.17482</td> <td>01.03.94</td> <td>25.02.07</td> <td>RL</td> </tr> <tr> <td>12.21441</td> <td>20/25</td> <td>21/207</td> <td>Sie</td> </tr> <tr> <td>21.250287</td> <td>20/25</td> <td>03.04.09</td> <td>RL</td> </tr> <tr> <td>12.251739</td> <td></td> <td></td> <td></td> </tr> <tr> <td>12.251820</td> <td></td> <td></td> <td></td> </tr> <tr> <td>12.251830</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Werkstoff:</th> <th>Werkst.-Nr.:</th> <th>Name</th> <th>Mod.-Nr.:</th> </tr> </thead> <tbody> <tr> <td>AL eloxiert</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>gez.</th> <th>gepr.</th> <th>Datum</th> <th>Teil-Nr.:</th> <th>Rev.:</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td>01.12.1994</td> <td>Schaupp</td> <td>D</td> </tr> </tbody> </table> <p>Maßstab : 1:1</p> <p>Wartungsschild</p> <p>BN-Schild</p> <p>Zeichnungs-Nr. 31.250115</p> <p>Rev. D</p>		Übernommen in:	Geänd. am:	Geänd. von:	Name	21.17482	01.03.94	25.02.07	RL	12.21441	20/25	21/207	Sie	21.250287	20/25	03.04.09	RL	12.251739				12.251820				12.251830				Werkstoff:	Werkst.-Nr.:	Name	Mod.-Nr.:	AL eloxiert				gez.	gepr.	Datum	Teil-Nr.:	Rev.:			01.12.1994	Schaupp	D
Übernommen in:	Geänd. am:	Geänd. von:	Name																																														
21.17482	01.03.94	25.02.07	RL																																														
12.21441	20/25	21/207	Sie																																														
21.250287	20/25	03.04.09	RL																																														
12.251739																																																	
12.251820																																																	
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Werkstoff:	Werkst.-Nr.:	Name	Mod.-Nr.:																																														
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"Schutzvermerk nach DIN ISO 16016 beachten"

## Approvals

Fehler! Verweisquelle konnte nicht gefunden werden.

# EG - Konformitätserklärung EC - Declaration of Conformity

im Sinne der EG-Richtlinie über nichtelektrische explosionsgeschützte Geräte  
nach 94/9/EG Anhang VIII (ATEX 95)  
*as defined by non-electrical explosion protected Equipment Directive 94/9/EC Annex VIII*

Der Hersteller / The Manufacturer

**F.A. Sening GmbH**  
**Regentstraße 1**  
**D-25474 Ellerbek**

erklärt hiermit, dass das nichtelektrische explosionsgeschützte Gerät  
*herewith we declare, that the non-electrical explosion protected Equipment*

**Gegenstand: Kreispumpe mit Getriebe / hydraulischer Antrieb**  
**Alpha-3-704, Beta2-3-1004, Delta-3-1204, Gamma**  
**und Bauart ähnlich**

**Subject: Centrifugal Pump with Gear Box / Hydraulic Motor**  
**Alpha-3-704, Beta2-3-1004, Delta-3-1204, Gamma**  
**and similar in design**

in der gelieferten Ausführung folgenden einschlägigen Bestimmungen entspricht:  
*corresponds to following pertinent regulations in the delivered implementation*

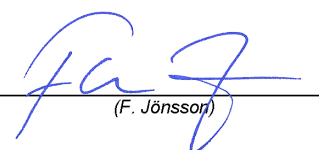
## Nichtelektrische explosionsgeschützte Geräte 94/9/EG *Non-electrical explosion protected Equipment Directive 94/9/EC*

- |    |   |                                |
|----|---|--------------------------------|
| 8  | Angewandte Gerätegruppe: .....                                | Gerätegruppe II                |
|    | <i>Applied group:</i>   | <i>Category II</i>             |
| 9  | Angewandte Untergruppe: .....                                 | Untergruppe B                  |
|    | <i>Applied subgroup:</i>                                      | <i>Subgroup B</i>              |
| 10 | Angewandte Gerätekategorie: .....                             | Gerätekategorie 2              |
|    | <i>Applied category:</i>                                      | <i>Category 2</i>              |
| 11 | Angewandte harmonisierte Normen, insbesondere:                | DIN EN 1127-1, DIN EN 13463-1, |
|    | <i>Applied harmonized standards, in particular:</i>           | DIN EN 1050, DIN EN ISO 12100, |
|    |   | CEN Report R044-001            |
| 12 | Geräte-Kennzeichnung: .....                                   | II 2G II B                     |
|    | <i>Equipment marking:</i>                                     |                                |
| 13 | Prüfungen/Überwachung/Kontrollen während der Fertigung: ..... | Hersteller                     |
|    | <i>Examination/inspection/tests during manufacturing:</i>     | <i>Manufacturer</i>            |

14 Anlagen/Enclosures:

15 Ort und Datum: Ellerbek, den 10.04.2012  
*Location and date*

Geschäftsführer  
*General Manager*

  
(F. Jönsson)



The specifications contained herein are subject to change without notice and any user of said specifications should verify from the manufacturer that the specifications are currently in effect. Otherwise, the manufacturer assumes no responsibility for the use of specifications which may have been changed and are no longer in effect.

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