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BANK Danske Bank A/S
SWIFT/BIC DABADKKK
ACC. DKK 4440 3120119907
IBAN DKK DK23 3000 3120 1199 07
ACC. EUR 4440 3106222347
IBAN EUR DK22 3000 3106 2223 47

INSTRUCTIONS FOR PERFECTOR PLANT

Gerstenberg Schröder

Gerstenberg & Agger A/S
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CONTENTS:

PILOT PUMPE
TYPE P-3-15/35

Serial No. 2513.001
Year 2004

CONTENTS:

PREFACE

The purpose of these operating instructions is to make the operator of the machine familiar with the machine and its application.

The operating instructions contain important information about safe, correct and effective use of the machine.

The information in the operating instructions is to be supplemented with all national working rules and regulations regarding environmental protection. Furthermore, precaution should always be taken when handling and using the machine.

The operating instructions should always be available for the use of the machine.

The operating instructions must be read and their recommendations should be performed by skilled persons who are responsible for the machine, for instance in connection with:

- Transportation
- Installation, operation, cleaning and handling of product
- Maintenance, covering inspection, troubleshooting and service as well as ordering and replacement of spare parts. Please note that if non-original spare parts are used, the guarantee of Gerstenberg & Agger will no longer be valid.

If you have any questions regarding the machine and the use of it which have not been answered in the operating instructions, please contact our local agent or the head office in Copenhagen.

Gerstenberg Schröder	DATA SHEET G&A MACHINERY/EQUIPMENT HIGH PRESSURE PUMP Project no.: 2513	No. 2513.001 Date/Drwn. 08.09.2004 App. MN/sja Page 1/1

TYPE	:	High Pressure Pump Type P-3-15/35
SERIAL NO. / YEAR	:	2513.001 / 2004
DIMENSION L x W x H:		Approx. 468 x 555 x 590 mm
WEIGHT	:	Approx.100 kgs
POWER SUPPLY	:	3 x 460V / 60 Hz
REMARKS	:	

Process Data

MAX. WORKING PRESSURE : 80 bar MAX. TEMPERATURE : 80°C

MAX. SOUND PRESSURE LEVEL : 76 dB

Machine Data

LUBRICATION OIL:
Castrol – Alpha SP 320

Charge :

ELECTRICAL MAIN MOTOR / MOTOR VARIATOR:
1 pcs. NORDGEAR, type SK92172AF-90L/4. Mounted with termistor.

FREQUENCY INVERTER:

V-BELT DRIVE:

Crankshaft Type	: None
Motor Pulley Type :	None
V-Belt Type :	None

SAFETY

The machine is designed and produced according to the current regulations and safety rules but may, when handled and operated incorrectly, pose a risk.

Generally, precaution should thus be taken when handling and operating the machine.

The machine must only be used within the limits stated in "Technical data".

Operators and service staff must have a qualified background supplemented by studying the operating instructions before they start working with the machine.

Safety manual

Warning: Danger of injury due to insufficient instruction

- Please note that your G&A equipment is a component of an industrial plant and may consist of parts supplied by G&A and by others as well.
- Before you start working with the G&A equipment, read and follow the instructions for usage and protection shown in all the operating manuals concerned.
- Follow the warnings and make them known to others
- Please note that only authorised persons may work on the G&A system. They must be familiar with the applicable regulations regarding industrial safety and accident prevention.

General safety rules

The following **directives of the manufacturer** as well as the ones shown in the manuals must be strictly followed at all times.

1. **Improper conduct:** Refrain in any way from work that impairs the safety of persons (users, third persons), property (installation) and environment.

2. **Access for unauthorised persons:** The manager is to ensure that only authorised persons work on facilities containing G&A pumps or parts.

3. **Protective gear:** May only be removed if the pump drive has been shut down, disconnected and secured from the main power supply.

4. **Unauthorised alterations of the system:** Installation of parts supplied by a third party and arbitrary alterations and changes affecting the safety of the facility are not allowed.

5. **Checks after repair work:** After each repair, checks must be carried out to ensure that all protective gear has been installed and is working faultlessly.

6. **Regulations for accident prevention specific to the industry:** Additionally, for the safe operation of facilities containing G&A pumps, the legal and other regulations regarding accident prevention specific to the industry and internal regulations must be observed.

Improper use

G&A declares the following **types of improper use** of their pumps and pump components as inadmissible:

- Pumping when cavitating
- Operation without pumping medium (dry run)
- Operation without pumping (wrong sense of rotation, operation with stop valves closed or bad lubrication)
- Operation beyond the binding limits of application
- Pumping of media with strongly abrasive additives

Caution: Danger of improper use

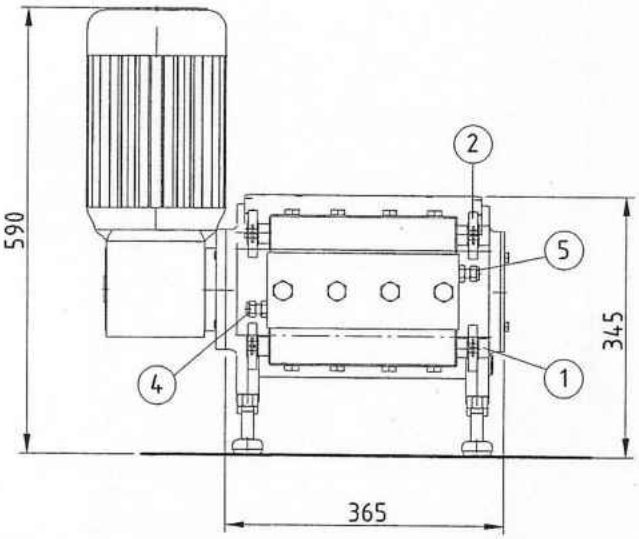
Plan and install your G&A pump according to the state of art. G&A declines any liability for systems that have not been planned or installed professionally. Please consult G&A in case of doubt.

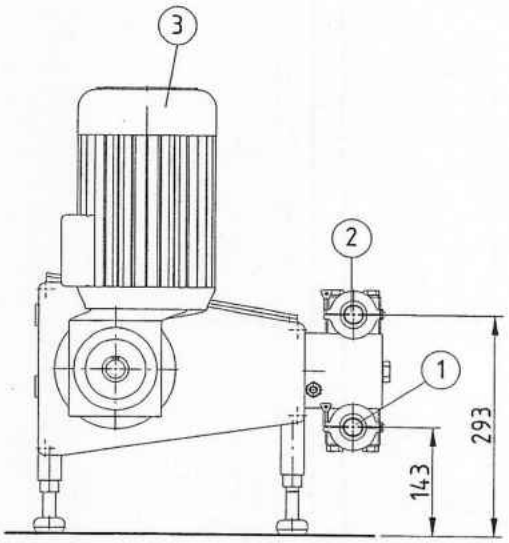
GERSTENBERG & AGGER A/S
COPENHAGEN

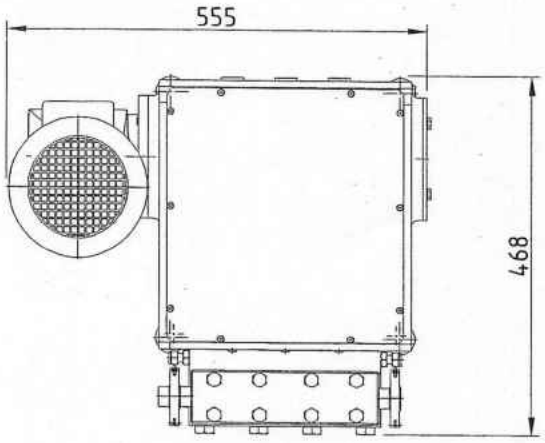
HP Pump
Type P3-15/35
and P3-8/35

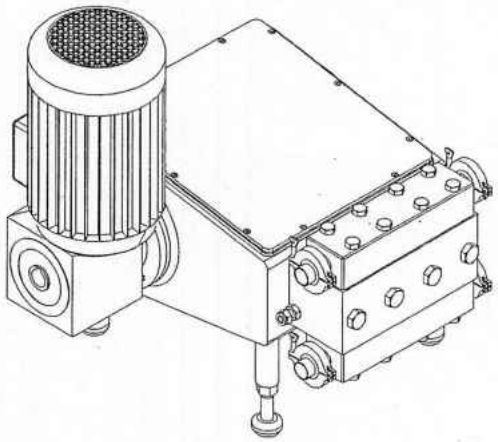
No.	38.100	Index	A
Date/Drwn.	03-12-2001 MN		
App.		Scale: ~~1:2~~	
Rev./App.	05-02-2003	AJE	
Country:		Page:	

(1) Product inlet, Clamp fitting, ø25mm pipe
(2) Product outlet, Clamp fitting, ø25mm pipe
(3) Gearmotor
(4) Inlet for flush water, ø8 mm pipe
(5) Outlet for flush water, ø8 mm pipe





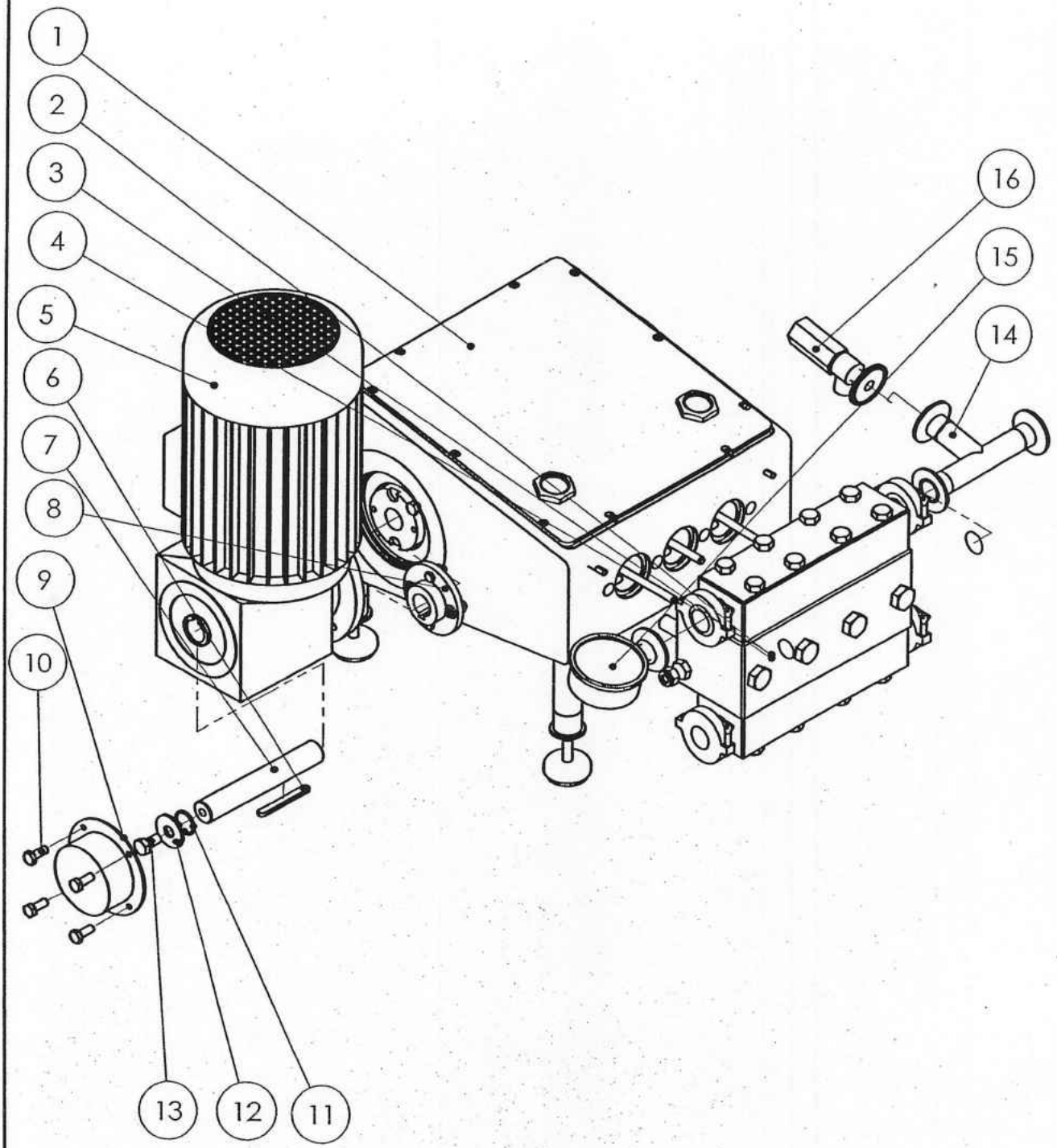




GERSTENBERG & AGGER A/S
COPENHAGEN

HT Pump P3-15/35
Assembly

No. 38.100	Index A
Date/Drwn. 03-12-2002 / MN	
App.	Scale: 1:6
Rev./App. -	-
Country: DK	Page: 1



GERSTENBERG & AGGER A/S
COPENHAGEN

SPARE PARTS LIST

Pump P-3-08/35

Assembly

No.SPL	39.938
Drwn.	03.12.02
Rev./App.	MN/bro
Page	1/1

Item	Part No.	Pcs/unit	Description
000	38.100-000		Labo Pump, P-3-15/35-LAB, Assembly Draw.
001	S38.107	1	Driver – P-xx/35-LAB
002	S38.106	1	Pump block Ø08
003	S38.105	3	Shaft seal Ø08
004	S38.104	6	Valve Assembly
005	663-0250	1	Cone Gear-NORD- SK92172AF-90L/4
006	15.209-594	1	FEDER-A--08*07*075, DS96-ST
007	38.100-024	1	Shaft Ø25x140, P-3-15/35-LAB
008	370-0830	1	Coupling-Flexdur-type-FD 13-4S
009	663-0503	1	Protecting Cover 68196020 Nord Gear
010	160-0097	4	Set screw M8x20 DIN933 A2
011	340-0035	1	Circlip 26*1.2
012	160-0299	1	Washer M12
013	160-0100	1	Set screw M10*020 DIN933 A2
014	S39.550	1	Tee piece with Collar branch Ø25
015	25.832-010	1	Pressure gauge 0-150 bar
016	S40.422	1	Safety relief valve for clamp collar Ø25-3

GERSTENBERG & AGGER A/S
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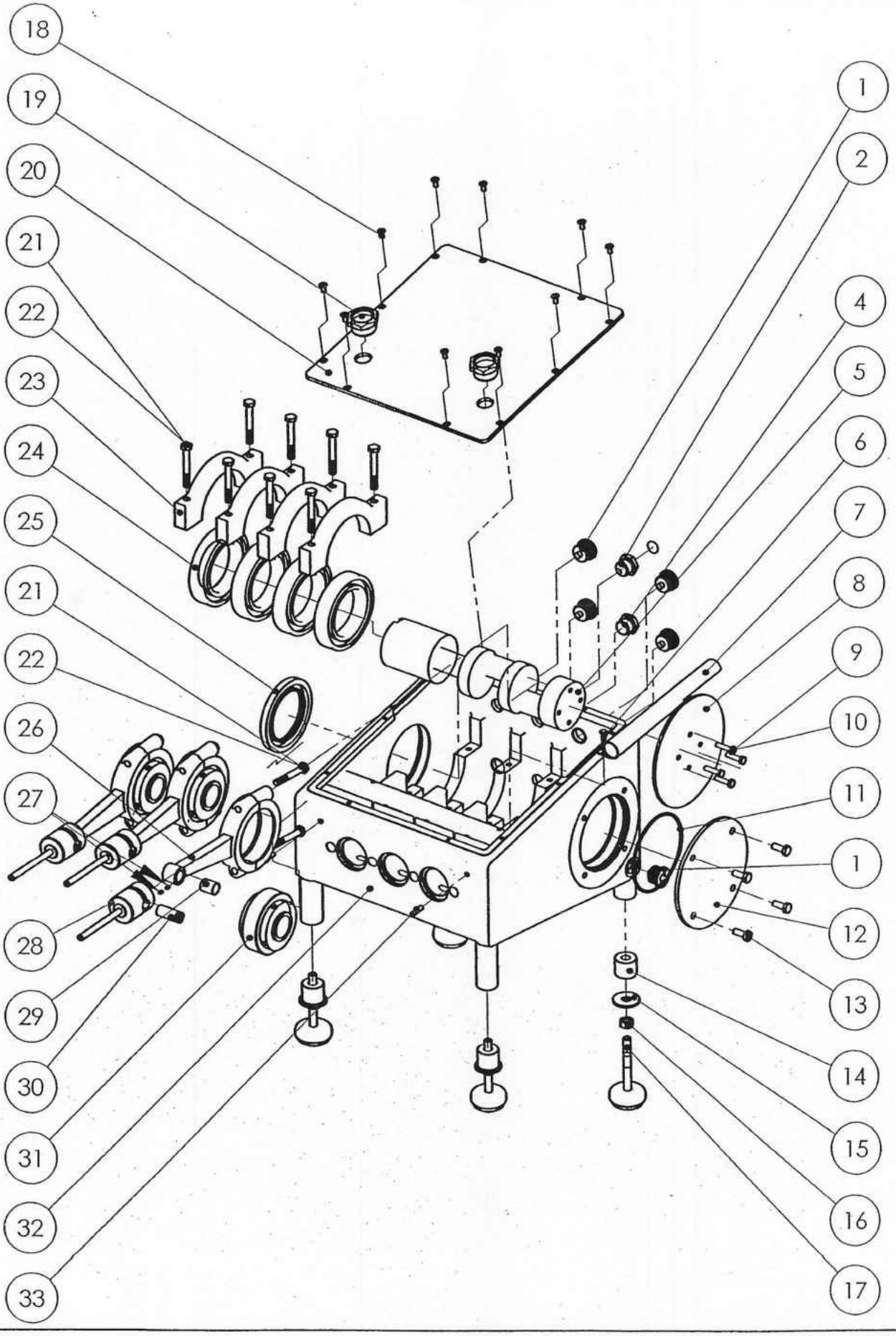
HT Pumpe P3-15/35
Driver

No. 38.101		Index A
Date/Drwn. 12-11-2002 / MN		
App.	Scale: 1:20	
Rev./App. -	-	
Country: DK	Page: 1	



GERSTENBERG & AGGER A/S
COPENHAGEN

SPARE PARTS LIST
Pump P-3-08/35
Driver

No.SPL 38.107-A
Drwn. 03.12.02
Rev./App. MN/bro
Page 1/2

Item	Part No.	Pcs/unit	Description
000	38.101-000		Driver - P3-xx/35-LAB
001	370-0230	5	Plug 1/2, magnetic, type 36Bm
002	100-0048	1	Adapter socket, ½*3/8, R211
003	663-0049	1	Airscrew for David/Brown
004	370-0004	1	Oil sight glass ½-600-4
005	38.100-004	1	Crank, P-3-15/35-LAB
006	160-1008	1	Screw DIN 933, M05*012 A2
007	38.100-012	1	Oil Groove, P-3-15/35-LAB
008	38.100-011	1	Oil Thrower P-3-15/35-LAB
009	160-0336	4	Screw DIN933, M06*025- A2
010	160-0032	4	Washer-DIN127B-Ø06, A2
011	140-0374	1	O-ring 109.50*3.00, NBR 70
012	38.100-028	1	Blind Cover P-3-15/35-LAB
013	160-0094	4	Screw DIN933, M06*016, A4
014	38-100-025	4	Distance ring P-3-15/35-LAB
015	160-0245	4	Washer DIN9021-Ø10, A2
016	160-0079	4	Nut M10, DIN934, M10, A2
017	370-0236	4	Machine shoes, M50-10-70
018	160-0761	10	Screw DIN7991, M05*012, UH-A2
019	370-0001	2	Oil sight glass 1 600-6
020	38.100-027	1	Inspection Cover P-3-15/35-LAB
021	160-1765	14	Screw DIN933 M08*060 A2
022	160-0254	14	Washer, DIN127B, Ø08, A2
023	38.100-003	4	Bearing Holder P-3-15/35-LAB
024	150-0265	4	Bearing 61914 70*100*16
025	140-0952	1	Oil seal ring 70-105-10-NBR

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SPARE PARTS LIST
Pump P-3-08/35
Driver

No.SPL 38.107-A
Drwn. 03.12.02
Rev./App. MN/bro

Item	Part No.	Pcs/unit	Description
026	38.100-005	3	Connecting Rod, P-3-15/35-LAB
027	160-1309	6	Screw, DIN916 M04*006 A2
028	38.100-026	3	Crosshead/Plunger Ø08 P-3-08/35
029	150-0267	3	Perma Bearing 1520 P10
030	38.100-008	3	Cross pin for P-3-15/35-LAB
031	150-0266	3	Bearing, Split Cooper Bearing
032	38.100-002	1	Crankhouse, P-3-15/35-LAB
033	160-0303	2	Cylindrical pin DIN7-06*24-A2

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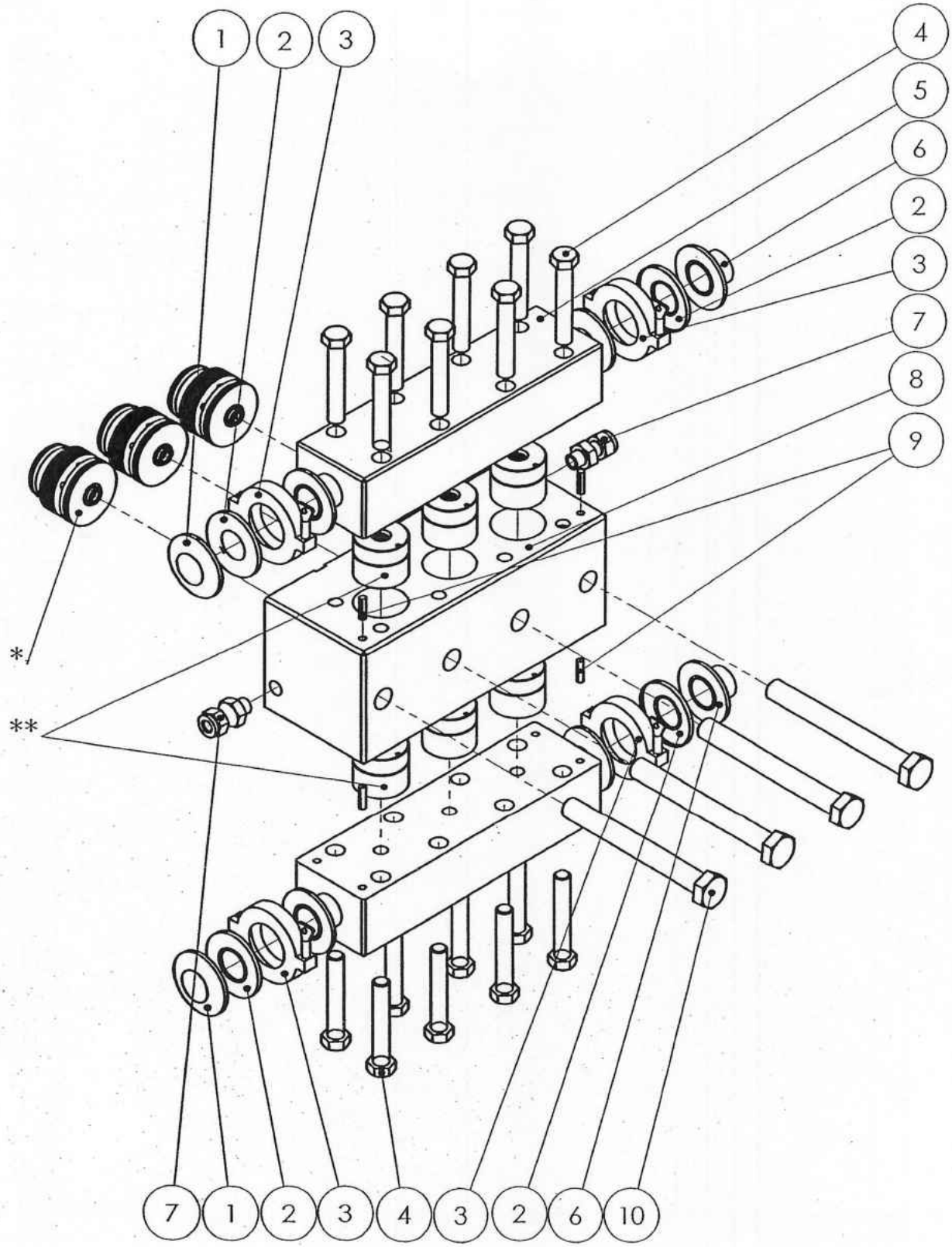
HT Pump P3-15/35
Pump block

No. 38.102	Index A
Date/Drwn. 31-10-2002 / MN	
App.	Scale: 1:10
Rev./App. -	-
Country: DK	Page: 1



* = Assembly nr.: 38.103
** = Assembly nr.: 38.104

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COPENHAGEN

SPARE PARTS LIST
Pump P-3-08/35
Pump Block Ø08

No.SPL 38.106-A
Drwn. 03.12.02
Rev./App. MN/bro

Item	Part No.	Pcs/unit	Description
000	38.102-000	1	Pump Block Ø15, Assembly Draw.
001	220-0101	2	Washer Ø25, Clamp 316
002	220-0099	4	Seal Ø25, Clamp/1, NBR
003	220-0382	4	Clamp-Ring-ISO-Ø25-38, SS,
004	160-2079	16	Screw, DIN931-M12*070, A2
005	38.100-019	2	Valve Cover P-3-15/35-LAB
006	220-0096	2	Collar branch Ø25, Clamp/1.-316
007	110-0043	2	Serto.Forsk.-Ø08*1/4, SO51121
008	38.100-034	1	Cylinder Block Ø08 P-3-15/35-LAB
009	160-0421	4	Cylindrical pin DIN7, 5*20 A2
010	160-1855	4	Screw-DIN912-M16*140, CH-A2

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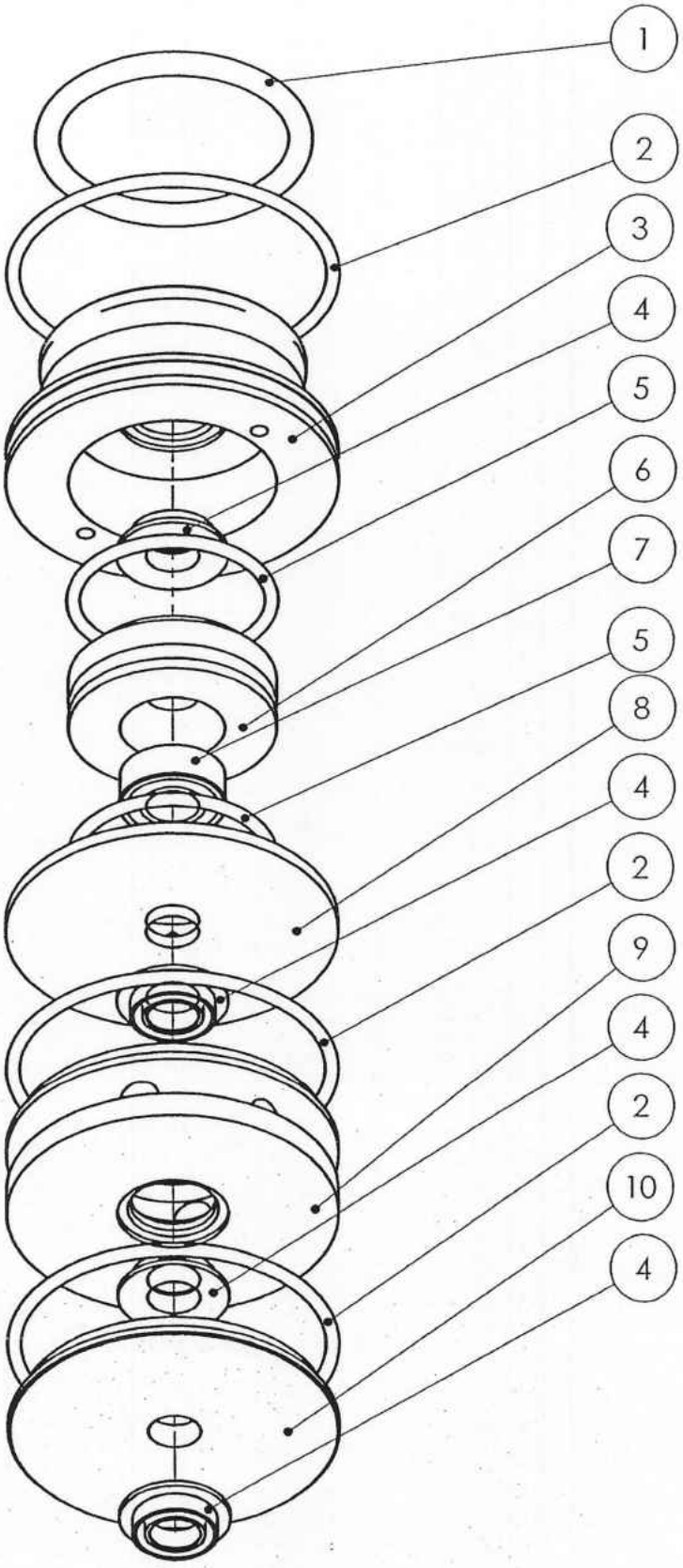
HT Pump P3-15/35
Shaft seal Ø15

No. 38.103	Index A
Date/Drwn. 29-10-2002 / MN	
App.	Scale: 1:2
Rev./App. -	-
Country: DK	Page: 1



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SPARE PARTS LIST
Pump P-3-08/35
Shaft Seal Ø08

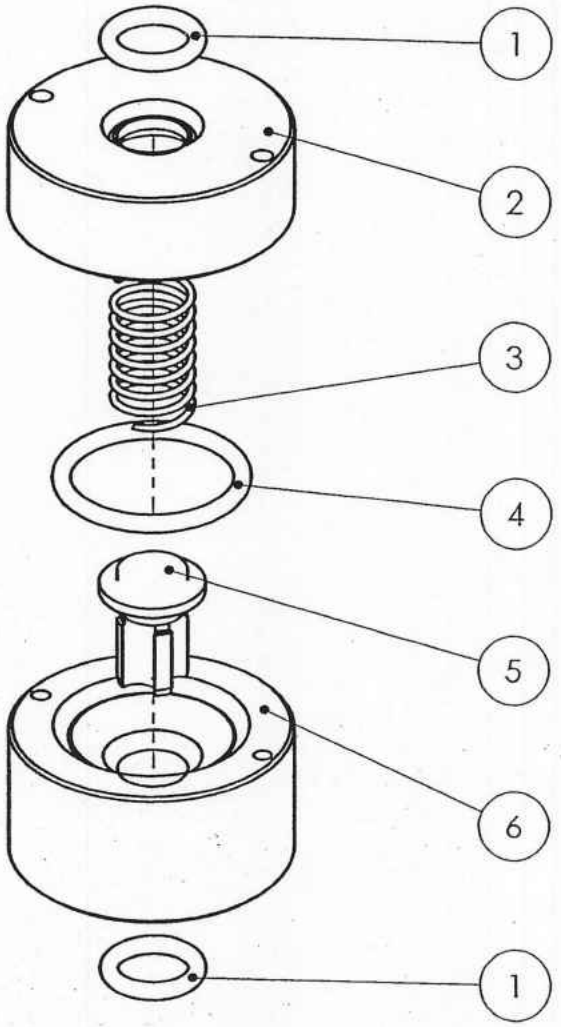
No. SPL	38.105-A
Drwn.	03.12..02
Rev./App.	MN/bro
Page	1/1

Item	Part No.	Pcs/unit	Description
000	38.103-000	1	Shaft Seal Ø15, Assembly Draw.
001	140-0256	1	O-ring, 34,52*3,53, NBR 70
002	140-1019	3	O-Ring, 46,00*2,00, NBR 70
003	38.100-035	1	Support Ring for Oil Seal Ø08 Mupo
004	140-0959	4	Mupuseal 30311-0080-40-SD
005	140-1022	2	O-Ring, 28,00*2,00, NBR 70
006	38.100-030	1	U-Cup Holder Ø08 P-3-15/35-LAB
007	140-0960	1	U-Cup, 8,0*16,0*6,3*5,7, PU 93 A
008	38.100-031	1	Leakage Ring Ø08 P-3-15/35-LAB
009	38.100-032	1	Circulation Ring Ø08 P-3-15/35-LAB
010	38.100-033	1	Product Support ring Ø08 P-3-15/35-Lab

GERSTENBERG & AGGER A/S
COPENHAGEN

HT Pump P3-15/35
Valve Assembly

No. 38.104	Index A
Date/Drwn. 30-10-2002 / MN	
App.	Scale: 1:2
Rev./App. -	-
Country: DK	Page: 1



GERSTENBERG & AGGER A/S
COPENHAGEN

SPARE PARTS LIST

Pump P-3-08/35

Valve Assembly

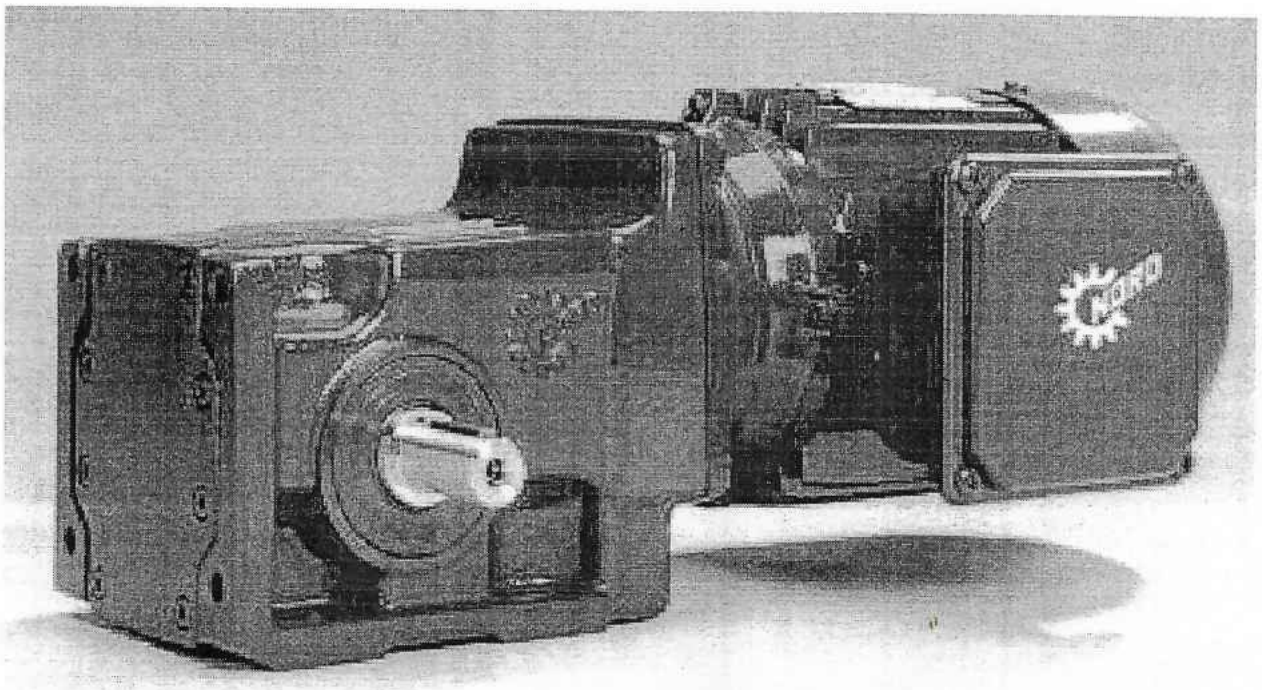
No. SPL	38.104-A
Drwn.	03.12..02
Rev./App.	MN/bro
Page	1/1

Item	Part No.	Pcs/unit	Description
000	38.104-000	1	Valve Assembly, Assembly Draw.
001	140-1023	2	O-Ring, 10,00*2,50, NBR 70
002	38.100-020	1	Valve House, P-3-15/35-LAB
003	15.027-102	1	Pressure spring -01,00*012,00*020-A2
004	140-1024	1	O-Ring, 23,00*2,50, NBR 70
005	38.100-022	1	Valve Cone P-3-15/35-LAB
006	38.100-023	1	Valve Seat P-3-15/35-LAB

Betriebs- und Wartungsanleitung
Operating and Maintenance Instruction
Instructions de conduite et d'entretien

B 1042
10/2000
D GB F

Diese Sicherheitshinweise sind aufzubewahren
These safety instructions must be kept available
Ces instructions de sécurité doivent être observées



Kegelradgetriebe, zweistufig

Helical-Bevel Gearboxes, double reduction

Réducteurs à couple cônique, à deux trains d'engrenages

Getriebebau NORD
GmbH & Co. KG
D-22934 Bargteheide · P.O.Box 1262
D-22941 Bargteheide · Rudolf-Diesel-Straße 1
Tel. 0 45 32/4 01-0 · Telefax 0 45 32/40 15 55
NORD Internet: http://www.nord.com

Δ Warnung
Es wird vorausgesetzt, daß die grundsätzlichen Planungsarbeiten der Anlage sowie Transport, Montage, Installation, Inbetriebnahme, Wartung und Reparaturen von qualifiziertem Personal ausgeführt bzw. durch verantwortliche Fachkräfte kontrolliert werden. Bei Arbeiten am Getriebemotor muß garantiert sein, daß keinerlei Spannung anliegt, und dieser gegen Wiedereinschaltung gesichert ist.

Δ Warnung
Veränderungen gegenüber dem Normalbetrieb (höhere Leistungsaufnahme, Temperaturen, Schwingungen, Geräusche usw. oder Ansprechen der Überwachungseinrichtungen) lassen vermuten, daß die Funktion beeinträchtigt ist. Zur Vermeidung von Störungen, die ihrerseits mittelbar oder unmittelbar schwere Personen- oder Sachschäden bewirken könnten, muß das zuständige Wartungspersonal dann umgehend verständigt werden.

Δ Im Zweifelsfall die entspechenden Betriebsmittel sofort abschalten!

Aufstellung, Vorbereitung
- Transportösen am Getriebe sind für das Gewicht des Antriebs ausgelegt
- Fundamente ausreichend bemessen und schwingungsfrei ausführen
- Getriebe oder -motor fest und ohne Verspannung montieren
- ausreichende Belüftung vorsehen
- serienmäßiges Innengewinde nach DIN 332 zum Aufziehen von Verbindungselementen auf die Wellen benutzen
- Schläge auf die Wellen vermeiden (Lagerbeschädigung!)
- Maschine und Getriebe möglichst mit elastischen Kupplungen verbinden
- vor dem Einschalten Abtriebselemente aufziehen bzw. Paßfeder sichern
- bei Aufsteckgetrieben mit Drehmomentstütze Gummipuffer verwenden

Elektrischer Anschluß
- Motoranschluß nach Schaltbild vornehmen
- Übereinstimmung von Netzspannung und Frequenz mit den Typenschild-Daten sicherstellen
- Sichere Schutzleiterverbindung herstellen
- evtl. falsche Drehrichtung korrigieren durch Vertauschen von 2 Phasen
- Nicht benötigte Kabeleinführungsöffnungen und den Kasten selbst staub- und wasserdicht verschließen
- Überbelastung und Phasenausfall durch Schutzschalter vorbeugen
- Einstellen des Motorschutzschalters auf Nennstrom
- Schaltbilder auf der letzten Seite

Inbetriebnahme
- bei längeren Lagerzeiten besondere Vorkehrungen treffen (siehe Werknormblatt "Langzeitlagerung")
- Lage der Ölstandschraube nach Bauformtabellen des entsprechenden Kataloges feststellen
- Prüfen des Ölstandes
- Entfernen des Verschlußstopfens vor Inbetriebnahme (Überdruck!), ggf. Druckentlüftungsschraube montieren
- Normale Erstbefüllung: siehe Schmierstofftabelle
- Luftgekühlte Motoren sind für Umgebungstemperaturen von - 20°C bis +40°C sowie Aufstellungshöhen â 1.000 m über NN ausgelegt
- Der Einsatz im Ex-Bereich ist nicht zulässig, sofern nicht ausdrücklich hierfür vorgesehen

Δ Caution
It is presumed that fundamental project work as well as all work with regard to transport, assembly, installation, starting-up, maintenance and repair is performed by qualified personnel or supervised by skilled labour taking overall responsibility. Make absolutely sure that no voltage is applied at all while work is being done on the geared motor. Drive must also be secured against switching on.

Δ Caution
Any deviation from normal operating conditions (increased power consumption, temperature, vibrations, noise etc.) or warning signals by monitoring equipment suggest malfunction. Inform the responsible maintenance personnel at once to prevent the trouble from getting worse and causing, directly or indirectly, serious physical injury or material damage.

Δ In case of doubt disconnect the machine immediately!

Preparing and performing installation
- Lifting devices on the drive are designed to carry the drive weight
- the foundation (base) should be of adequate size and vibration-proof
- install gear unit or geared motor rigid and braceless
- ensure sufficient ventilation
- make use of tapped hole (DIN 332) to suit fastening to the shaft end
- avoid shocks on shafts (bearing damage!)
- preferably use flexible coupling between output shaft and driven machine
- fit output elements to shaft end or secure feather key before starting the motor
- use torque arm with rubber buffer on shaft mounting gearboxes

Connection of motor
- Connect motor according to diagram
- make sure that mains voltage/frequency are in accordance with nameplate information
- make secure protective conductor conection
- if motor is running in reverse direction, interchange two phases
- Close unused cable entrances holes and the box itself in a dust- and watertight manner.
- install protective switches to prevent overload and phase failure
- set motor protection switch to nominal current
- wiring diagrams on the last page

Starting up
- in case of long-time storage take special precautions (as provided in works standard sheet "Extended Storage")
- check position of oil-level plug with help of mounting position tables in applicable catalogue
- check oil-level
- prior to starting-up, remove vent plug from vent screw if necessary
- if not specified otherwise, first oil filling as is shown in list of lubricants
- air-cooled motors are designed for ambient temperautres between -20°C and +40°C and for installation at altitudes â 1.000 m above M.S.L.
- Their use in hazardous areas is prohibited unless they are expressly intended for such use (follow additional instructions)

Δ Avertissement
Il est impératif que les travaux fondamentaux de l'installation, ainsi que tous les travaux de transport, montage, installation, mise en exploitation, entretien et réparation soient accomplis par du personnel qualifié et contrôlés par des techniciens spécialisés dans ce domaine. Avant toute intervention sur le motoréducteur, il faut s'assurer que celui-ci n'est plus sous tension et que la remise sous tension soit interdite.

Δ Avertissement
Si en utilisation normale, des modifications de fonctionnement apparaissent telles que puissance absorbée trop élevée, température élevée, vibrations fortes, bruit intense etc. ou en rapport avec les contrôles techniques, cela laisse supposer que différentes fonctions de l'appareil peuvent être détériorées. Pour éviter ensuite des problèmes, qui pourraient entraîner de graves accidents corporels ou de graves dégats matériels, le personnel d'entretien compétent doit immédiatement être informé.

Δ Si vous êtes dans le doute, coupez immédiatement l'alimentation

Mise en place, préparation
- Le matériel utilisé pour la manutention doit tenir compte du poids de l'équipement
- prendre largement les dimensions des embases et les réaliser exemptes de vibrations
- monter les réducteurs et motoréducteurs solidement et sans haubanage
- prévoir une aération suffisante
- prévoir le taraudage conforme à la norme DIN 332 pour monter des accouplements sur les arbres d'entrée et de sortie
- éviter de donner des coups sur les arbres (cela pourrait détériorer le roulement!)
- lier autant que possible la machine et le réducteur avec des accouplements élastiques
- avant la mise en service, enlever l'élément d'accouplement ou/et fixer la clavette
- utiliser pour l'exécution arbre creux avec bras de réaction une butée en caoutchouc

Branchements électriques
- brancher le moteur selon le schéma
- s'assurer que la tension du réseau et la fréquence correspondent aux données inscrites sur la plaque signalétique
- Le cable de raccordement doit être protégé
- corriger un éventuel mauvais sens de rotation par une inversion de deux phases
- Les entrées de câbles non utilisées doivent être obturées, la boîte elle-même devant être fermée de façon à être étanche à l'eau et à la poussière
- prévoir une protection électrique contre les surcharges, court-circuit et défaut de phases
- régler la protection électrique suivant l'intensité nominale du moteur
- schéma de branchement à la derniére page

Mise en fonctionnement
- si un stockage longue durée du réducteur est prévu, il faut prendre les dispositions nécessaires (voir spécification "Stockage longue durée")
- vérifier que la vis de niveau d'huile corresponde à la position de montage du réducteur (voir catalogue)
- contrôler le niveau d'huile
- enlever la mèche de la vis d'évent avant la mise en route (pour éviter une surpression) ou fixer le clapet d'évent sur le réducteur
- pour le premier remplissage voir le tableau des lubrifiants
- les moteurs autoventilés sont dimensionnés pour des températures ambiantes comprises entre -20°C et +40°C, ainsi que pour une altitude â 1000 mètres au-dessus du niveau de la mer
- Leur utilisation dans des atmosphères explosives est interdite, à moins qu'elles ne soient expressément prévues à cet effet (respecter les indications supplémentaires)

Wartung
MOTOR
- Staubablagerungen entfernen (Überhitzung!)
- Wälzlager und Wellendichtringe gegebenenfalls austauschen

GETRIEBE
Die Getriebe SK 92072, SK 92172 und SK 92372 haben keine Entlüftungs- und Ölablaßschrauben

SK 92672 und SK 92772
- regelmäßige Ölstandskontrolle
- Wechseln des Schmierstoffes alle 10.000 Betriebsstunden oder spätestens nach 2 Jahren.
- Doppelte Fristen bei synthetischen Produkten
- Verkürzung der Schmierstoffwechselintervalle bei extremen Betriebsbedingungen (hohe Luftfeuchtigkeit, aggressive Umgebung und hohe Temperaturschwankungen)
- Verbinden des Schmierstoffwechsels mit gründlicher Reinigung des Getriebes
- Wälzlager und Wellendichtringe gegebenenfalls austauschen

Δ Synthetische und mineralische Schmierstoffe nicht miteinander mischen! Das gilt auch für die Entsorgung der Schmierstoffe!

Maintenance
MOTOR
- remove dust deposit (overheating)
- Replace anti-friction bearings and shaft seals if required

GEARBOX
No vent screws or oil drain plugs are provided on the gearbox types SK 92072, SK 92172, and SK 92372.

SK 92672 and SK 92772
- regular oil level check
- change lubricant every 10.000 working hours or after two years at the latest.
- combine the lubricant change with thorough cleaning of gear unit
- lubricant changing intervals will be twice as long if synthetic products are used
- extreme working conditions (high air humidity, aggressive media and large temperature variations) call for reduced lubricant changing intervals
- Replace anti-friction bearings and shaft seals if required

Δ Synthetic and mineral lubricants must not be mixed either for filling or for disposal!

Entretien
DU MOTEUR
- enlever la poussière du moteur (échauffement)
- Remplacer paliers à roulement et bagues d'étanchéïté de l'arbre si nécessaire

DU REDUCTEUR
Les réducteurs SK 92072, SK 92172 et SK 92372 n'ont ni des bouchons d'évent, ni des bouchons de vidange d'huile

SK 92672 et SK 92772
- vérifier régulièrement le niveau d'huile
- vidanger le lubrifiant après 10.000 heures de fonctionnement ou au plus tard après 2 ans d'utilisation.
- profiter de la vidange pour effectuer un nettoyage approfondi du réducteur
- pour des lubrifiants synthétiques, ce délai peut être doublé
- réduire les intervalles entre les vidanges dans des conditions d'utilisation extrêmes (hygrométrie élevée, ambiance agressive ou variations importantes des températures)
- Remplacer paliers à roulement et bagues d'étanchéïté de l'arbre si nécessaire

Δ Des lubrifiants synthétiques et minéraux ne doivent pas être mélangés! Ceci s'applique également pour le retraitement des lubrifiants!

ÖLFÜLLMENGE [cm³]	CAPACITY [cm³]		QUANTITE DE LUBRIFIANT [cm³]		
Bauform Mounting position Position de montage	**zweistufig** **double reduction** **à deux trains d'engrenages**				
	SK 92072	**SK 92172**	**SK 92372**	**SK 92672**	**SK 92772**
B3	400	600	900	1.800	2.300
B3 I	800	1.000	1.600	3.400	5.300
B6	700	900	1.300	3.500	4.500
B6 I	400	600	900	1.800	2.300
B6 II	800	1.000	1.600	3.400	5.300
B8	600	1.100	1.450	3.200	4.600
B8 I	700	900	1.300	3.500	4.500
V5	600	750	1.200	2.600	4.100
V5 I	600	750	1.200	2.600	4.100
V6	600	750	1.200	2.600	4.100
V6 I	600	750	1.200	2.600	4.100
B5	700	1.000	1.500	2.800	4.400
B5 I	400	600	1.150	1.550	2.750
B5 II	800	1.100	1.700	3.300	5.400
B5 III	600	950	1.200	2.500	4.100
V1	600	750	1.150	2.400	3.500
V3	600	750	1.150	2.400	3.500
H1	400	600	1.150	1.550	3.000
H2	600	950	1.200	2.500	4.500
H3	800	1.100	1.700	3.300	5.500
H4	700	1.000	1.500	2.800	4.300
H5	600	750	1.150	2.400	3.600
H6	600	750	1.150	2.400	3.000

Hinweis:
Diese Tabelle stellt vergleichbare Schmierstoffe unterschiedlicher Hersteller dar. Innerhalb einer Viskosität und Schmierstoffsorte kann der Ölhersteller gewechselt werden. Beim Wechsel der Viskosität bzw. der Schmierstoffsorte muß Rücksprache mit uns gehalten werden, da sonst keine Gewährleistung für die Funktionstüchtigkeit unserer Getriebe übernommen werden kann.

Note:
This table lists compatible lubricants of different suppliers. Within the same viscosity class and type of lubricant the supplier can be chosen freely. In case you change the viscosity class resp. the type of lubricant you should contact us in advance as otherwise we cannot assure the proper function of our drive and the warranty becomes void.

Indication:
Ce tableau présente les lubrifiants comparables des différents fabricants. Si l'on respecte les critères de viscosité et le type de lubrifiant, on peut uiliser n'importe quelle marque d'huile après ne vidange. Afin de pouvoir garantir un bon fonctionnement de nos réducteurs, veuillez nous consulter avant de remplacer un lubrifiant par un autre possédant des caractéristiques différentes de viscosité et de type.

Schmierstoffarten / Type of lubricant / Type de lubrifiant

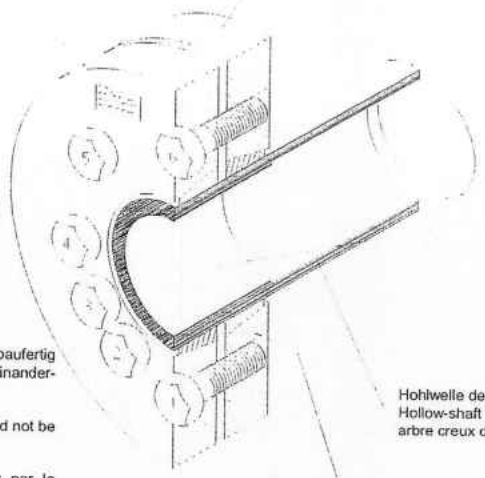
Schmierstoffart Type of lubricant Type de lubrifiant	Umgebungstemp. Ambient temp. Temp. ambiante	ARAL	BP	Castrol	DEA	ESSO	FUCHS	KLÜBER LUBRICATION	Mobil	Optimol	Shell	Tribol
Mineralöl Mineral oil Huile minérale	Schneckengetriebe 0 ... 40°C ISO VG 680	Degol BG 680 Degol BG 680 plus	--	Alpha SP 680	Falcon CLP 680	--	Renolin CLP 680 CLP 680 Plus	Klüberoil GEM 1-680	Mobilgear: - 636 - XMP 680	Optigear BM 680	Shell Omala 680	Tribol 1100/680
	ISO VG 220 - 5 ... 40°C (normal)	Degol BG 220 BG 220 plus	Energol GR-XP 220	Alpha SP 220 Alpha MW220 Alpha MAX 220	Falcon CLP 220	Spartan EP 220	Renolin CLP 220 Renolin CLP 220 Plus	Klüberoil GEM 1-220	Mobilgear 630 Mobilgear XMP 220	Optigear BM 220	Shell Omala 220	Tribol 1100 / 220
	ISO VG 100 - 15 ... 25°C	Degol BG 100 BG 100 plus	Energol GR-XP 100	Alpha SP 100 Alpha MW 100 Alpha MAX 100	Falcon CLP 100	Spartan EP 100	Renolin CLP 100 Renolin CLP 100 Plus	Klüberoil GEM 1-100	Mobilgear: - 627 - XMP 110	Optigear BM 100	Shell Omala 100	Tribol 1100 / 100
	ISO VG 15 - 45 ... - 15°C *	Vitamol 1010	Bartran HV 15	Hyspin AWS 15 Hyspin SP 15 Hyspin ZZ 15	Astron HVLP 15	Univis J13	Renolin B 15 HVI	ISOFLEX MT 30 rot	Mobil DTE 11 M	Ultra 10	Shell Tellus T 15	Tribol 943 AW 22
Synthetisches Öl Synthetic oil Huile synthétique	Schneckengetriebe -5 ... 60°C ISO VG 680	Degol GS 680	Energol SG-XP 680	--	--	--	Renolin PG 680	Klübersynth GH-6-680	Glygoyle HE 680	Optiflex A 680	Shell Tivela S 680	Tribol 800 / 680
	ISO VG 220 -25 ... 80°C *	Degol GS 220	Enersyn SG-XP 220	Alphasyn PG 220	Polydea PGLP 220	Glycolube 220	Renolin PG 220	Klübersynth GH-6-220	Glygoyle HE 220	Optiflex A 220	Shell Tivela WB Tivela S 220	Tribol 800/ 220
Biologisch abbaubares Öl Biodegradable oil Huiles biodégradables	Schneckengetriebe ISO VG 680 -5 ... 40°C	--	--	--	--	--	Plantogear 680 S	--	--	--	--	--
	ISO VG 220 -5 ... 40°C	Degol BAB 220	Biogear SE 220	Carelub GES 220	Ergon ELP 220	--	Plantogear 220 S	Klübersynth GEM2-220	--	Optisynt BS 220	--	Tribol BioTop 1418 / 220
Lebensmittel-verträgliches Öl [1] Food-grad oil [1] Huiles pour environnement alimentaire [1]	Schneckengetriebe -5 ... 40°C ISO VG 680	--	--	--	--	--	Bel-Ray No-Tox Synt.Worm Gear Oil 680	Klüberoil 4 UH1-680N Klübersynth UH1 6-680	--	Optileb GT 680	Shell Cassida Fluid GL680	Tribol FoodProof 1800 / 680
	ISO VG 220 -25 ... 40°C	Eural Gear 220	--	Vitalube GS 220	--	Gear Oil FM 220	Bel-Ray No-Tox Gear Oil 90 Synt.Gear Oil 220	Klüberoil 4 UH1-220N Klübersynth UH1 6-220	Mobil DTE FM 220	Optileb GT 220	Shell Cassida Fluid GL220	Tribol FoodProof 1810 / 220 oder 1800 / 220
Synth. Fließfett Synth. fluid grease Graisse fluide synthétique	- 25 ... 60°C	Aralub BAB EP0	Enersyn GSF	Alpha Gel 00	--	Fließfett S 420	Renolit LX-PG 00	Klübersynth GE 46-1200 Klübersynth UH1 14-1600 [1]	Glygoyle Grease 00	Obeen UF 00	Tivela Comp. A Tivela GL 00	Tribol 800 / 1000

Schmierstoffarten für Wälzlager / Type of lubricant for anti friction bearings / Type de librifiant pour roulements à rouleaux												
Schmierstoffart Type of lubricant Type de lubrifiant	**Umgebungstemp. Ambient temp. Temp. ambiante**	ARAL	BP	Castrol	DEA	ESSO	FUCHS	KLÜBER LUBRICATION	Mobil	Optimol	Shell	Tribol
Fett (Mineralölbasis) Grease (mineral oil basis) Graisse (base huile minérale)	- 30 ... 60°C (normal)	Aralub HL 2	Ener-grease LS 2	Spheerol AP 2 LZV-EP	Glissando 20	Mehr-zweckfett Beacon2	Renolit FWA 160	Klüberplex BEM 41-132	Mobilux 2	Longtime PD 2	Shell Alvania R2	Tribol 4020/220-2
	* - 50 ... 40°C	Aralub SEL 2	--	Spheerol EPL2	--	--	Renolit JP 1619	--	--	Longtime PD 1	Shell Alvania RL 2	Tribol 3785
Synthetisches Fett Synthetic grease Graisse synthétique	* - 25 ... 80°C	Aralub SKL 2	--	Product 783/46	Discor B EP 2 LF	Beacon 325	Renolit S 2 Renolit HLT 2	Isoflex Topas NCA 52 Petamo GHY 133 N	Mobiltemp SHC 32	Optitemp LG 2	Aero Shell Grease 16 oder 7	Tribol 3499
Biologisch abbaubares Fett Biodegradable Grease Graisse biodégradables	- 25 ... 40°C	Aralub BAB EP 2	BP Bio-grease EP 2	Biotec	Dolon E EP 2	--	Plantogel 2 S	Klüberbio M 72-82	Schmierfett UE 100 B	EF 584	Shell Alvania RLB 2	Molub-Alloy BioTop 9488
Lebensmittelver-trägliches Fett [1] Food-grade grease[1] Graisse pour environnement alimentaire [1]	- 25 ... 40°C	Eural Grease EP 2	BP Energrease FM 2	Vitalube HT Grease 2	Tamix FRA 1	Carum 330	Renolit G 7 FG 1	Klübersynth UH1 14-151	Mobil-grease FM 102	Obeen UF 2	Shell Cassida RLS 2	Molub-Alloy Food-Proof 823-2 FM

* Bei Umgebungstemperaturen unterhalb -30°C und oberhalb 60°C sind Wellendichtringe in besonderer Werkstoffqualität einzusetzen
* With ambient temperatures below -30°C and above approx. 60°C shaft sealing rings of a special material quality must be used
* Lors d'une température ambiante inférieure à -30°C ou supérieure à environ 60°C, il y a lieu d'utiliser des joints d'étanchéité spéciaux

[1] Lebensmittelverträgliche Öle + Fette nach Vorschrift H1 / FDA 178.3570
[1] Food grade lubricants with USDA-H1 approval FDA 178.3570
[1] Huiles pour environnement alimentaire + graisses suivant prescription H1 / FDA 178.3570

Hohlwelle mit Schrumpfscheibe - Montage - Demontage und Wartungshinweise
Hollow shaft with shrink-discs - Assembly - Dismantling suggestions and maintenance
Exécution des arbres creux avec frette de serrage - Montage - Démontage et entretien



Montageablauf:

1. Entfernen der Transportsicherung zwischen den Flanschen, falls vorhanden.
2. Anziehen der Spannschrauben (leicht von Hand) bis das Spiel zwischen den Flanschen und dem Innenring beseitigt ist. Der Innenring muß noch leicht drehbar sein.
3. Einfetten der Bohrung des Innenringes, dadurch leichte Montage der Schrumpfscheibe auf die Getriebehohlwelle.
4. Aufsetzen der Getriebehohlwelle auf die Maschinenwelle.

Maschinenwellenschaft und Hohlwellenbohrung müssen im Bereich der Schrumpfverbindung absolut fettfrei sein.
Die Maschinenwelle vor der Montage im Bereich, welche später Kontakt mit der Bronzebuchse der Hohlwelle hat, einfetten. Die Bronzebuchse nicht einfetten, um bei der Montage eine Befettung des Schrumpfsitzes zu vermeiden.

5. Durch leichtes Anziehen der Spannschrauben positionieren sich die Spannflansche automatisch.
6. Festziehen der Spannschrauben der Reihe nach im Uhrzeigersinn über mehrere Umläufe - nicht überkreuz - 1/4 bis 1/2 Schraubenumdrehung pro Umlauf.Die Spannschrauben mit einem Drehmomentschlüssel bis zu dem auf der Schrumpfscheibe oder in der Maßtabelle angegebenen Anzugsdrehmoment anziehen.

Demontageablauf:

1. Spannschrauben der Reihe nach über mehrere Umläufe lösen, pro Umlauf ca. 1/4 Umdrehung. Spannschrauben nicht aus ihrem Gewinde entfernen - **Unfallgefahr!!**
2. Die Spannflansche sind vom Konus des Innenringes zu lösen.
3. Abnehmen des Getriebes von der Maschinenvollwelle.

Wartung der Schrumpfscheiben:
Eine montierte Schrumpfscheibe ist wartungsfrei. War eine Schrumpfscheibe längere Zeit im Einsatz und wurde demontiert, dann ist sie vor der erneuten Montage zu zerlegen und zu reinigen. Nach der Reinigung sind die Kegelflächen (Konus) der Spannflansche und des Innenringes mit Molykote G-Rapid Plus oder vergleichbarem Schmierstoff einzustreichen. Die Schrauben sind im Gewinde und Kopfauflage mit normalem Fett zu behandeln.

Installation instructions:

1. Remove transportation spacers (if provided) located between outer collars.
2. Lightly handtighten locking screws to eliminate play between outer collars and inner ring. You should still be able to easily turn inner ring.
3. Lightly lubricate the bore of the shrink-disc to facilitate easy mounting onto hollow-shaft of reducer.
4. Fit shrink-disc onto hollow-shaft and mount hollow-shaft reducer onto solid shaft.

Hollow- and solid shaft must be clean and free from any lubricant.
Exception: Grease solid shaft at end where it will make contact with bronze bushing of the hollow-shaft when it is mounted. Never grease the front of the solid shaft which makes contact under the shrink-disc. Tighten locking screws only after mounting the hollowshaft onto the solid shaft.

5. Now tighten locking screws only lightly to position outer collars.
6. Use torque wrench and equally tighten all screws one after another (never cross wise) in a clockwise or counter clockwise sequence by approximately 1/4 to 1/2 turn until specified tightening torque (per table) is reached.

Removal:

1. Loosen locking screws in sequence in several steps by using approximately 1/4 turns. **Danger** - Do not remove locking screws completely.
2. Loosen the outer collars from the double tapered inner ring.
3. Remove hollow-shaft reducer from solid shaft.

Maintenance:
An installed shrink-disc is maintenance free. Before reinstalling (after prolonged use) it should be taken apart and thorougly cleaned. Relubricate the taper of the outer collars and of the inner ring with Molycote G-Rapid plus or equivalent. Regrease screw threads and head contact area with mulitpurpose grease.

Procédure de Montage:

1. Les éventuelles protections de transport placées entre les surfaces de serrage doivent être retirées.
2. Les vis de serrage doivent être légèrement serrées à la main, jusqu'à ce qu'il n'y ait plus de jeu entre les surfaces de serrage. L'anneau intérieur doit toutefois pouvoir encore être tourné aisément.
3. L'alésage (D1) de la bague intérieure de la frette doit être légèrement graissé. De la sorte, le montage de la frette sur l'arbre creux est facilité.
4. Positionner l'arbre creux réducteur sur l'arbre machine.

L'arbre machine et l'arbre creux doivent absolument être exempt-de-graisse-au niveau de la liaison par frette.
Préalablement au montage, l'arbre machine doit être graissé à l'endroit du position-nement prévu de la bague bronze de l'arbre creux. Ne pas graisser la bague bronze, pour éviter un graissage du siège de la frette lors du montage.

5. Serrer légèrement les vis de serrage de la frette, afin que les surfaces de serrage se positionnent automatiquement.
6. Serrer les vis dans le sens des aiguilles d'une montre les unes après les autres, en plusieurs fois, en faisant à chague fois d' 1/4 à 1/2 tour de vis. Ne pas serrer en diagonale! Utiliser une clef dynamométrique pour le serrage. Les couples de serrage sont indiqués sur les frettes, ou doivent être relevés sur les plans.

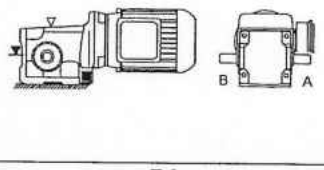
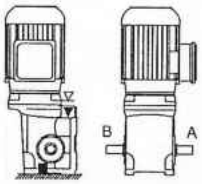
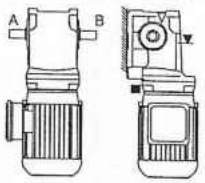
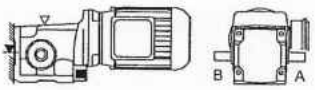
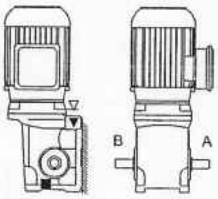
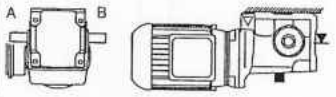
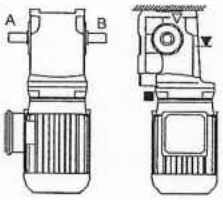
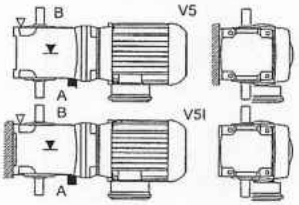
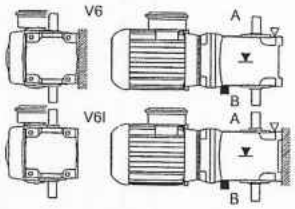
Procédure de démontage:

1. Les vis de serrage doivent être desserrées dans l'ordre, les unes après les autres, en plusieures fois, avec environ 1/4 de tour par vis à chaque fois. Ne pas sortir les vis du filetage. **Risque d'accident!!**
2. Le plan de serrage doit être écarté du cône de la bague intérieure.
3. Retirer le réducteur de l'arbre machine.

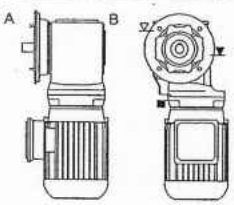
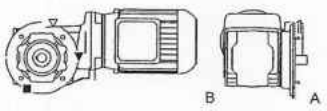
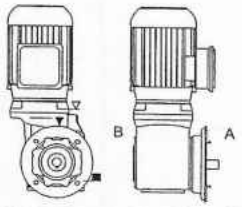
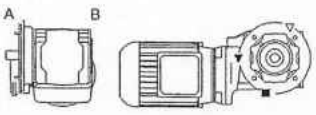
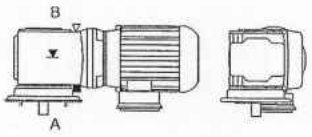
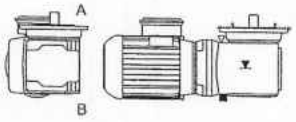
Entretien des frettes de serrage:
Une frette de serrage montée ne nécessite aucun entretien. Si une frette utilisée depuis un certain temps est demontée, un nettoyage préalable à toute nouvelle utilisation est nécessaire. Après nettoyage, les surfaces coniques de serrage et la bague intérieure doivent être enduites de Molykote G-Rapid Plus ou d'un type de graisse analogue. Les filetages et têtes de vis doivent être graissés normalement.

BAUFORMEN
MOUNTING POSITIONS
POSITIONS DE MONTAGE

FUSSAUSFÜHRUNG FOOT MOUNTED EXECUTION A PATTES

			
	B3	B3 I	B6
			
	B6 I	B6 II	B8
			
	B8 I	V5 /V5 I	V6 / V6 I

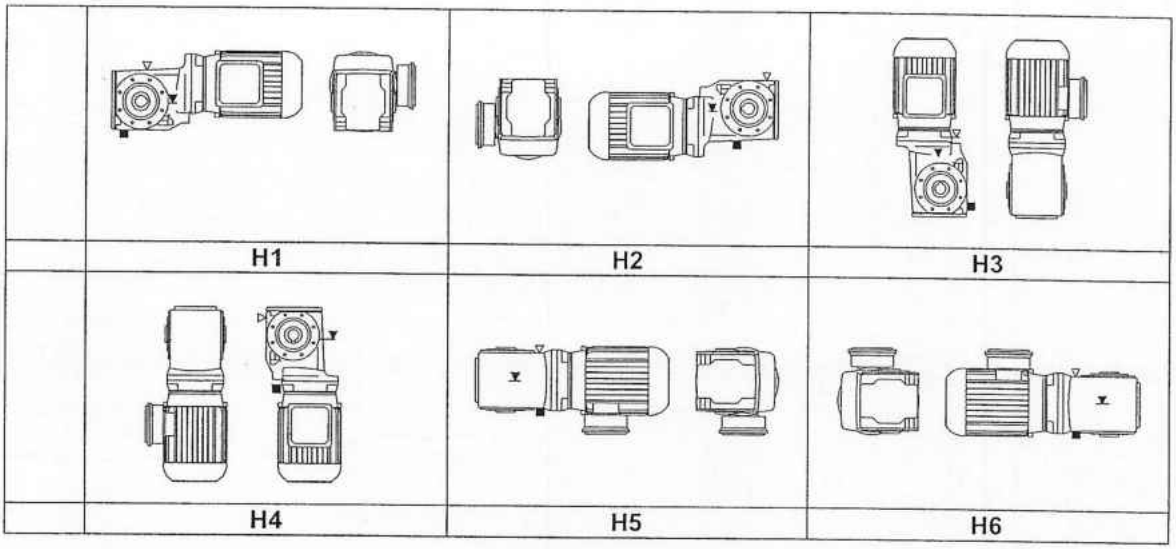
FLANSCHAUSFÜHRUNG FLANGE MOUNTED EXECUTION A BRIDE

			
	B5	B5 I	B5 II
			
	B5 III	V1	V3

Symbole: Symboles: Symboles:	Entlüftung Vent plug Event	Ölablaß Drain plug Vidange	Ölstand Oil level Niveau d'huile	Befestigung Mounting surface Fixation

BAUFORMEN
MOUNTING POSITIONS
POSITIONS DE MONTAGE

AUFSTECKAUSFÜHRUNG SHAFT MOUNTED EXECUTION A ARBRE CREUX



Symbole: ▽ **Entlüftung**
Symboles: **Vent plug**
Symboles: **Event**

▤ **Ölablaß**
Drain plug
Vidange

▽ **Ölstand**
Oil level
Niveau d'huile

ACHTUNG / ATTENTION / :

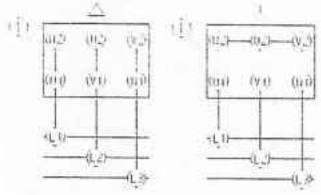
Die Getriebe sind normal mit Mineralöl befüllt (Viskositätsklasse ISO VG 220, für –5° bis 40°C Umgebungstemperatur).
Synthetisches Öl ist gegen Mehrpreis lieferbar.
Die Getriebe **SK 92672** und **SK 92772** haben Entlüftungs-, Ölstands und Ölablaßschrauben.

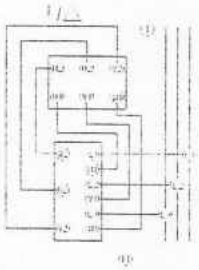
The standard-lubrications is mineral-oil (viscosity class ISO 220 ambient temperature –5° to 40°C).
Synthetic oil available at surcharge.
The Gear Untis **SK 92672** and **SK 92772** have vent and drain plugs.

Les réducteurs sont remplis d'huile minérale (de viscosité ISO VG 220, pour un température ambiante de -5° à 40°C).
Une huile synthétique peut être livrée avec un supplément de prix.
Les réducteurs **SK 92672** et **SK 92772** sont à aucune vis ni clapet d'évent.

Schaltbilder / Wiring diagrams / Schémas de branchement

Drehstrom-Motor mit Kurzschlußanker
Three phase squirrel-cage motor
Moteur triphasé à cage d'écureull

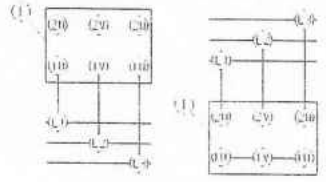




I) Klemmbrett
Terminal board
Plaque à bornes

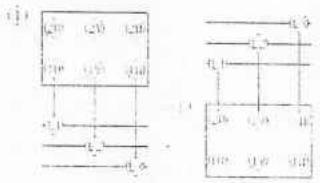
II) Schalter
Switch
Démarreur

Drehstrom-Motor mit Kurzschlußanker, in Dahlander-Schaltung
Three phase squirrel-cage motor, Dahlander connection
Moteur triphasé à cage d'écrureull, couplage Dahlander



niedrige - Drehzahl - hohe
low - speed - high
inférieure - vitesse - supérieure

Drehstrom-Motor, polumschaltbar, zwei getrennte Wicklungen
Three phase motor, polechanging, two separate windings, two speeds
Moteur triphasé à commutation de pôles, deux bobinages séparés, deux vitesses



niedrige - Drehzahl - hohe
low - speed - high
inférieure - vitesse - supérieure

INSTRUCTION MANUAL

Mass Flow / Pressure meters and controllers for gases and liquids

Doc. no.: 9.17.001 F
Date: 23-10-2002

ATTENTION
Before installing and operating the instrument it is recommended that this instruction be read. Not following the guidelines could result in personal injury and/or damage to the equipment

The information in this manual has been reviewed and is believed to be entire reliable. No responsibility, however, is assumed for inaccuracies. The material in this manual is for information purposes only, and is subject to change without notice.

Bronkhorst High-Tech B.V.
"June 1989"

Warranty

The products of Bronkhorst High-Tech B.V. are warranted against defects in material and workmanship for a period of one year from the date of shipment provided they are used in accordance with the ordering specifications and not subjected to abuse or physical damage. Products that do not operate properly during this period may be repaired or replaced at no charge. Repairs are normally warranted for 90 days or the balance of the original warrant, whichever is longer.

The warranty includes all initial and latent defects, random failures, and undeterminable internal causes.

It excludes failures and damage caused by the customer, such as contamination, improper electrical hook-up, physical shock etc.

Re-conditioning of products primarily returned for warranty service that is partly or wholly judged non-warranty may be charged for.

Bronkhorst High-Tech B.V. prepays outgoing freight charges when any party of the service is performed under warranty, unless otherwise agreed upon beforehand, however, if the product has been returned collect to Bronkhorst HIGH-TECH B.V., these costs are added to the repair invoice. Import and/or export charges, foreign shipping methods/carriers are paid for by the customer.

Short-Form Operation Instruction

Before installing your Mass Flow or Pressure Meter/ Controller it is important to read the attached label and check:
- flow/pressure rate
- fluid to be metered
- up and downstream pressures
- input/output signal

Check the red-coloured sticker and make sure the test pressure is in agreement with normal safety factors for your application.

Check if the piping system is clean. For absolute cleanliness always install filters to assure a clean liquid stream or a moisture and oil-free gas stream.

Install the Meter/Controller in the line and tighten the fittings according to the instructions of the supplier of the fittings. Choose the mounting position according to the directions given in this manual.

Check the system for leaks before applying fluid pressure

Electrical connections must be made with a standard cable or according to the hook - up diagram in the back of this manual.

Apply power to the instrument and allow for approx. 30 minutes to warm-up and stabilize. This may be done with or without fluid pressure, applied to the system.

Your instrument is now ready for operation.

TABLE OF CONTENTS

1. Introduction

2. Installation

3. Operation

4. Maintenance

5. Troubleshooting

Appendices

1 Introduction

1.1 General description

1.1.1 Gas flow

The Bronkhorst High-Tech B.V. series mass flow meter for gases is an accurate device for measuring gas flows up to 700 bar depending on body rating, virtually independent of pressure and temperature changes. The system can be completed with a control valve and flexible readout to measure and control gas flows from 3 ml_n/min up to several thousand m^3_n/h, depending on the specific type of instrument.
For a limited flow range a metal sealed model is available.

1.1.2 Liquid flow

The Bronkhorst High-Tech B.V. mass flow meter for liquids is an accurate device for measuring liquid flows up to 400 bar, virtually independent of pressure and temperature changes. The system can be completed with a control valve to measure and control liquid flows from less than a gram per hour up to 20 kg/h.

1.1.3 Pressure

The Bronkhorst High-Tech B.V. pressure meter measures pressures from 100 mbar up to 400 bar depending on body rating, either absolute pressure or gauge pressure and in the range 0 to 15 bar differential pressure too. The pressure controller controls pressure with a very high accuracy and repeatability. The controller is available in forward control (P-600 series) and backward control (P-700 series).
The flow going through the pressure controller depends on up and downstream pressures, the orifice diameter of the valve and kind of fluid.

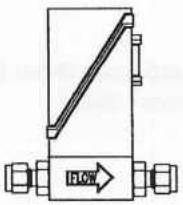
1.2 Housings

Each instrument housing style incorporates several provisions to comply with EMC requirements.

1.2.1 Gasflow and pressure meters / controllers

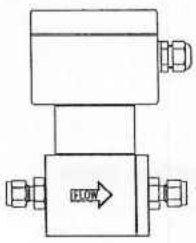
Gasflow / pressure meters and controllers are available in a wide variety of different models. The following types of housings / models can be distinguished:

1.2.2 EL-FLOW®, EL-PRESS (Euro-style)



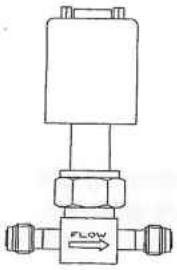
The p.c.board is placed in a metalized plastic cover. For electrical connection the instrument has a male 9-pin miniature sub-D connector. These instruments are
suited for indoor (dry) applications, like laboratories and in well protected (OEM) housings.

1.2.3 IN-FLOW



To comply with the IP65 ingress protection standard, the p.c.board is housed in a sealed casted aluminium housing. Electrical connections are made through cable glands, and by means of wire terminals.
The instruments are suited for light industrial (outdoor) use to IP65. This type of housing is not available for pressure instruments.

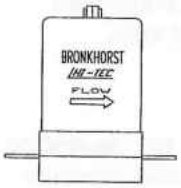
1.2.4 COMBI-FLOW (flow and pressure) meters / controllers



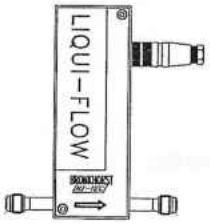
The p.c.boards are housed in a round shaped aluminium housing. For electrical connection the instrument has a male 9-pin miniature sub-D connector. These instruments are suited for indoor (dry) applications, like laboratories and in well protected (OEM) housings.

1.2.5 Liquid flow meters / controllers

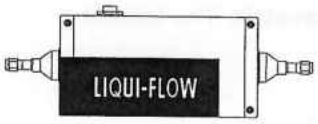
Four different liquid flow meters can be distinguished:



The µ-FLOW model for up to a few g/h, basically a straight capillary tube with a sensor. The p.c.boards are housed in a round shaped aluminium housing. For electrical connection the instrument has a male 9-pin miniature sub-D connector. The instrument is suited for indoor (dry) applications, like laboratories and in well protected (OEM) housings.



The LIQUI-FLOW® models for up to 1000 g/h. This is a fully aluminium casted instrument, which means that the instrument is formed by the housing.



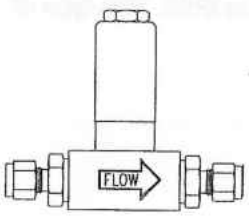
The LIQUI-FLOW® model for the range up to 20 kg/h. The sensor tube of this instrument is placed inside a standard casted aluminium housing.

The last two models have an IP-65 ingress protection class. For electrical connection a round male 8-pin DIN connector is incorporated in the design. The instruments are suited for light industrial (outdoor) use.

1.3 Valves

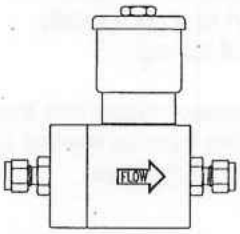
Two solenoid housing models can be distinguished. The basic mechanical design of both models is the same. Valves are used as separate units, or integrated with a meter to form a complete control unit. The solenoid versions are:

1.3.1 Laboratory style



The solenoids of these valves have an IP-50 ingress protection class. This means that the valves are suited for indoor (dry) use.

1.3.2 Industrial style



The solenoids of these valves have an IP-65 ingress protection class. This means that they are suited for light industrial (outdoor) use.

1.4 Sensor principles

1.4.1 Gas flow sensors

All gasflow sensors operate according to the same principle. They are operating on a principle of heat transfer by sensing the delta-T along a heated section of a capillary tube. Part of the total flow is forced through the capillary by means of a laminar flow device in the main stream generating a delta-p.
The design of the laminar flow device is such that flow conditions in both the capillary and laminar flow device are comparable, thereby resulting in proportional flow rates through the meter. The delta-T sensed by the upstream and downstream temperature sensors on the capillary depends on the amount of heat absorbed by the gas flow.
The transfer function between gas mass flow and signal can be described by the equation:

$$V_{signal} = K \cdot c_p \cdot \Phi_m$$

V_{signal} = output signal
c_p = specific heat
K = constant factor
Φ_m = mass flow

The temperature sensors are part of a bridge circuit and the imbalance is linearised and amplified to the desired signal level.

1.4.2 Liquid flow sensors

For liquid flow measurements four sensor arrangements can be distinguished. They have in common that there is no bypass system involved, which means that they are of the type: "thru flow". The following sensor arrangements can be distinguished:

- The µ-FLOW model for flowrates up to a few g/h.
  Basically this is a small capillary tube with two sensing elements placed on the tube. The two elements both serve as heater as well as temperature sensing elements. The delta-T sensed by the upstream and downstream temperature sensors on the capillary depends on the amount of heat absorbed by the mass of the liquid. The temperature sensors are part of a bridge circuit and the unbalance is amplified to the desired signal level. The transfer function between liquid mass flow and signal can be described by the equation:

$$V_{signal} = K \cdot c_p \cdot \Phi_m$$

V_{signal} = output signal
c_p = specific heat
K = constant factor
Φ_m = mass flow

- The LIQUI-FLOW mass flow meter for flow rates up to about 1000 g/h is basically a tube of stainless steel without any built-in obstructions, internal diameter approx 1 mm. This tube is part of a completely casted aluminium housing. An important part of the instrument is formed by two legs of tubing; an upstream section and a downstream section.
  On these two legs the heater/sensor arrangement of patented design is placed. The sensor measures the temperature difference between the upstream and the downstream leg of the measuring tube by means of a thermopile. The simplified transfer function can be described according to the following equation:

$$V_{signal} = K \cdot c_p \cdot \Phi_m$$

V_{signal} = output signal
K = specific heat
c_p = specific heat
Φ_m = mass flow

- The LIQUI-FLOW model for flowrates up to about 20 kg/h is basically a straight pipe. On this pipe a configuration of sensors and heaters is placed. The heater temperature is maintained at a certain level above the incoming liquid temperature.
  The power needed to maintain this temperature while the fluid is flowing is measured.
  Furthermore the output temperature downstream, at a certain distance from the heater is measured, resulting in the delta-T signal (T_{out}-T_{in}).
  By combining the two signals, the transfer function of the instrument can be described according to the following equation:

$$V_{signal} = \frac{\text{Power}}{\Delta T} K \cdot c_p \cdot \Phi_m$$

V_{signal} = output signal
c_p = specific heat
Φ_m = mass flow

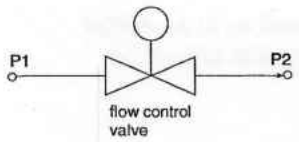
1.4.3 Pressure sensor

The EL-PRESS pressure sensor is formed by a piezoresistive bridge on the surface of a silicon crystal. The sensor is mounted in a stainless steel construction and separated from the fluid by a thin metal membrane. The chamber around the sensor is filled with oil to couple the pressure from the fluid to the sensor.

1.5 Valve principles

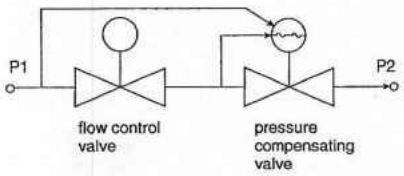
Control valves are not designed to provide positive shut-off, although some models have excellent capabilities for this purpose.
It is recommended to install a separate shut-off valve in the line if so required. Also pressure surges, as may occur during system pressurisation must be avoided. The following models can be distinguished:

1.5.1 Solenoid valve



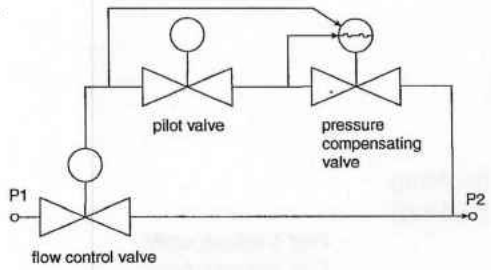
This is considered to be the standard (direct operated) control valve. In general it is a normally closed solenoid valve. The plunger is lifted by the force of the magnetic field of the coil. The orifice under the plunger is removable for optimising the orifice diameter. Also a normally opened solenoid valve is available.

1.5.2 Vary-P valve



For process conditions where up- and downstream pressures vary much, a special type of valve, VARY-P has been designed. This valve consists of two valves, a solenoid operated control valve and a fixed adjusted pressure compensation valve.

1.5.3 Pilot operated valve



For high flow rates the pilot operated valve has been designed. A solenoid driven control valve controls the pressure difference across a piston, which lifts the main plunger.

1.5.4 Bellows valve

This valve type is a direct driven, low power, solenoid operated control valve. A special design, incorporating a metal bellows allows for a relatively large orifice opening to be controlled. The design is suited for low pressure or vacuum applications.

1.6 Sensors and laminar flow devices

Flow devices are used to determine the total flow rate of a gas flow meter or controller.
Mind that liquid flow sensors and pressure sensors do not require a flow device.
Depending on the application the flow sensors have different removable capillaries, requiring a different laminar flow device.
Furthermore for flow rates higher than 1250 l_n/min the main laminar flow device is used in combination with a capillary / flow device arrangement in order to compensate for the non ideal transfer function of the main flow device.

In general two types of capillary tubes are available:

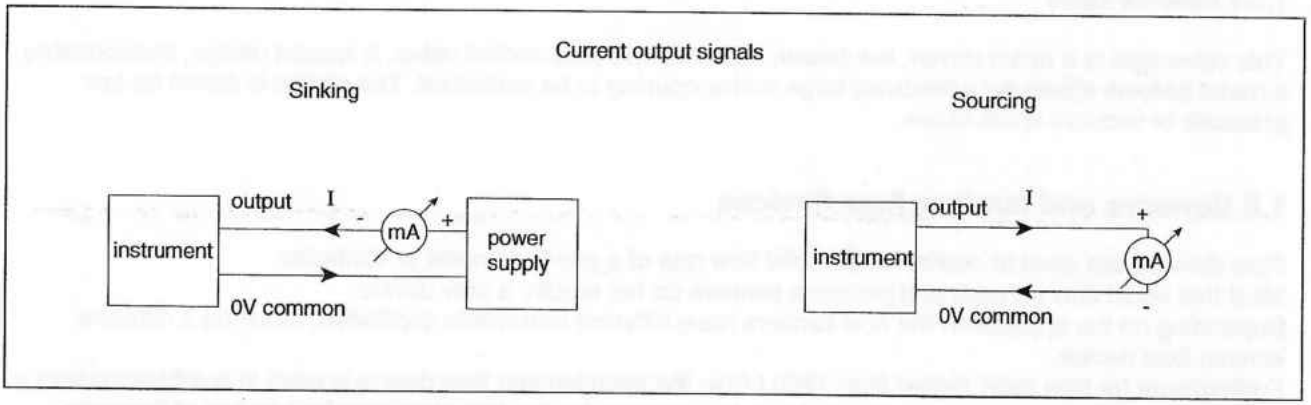
- Small bore (C-type)
  The following notes apply to this type of sensor:
  - These sensors have a pressure drop of approx. 35 mbar
  - The laminar flow device consists of a stack of discs with precision etched flow channels. Each flow channel represents approx. 10 ml_n/min airflow at 35 mbar delta-P.
  - In COMBI-FLOW applications and in all instruments with a pressure rating above 100 bar (M-type) the sensor is fitted with metal seals.
  - In general instruments with these sensors may be mounted horizontal, as well as in a vertical position, at low operating pressures. At high pressures (>10 bar) the instruments should be mounted in a horizontal position (COMBI-FLOW vertical).

- Large bore (D-type)
  To this type of sensor the following remarks apply:
  - These sensors are preferably used for reactive gases and at low pressure applications.
  - The pressure drop is less than 0.5 mbar.
  - The laminar flow device forms together with the main channel an annular channel. The dimensions of this annular channel determine the flow capacity of the instrument.
  - The instrument must always be mounted in a horizontal position.

1.7 Electronics

Each electronic housing is designed to provide RFI and EMI protection.
The p.c.boards designed by BRONKHORST HIGH-TECH B.V. are mainly provided with surface mounted devices (SMD).
Each electronic p.c.board is set for one of the following output (and corresponding input) signals:

Signal code	**output (sensor) signal**	**input (setpoint) signal**	
A	0...5 Vdc	0...5 Vdc	
B	0...10 Vdc	0...10 Vdc	
C	0...20 mA (sinking)	0...5 Vdc	
D	4...20 mA (sinking)	1...5 Vdc	
F	0...20 mA (sourcing)	0...20 mA (sinking)	
G	4...20 mA (sourcing)	4...20 mA (sinking)	
K	0...5 Vdc (cable compensation)	n.a.	For meters only
L	0...10 Vdc (cable compensation)	n.a.	For meters only



For meters only the output signal is available.

1.8 Conversion factors

1.8.1 Gas conversion factors

The general formula for determining the relationship between signal and mass flow is:

$$V_{signal} = K \cdot c_p \cdot \Phi_m = K \cdot c_p \cdot \rho \cdot \Phi_v$$

in which:

V_{signal}	= output signal
K	= constant
ρ	= density
c_p	= specific heat
Φ_m	= mass flow
Φ_v	= volume flow

As soon as the c_p value and density of the gas to be metered change, the signal must be corrected. The conversion factor C is:

$$C = \frac{c_{p_1} \cdot \rho_1}{c_{p_2} \cdot \rho_2}$$

in which:

c_p	= specific heat
ρ_n	= density at normal conditions

(1) gas calibrated
(2) gas to be measured

Note:
The c_p value used for the calculation of the conversion factor must be taken at a temperature approx. 50°C. higher than the required temperature.
This factor is called c_p cal.
The conversion factors for commonly used gases related to N_2 at normal conditions are stated in the Gas Conversion Table in the appendix 1.

Example:
Meter calibrated on N_2 (200 ml_n/min).
Gas flow passing the meter is CO_2.
Output signal reads 80.0%.

$$\text{Actual } CO_2 \text{ flow} = 80.0 \cdot \frac{0.74}{1.00} = 59.2\%$$

$$\text{so} \quad \frac{59.2}{100} \cdot 200 = 118.4 \text{ } ml_n/min$$

* **n** means **normal conditions**

At normal conditions volumes are converted to a temperature of 0°C and pressure of 1 atm or 1013,25 mbar. (760 Torr)

Note:
Best accuracy is always achieved by performing calibration under operating conditions. Should this not be possible or practical, then the use of a theoretical conversion factor is a means to determine the flow rate of the instrument on the gas to be metered, however, it will introduce inaccuracies.

The approximate accuracy of the conversion factors listed is:

typical for conversion factors; > 1 **2% x factor**
< 1 **2% / factor**

However, as the accuracy of the factor also depends on viscosity, pressure and temperature, special attention should be taken for gases in the gas/liquid state where specific heat, density and viscosity can vary tremendously. Apply to factory for more detailed information.

For gas mixtures a good approach is the following simplified equation:

$$\frac{1}{C_{mix}} = \frac{V_1}{C_1} + \frac{V_2}{C_2} + \ldots\ldots \frac{V_n}{C_n}$$

C_{mix} = Conversion factor for gas mixture
C_n = Conversion factor for gas n
V_n = Volumetric part of gas n in the mixture

Example Gas mixture contains:

(1) 10% N_2 C1 = 1,00
(2) 30% Ar C2 = 1,40
(3) 50% CH_4 C3 = 0,76
(4) 10% He C4 = 1,41

$$\frac{1}{C_{mix}} = \frac{0{,}10}{1{,}00} + \frac{0{,}30}{1{,}40} + \frac{0{,}50}{0{,}76} + \frac{0{,}10}{1{,}41} = 1{,}043$$

$C_{mix} = 0{,}959$

When the original meter has been calibrated on 500 ml_n/min N_2, 100% means:

$$500 \cdot \frac{0{,}959}{1{,}00} = 480 \text{ } ml_n/\text{min mixture.}$$

When the original meter has been calibrated on 500 ml_n/min Argon, then 100% means:

$$500 \cdot \frac{0{,}959}{1{,}40} = 343 \text{ } ml_n/\text{min gas mixture.}$$

1.8.2 Liquid conversion factors

The general formula for determining the relationship between signal and mass flow reads:

$$V_{signal} = k \cdot c_p \cdot \Phi_m$$

in which:
- V_{signal} = output signal
- k = calibration constant
- c_p = heat capacity at constant pressure of the fluid
- Φ_m = mass flow

A conversion factor must be used if the liquid flow meter is not used on the calibrated liquid.
This conversion factor reads:

$$\Phi_{m1} = Cf \cdot \Phi_{m2} \qquad Cf = \frac{c_{p1}}{c_{p2}}$$

in which:
- c_{p1} = heat capacity of the calibration liquid
- c_{p2} = heat capacity of the new liquid

For application of this formula consult Bronkhorst High-Tech B.V.

1.8.3 Software for conversion factor calculation

Bronkhorst High-Tech B.V. gathered the physical properties of over 600 fluids in a database called FLUIDAT. Application software, such as FLOW CALCULATIONS, enables the user to calculate accurate conversion factors, not only at 20°C/1 atm (as shown in the conversion table, App.1) but at any temperature/pressure combination, both for gases and for liquids.
Apply to your distributor for more details of this software.

2 Installation

2.1 Receipt of equipment

Check the outside packing box for damage incurred during shipment. Should the packing box be damaged, then the local carrier must be notified at once regarding his liability, if so required. At the same time a report should be submitted to:

BRONKHORST HIGH-TECH B.V.
RUURLO HOLLAND

If applicable, otherwise contact your distributor.
Remove the envelope containing the packing list; carefully remove the equipment from the packing box.
Do not discard spare or replacement parts with the packing material and inspect the contents for damaged or missing parts.

2.2 Return shipment

When returning material, always describe the problem and if possible the work to be done, in a covering letter.

It is absolutely required to notify the factory if toxic or dangerous fluids have been metered with the instrument!

This to enable the factory to take sufficient precautionary measures to safeguard the staff in their repair department. Take proper care of packing, if possible use the original packing box; seal instrument in plastic etc.

Contaminated instruments must be dispatched with a completely filled in 'declaration on contamination form'.
Contaminated instruments without this declaration will not be accepted.

Note:
If the instruments have been used with toxic or dangerous fluids the customer should pre-clean the instrument.

Important:
Clearly note, on top of the package, the customer clearance number of Bronkhorst High-Tech B.V., namely:

NL801989978B01

If applicable, otherwise contact your distributor for local arrangements.

2.3 Service

If the equipment is not properly serviced, serious personal injury and/or damage to the equipment could be the result. It is therefore important that trained and qualified service personnel perform servicing.
Bronkhorst High-Tech B.V. has a trained staff of servicemen available.

2.4 Mounting

The mounting position depends on the type of instrument. For flowmeters the preferred position is horizontal, and at high pressures all meters should be mounted in this position (exception: COMBI-FLOW series to be mounted vertically). Avoid installation in close proximity of mechanic vibration and/or heat sources.

2.5 In-line filter

Although fluids to be measured should be absolutely free of dirt, oil, moisture and other particles, it is recommended to install an in-line filter upstream of the flowmeter / controller, and if backflow can occur, a downstream filter is recommended too. Be aware of the pressure drop caused by the filter.
On the inlet of some instruments a screen is placed to prevent foreign matter from entering the instrument and to maintain a good flowpattern. This device **cannot** be seen as a filter element.
Contact your distributor for further information.

2.6 Fluid connections

Bronkhorst High-Tech B.V. meters / controllers are equipped with compression or face-seal-fittings. For some instruments these fittings are orbitally welded to the body. For leak tight installation of compression type fittings be sure that the tube is inserted to the shoulder in the fitting body and that no dirt or dust is present on tube, ferrules or fittings. Tighten the nut fingertight; while holding the instrument, then tighten the nut 1 turn. If applicable follow the guidelines of the supplier of the fittings. Special types of fittings are available on request. While tightening fittings, do not apply excessive force, in order to avoid damaging in/output thread or other sensitive parts of your instruments.

* **Note:** Always check your system for leaks, before applying fluid pressure. Especially if toxic, explosive or other dangerous fluids are used.

2.7 Piping

BE SURE THAT PIPING IS ABSOLUTELY CLEAN!
DO NOT install small diameter piping on high flowrates, because the inlet jetflow will affect the accuracy.
DO NOT mount abrupt angles direct on in- and outlet, especially not on high flowrates. We recommend at least 10 pipe diameters distance between the angle and the instrument.
DO NOT mount pressure regulators direct on the inlet of gas flow meters/controllers, but allow some meters of piping (at least 25 D). Special attention should be taken at high flow rates with flow controllers. An up- and downstream buffer is needed with a volume calculated according to the following formula:

$$V \geq \frac{0{,}15\ d^2}{\sqrt{\rho}}$$

in which:

V = Volume in litres
d = orifice diameter in mm
ρ = density at normal conditions
$d = 7{,}6\ \sqrt{k_v}$

Example:
Flow controller at 500 l_n/min Air and orifice diameter d = 4 mm, needs for stable control a buffer volume of:
$V \geq 0{,}15 \cdot 4^2 : \sqrt{1{,}29} = 2{,}1$ litres

Also the capacity of the pressure regulator should be at least 2 times the flow controller, so in this case $2 \cdot 500 = 1{,}000$ l_n/min.

2.8 Electrical connections

Bronkhorst High-Tech B.V. recommends to use their standard cables. These cables have the right connectors and if loose ends are used, these will be marked to prevent wrong connection.
Hook-up diagrams are enclosed in the back of this manual.

2.9 Caution

Each meter/controller is pressure tested to at least 1.5 times the working pressure of the process conditions stipulated by the customer, with a minimum of 8 bar.
For pressure meter/controllers. The test pressure depends on the range of the pressure transducer.
In general 2 x F.S. value for ranges 1 and 2 bar
1.5 x F.S. value for ranges up to 200 bar
1.25 x F.S. value for ranges up to 400 bar

The tested pressure is stated on the flow meter/controller with a RED COLOURED sticker. Check test pressure before installing in the line.
If the sticker is **not** available or the test pressure is incorrect, the instrument should **not** be mounted in the process line and be returned to the factory.
Each instrument is helium leak tested to at least $2 \cdot 10^{-9}$ mbar l/s Helium.

2.10 Supply pressure

Do not apply pressure until electrical connections are made. When applying pressure to the system, take care to avoid pressure shocks in the system and increase pressure gradually, especially on high pressure units incorporating a piston operated control valve.

2.11 System purging

If explosive gases are to be used, purge the process with inert dry gas like Nitrogen, Argon etc. for at least 30 minutes.
In systems with corrosive or reactive fluids, purging with an inert gas is absolutely necessary, because if the tubing has been exposed to air, introducing these fluids will tend to clog up or corrode the system due to a chemical reaction with oxygen or moist air.
Complete purging is also required to remove such fluids from the system before exposing the system to air. It is preferred not to expose the system to air, when working with these corrosive fluids.

2.12 Seals

Bronkhorst High-Tech B.V. has gathered a material compatibility chart from a number of sources believed to be reliable.
However, it is a general guide only. Operating conditions may substantially change the accuracy of this guide. Therefore there is no liability for damages accruing from the use of this guide.
The customers' application will demand its own specific design or test evaluation for optimum reliability.
So check if the seals like O-rings, plunger and packing gland of capillary are correct for the process.

2.13 Equipment storage

The equipment should be stored in its original packing in a cupboard warehouse or similar. Care should be taken not to subject the equipment to excessive temperatures or humidity.

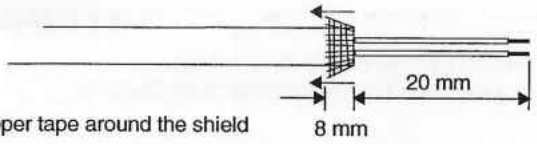
2.14 Electromagnetic compatibility

2.14.1 Conditions for compliance with EMC requirements

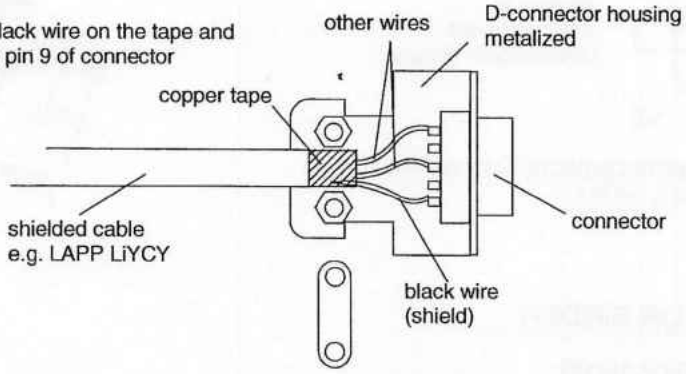
All instruments described in this manual carry the CE-mark.
Therefore they have to comply with the EMC requirements as are valid for these instruments.
However compliance with the EMC requirements is not possible without the use of proper cables and connector/gland assemblies.
For good results Bronkhorst High-Tech B.V. can provide standard cables. Otherwise follow the guidelines as stated below.

1. D-Connector assembly

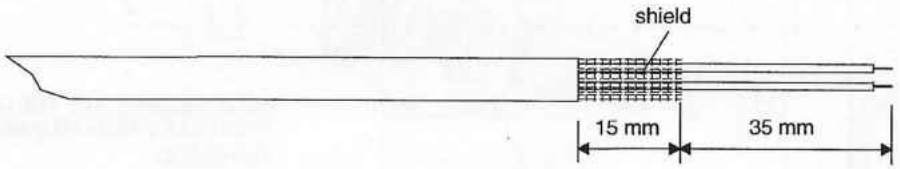
Fold the shield of the cable back over the cable (the shield must be around the cable).



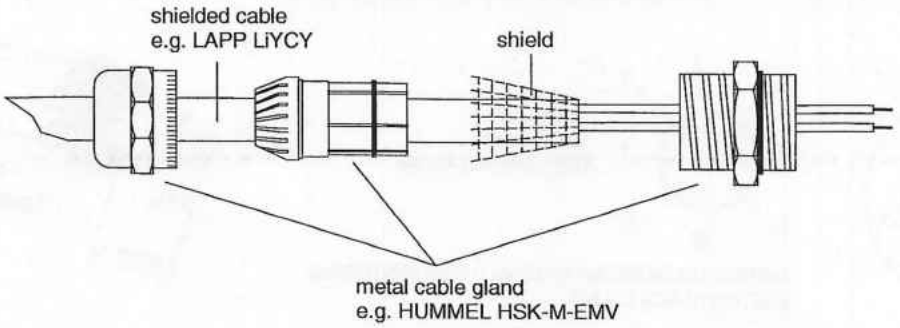
Wind a copper tape around the shield



2. Cable gland assembly



Fold the shield of the cable back over the cable (shield must be around the cable).

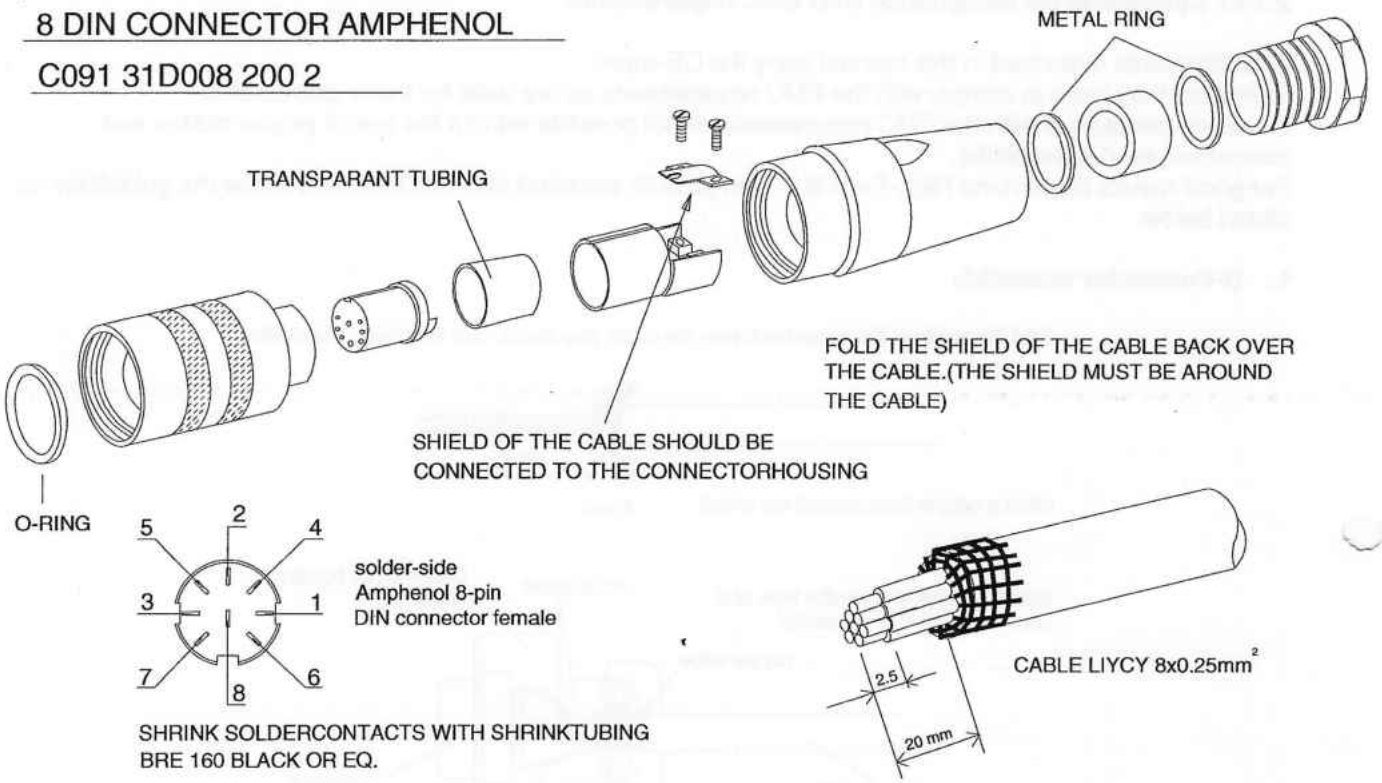


Mount the metal PG cable gland as shown in the drawing above

3. Connector LIQUI-FLOW®

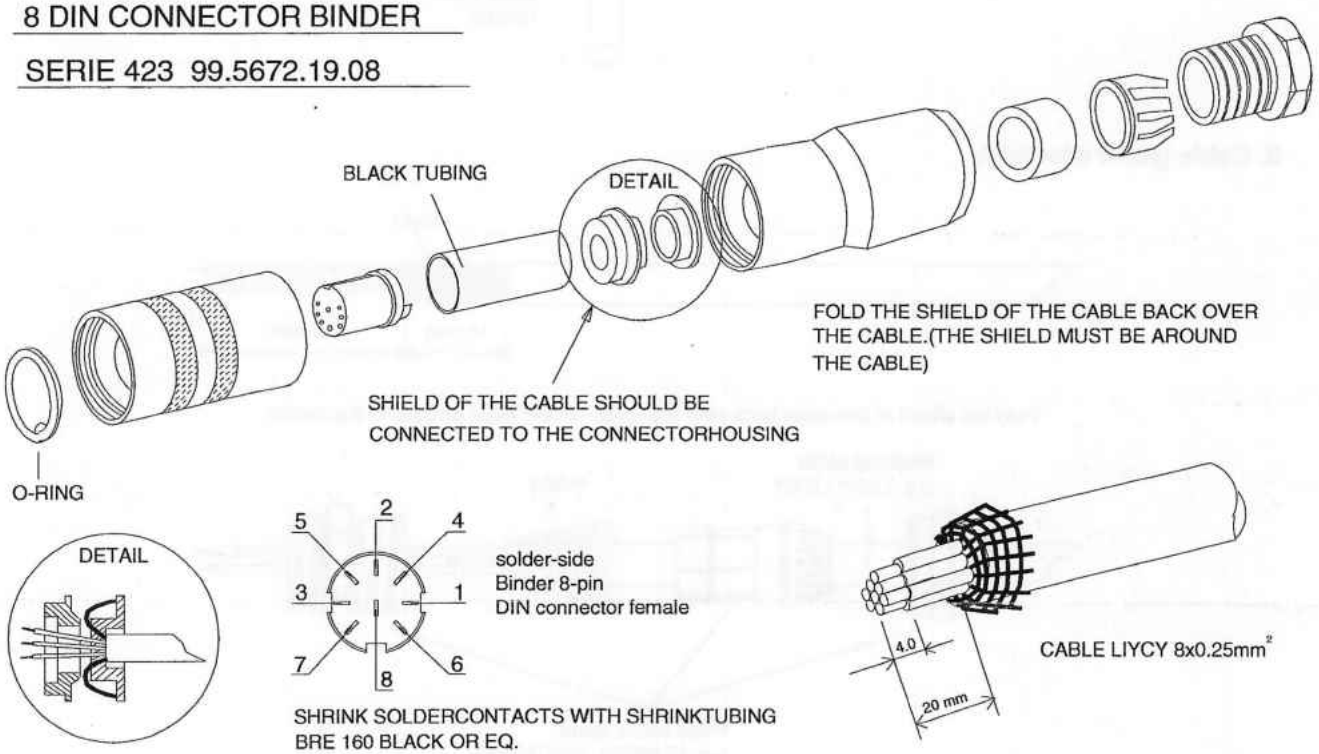
8 DIN CONNECTOR AMPHENOL

C091 31D008 200 2



8 DIN CONNECTOR BINDER

SERIE 423 99.5672.19.08



Note:
When connecting the system to other devices (e.g. to PLC), be sure that the integrity of the shielding is not affected. Do not use unshielded wire terminals.

3 Operation

3.1 General

The Bronkhorst High-Tech instruments are designed in such a way that they will meet user process requirements in the best possible way.
Flow / pressure meters and controllers are powered from a dc power source. When providing your own power supply be sure that voltage and current rating are according to the specifications of the instrument(s) and furthermore that the source is capable of delivering enough energy to the instrument(s).
Cable wire diameters should be sufficient to carry the supply current and voltage losses must be kept as low as possible. When in doubt: consult factory.

3.2 Power and warm-up

Before switching on power check if all connections have been made according to the hook-up diagram, which belongs to the instrument.
Check fluid connections and make sure there is no leakage. If needed purge the system with a proper fluid. For a gas instrument only purging with gases is allowed. Liquid instruments may be purged with either a gas or a liquid, whatever is needed for the purpose.
Turn on power and allow at least 30 minutes to warm up and stabilize. In cases where no electronics are involved (valves only) warming up is not needed.
During warm-up period, fluid pressure may either be on or off.

3.3 Zeroing

In general the zero point of each instrument is factory adjusted. If so required the zero point of the instrument may be re-adjusted.
Zero points must be adjusted to read approx. 0.2%. The circuit will cut off signals below zero to prevent negative zero drift. When adjustment is required, first make sure that there is a positive deviation, and then slowly adjust the readout to read approx. 0.2%. To be sure that there is no accidental flow or pressure level other than zero, adjustment is done best when the instrument is not part of a system.

3.4 Start-up

Turn on fluid supply gently. Avoid pressure shocks, and bring the instrument gradually up to the level of the actual operating conditions. Also switch off fluid supply gently. In case of liquid control be sure to remove all trapped gas bubbles from the system. The purge connection on top of the control valve can be used for this purpose.

3.5 Operating conditions

Each instrument has been calibrated and adjusted for customer process conditions.
Controllers or valves may not operate correctly, if process conditions vary too much, because of the restriction of the orifice in the valve.
For flowmeters performance and accuracy may be affected tremendously if physical fluid properties such as heat capacity and viscosity change due to changing process conditions.

3.6 Instrument performance

3.6.1 Sensors

Assuming that the transfer function of a system is an exponential shaped curve, the time constant is defined as follows:
time constant = time for the signal to reach 63.2 % of its final output value. Approx. five time constants is the time to reach the final value.

Each flow sensor has a time constant of 5...10 seconds, which can be electronically improved to approx. 1...3 seconds.
For gas flow meters factory standard adjustment is 3 seconds typical.
For liquid flow meters the actual response depends on model and flow rate.
Pressure sensors have a time constant of some milliseconds. However the actual response is determined by the pneumatic response of the system which the pressure meter is part of.

3.6.2 Controllers

The dynamic response of a controller is factory set. Standard settling time is defined as the time to reach the setpoint (and stay) within ± 2% of the initial setpoint.
The control mode is factory set in such a way that after a step change, there will be little overshoot.

Note:
In pressure control systems the system widely determines the response behaviour of the control loop. During testing the customer system is simulated as closely as possible. In some cases however readjustment is needed for optimum performance under actual conditions.

4 Maintenance

4.1 General

No routine maintenance is required to be performed on the meters or controllers. Units may be flushed with clean, dry inert gas.
In case of severe contamination it may be required to clean the laminar flow device and the valve orifice separately.

4.2 Gas flow sensor

The gasflow sensor is constructed in such a way that for a change in range, the laminar flow element can be removed. It is not recommended for the user to disassemble the instrument other than for removing the laminar flow element for inspection, or range changing only. After replacing the laminar flow element it becomes necessary to recalibrate the flow meter. When doing so proceed according to a suitable calibration procedure. Depending on the model number laminar flow elements can be ordered separately.

4.3 Liquid flow sensor

The user cannot change the flow range of a liquid flow sensor. The sensor is an integral part of the instrument and cannot be removed from it. For occasional cleaning the instrument may be flushed with a cleaning fluid.

4.4 Pressure sensor

It is not recommended for the user to disassemble the pressure sensor, because the thin metal membrane is very delicate.

4.5 Controllers

All sensor types can be combined with a control valve to be operated together as a control loop. Controller systems are either available as separate units; a sensor and a control valve, or as an integrated unit.
If applicable maintenance procedures are described under "control valves"

4.6 Control valves

Control valves cannot be used for shut-off and/or on-off applications. Pressure surges, as may occur during system pressurisation or deflation must be avoided.

4.6.1 Solenoid valves

These are considered to be the direct operated control and pilot valves. They may be disassembled in the field by the user for cleaning and servicing. The parts can be cleaned with a cleaning liquid, or in an ultrasonic bath.
To disassemble the valve proceed as follows:

a) disconnect the instrument connector (not necessary with separate valve)
b) remove the hex nut on top of the valve assembly
c) lift the cover (coil) assembly
d) unscrew the flange
e) lift valve assembly carefully from the base
f) unscrew set screw for the orifice and subsequently loosen the orifice and the orifice holder
g) remove the plunger assembly

Clean parts and carefully re-assemble in reverse order. It is recommended to replace the O-rings prior to re-assembly.
After having re-assembled the control valve, it is recommended to check the control characteristics of the valve. This can best be done by using a separate variable 15 Vdc power supply source.
Proceed as follows:

- disconnect the valve leads and connect to supply source
- apply gas pressure as per working conditions
- apply power by gradually increasing voltage
- the valve should open at 7 Vdc ± 3 Vdc
- the fully opened position is reached at approx. 9 Vdc ± 1.5 Vdc.

In case the valve does not operate within the voltage levels stated, then it must be disassembled, and the orifice must be adjusted to the proper position.
Re-assemble valve and repeat procedure if required.

4.6.2 Vary-P valve

The vary-P valve is designed to cope with extremely varying process conditions on either upstream or downstream side of the valve or a combination of these. Δp can vary over a wide range. The basic control valve is a direct operated solenoid control valve.
The design has been patented.
For orifice selection and maintenance other than the pilot valve consult the factory.

4.6.3 Pilot operated valve

This control valve is an indirect control valve, consisting of a spring-loaded membrane/orifice system which is positioned by a solenoid operated direct control (pilot valve). The two devices are integrated in one block.
Basically follow the same procedures for dis-assembly as stipulated under "Solenoid valves"
For cleaning purposes it may be required to dis-assemble further, i.e. also remove the membrane assembly.

Note:
When pressure testing a system incorporating a pilot operated control valve, a special procedure must be followed in order to prevent damage to the valve. In such cases it is necessary to contact the factory prior to do this.

4.6.4 Bellows valve

These valves are suited for low pressure or vacuum applications. Preferably the user should not disassemble this model.

4.7 K_v-value calculation

This calculation method can be used to determine the K_v-value of the main orifice of a control valve.

4.7.1 For gases

Determine desired Δp across valve.
Δp must be at least 20% of supply pressure, or in closed loop systems, of total pressure difference in loop.
If Δp is 20-50% of supply pressure, use formula:

$$K_v = \frac{\Phi_{vn}}{514}\sqrt{\frac{\rho_n \cdot T}{\Delta p \cdot p_2}}$$ under critical

If ΔP is 50-100% of supply pressure, use formula:

$$K_v = \frac{\Phi_{vn}}{257 \cdot p_1}\sqrt{\rho_n \cdot T}$$ overcritical

Units:
Φ_{vn} = flow [m_n^3/h]
p_1 = supply pressure [bara]
p_2 = downstream pressure [bara]
Δp = pressure difference (p_1 - p_2) [bard]
T = temperature [K]
ρ_n = density [kg/m_n^3]

The orifice diameter can be determined by: $d = 7.6\sqrt{K_v}$ [mm]

4.7.2 For liquids

$$K_v = \Phi_v\sqrt{\frac{\rho}{\Delta p \cdot 1000}}$$

Units:
Φ_v = volume flow [m^3/h]
ρ = density at 20°C and 1 atm [kg/m^3]
Δp = delta p [bard]

The orifice bore diameter can be determined by:

$$d = 7.6\sqrt{K_v}$$ [mm]

On LFC's only one type of normally closed valve is available. Diameter of orifice can be calculated or looked up in the table.

Diameter [mm]	K_v	Normally closed Δp max. [bard]
0,10	$1{,}73 \times 10^{-4}$	10
0,14	$3{,}39 \times 10^{-4}$	10
0,20	$6{,}93 \times 10^{-4}$	10
0,30	$1{,}56 \times 10^{-3}$	10
0,37	$2{,}37 \times 10^{-3}$	10
0,50	$4{,}33 \times 10^{-3}$	10
0,70	$8{,}48 \times 10^{-3}$	10
1,00	$1{,}73 \times 10^{-2}$	10

* For liquids having a dynamic viscosity: 15 cP < μ < 100 cP the K_v value should be calculated according to:

$$K_v = \Phi_v \sqrt{\frac{\rho}{\Delta p \cdot 1000}} \cdot \sqrt{\mu}$$

Units:
Φ_v = volume flow [m^3/h]
ρ = density at 20°C and 1 atm. [kg/m^3]
Δp = delta p [bard]
μ = dynamic viscosity [c_p]

For maximum possible viscosity apply to factory

4.8 Maximum pressure drop

For (pilot) solenoid operated control valves with small orifices the maximum allowable pressure drop for gases is according to the table.

Diameter [mm]	K_v	Normally closed Δp max. [bard]	Normally opened Δp max. [bard]
0,05	$4{,}33 \times 10^{-5}$	40	30
0,07	$8{,}48 \times 10^{-5}$	30	20
0,10	$1{,}73 \times 10^{-4}$	30	20
0,14	$3{,}39 \times 10^{-4}$	30	20
0,20	$6{,}93 \times 10^{-4}$	30	20
0,30	$1{,}56 \times 10^{-3}$	30	20
0,37	$2{,}37 \times 10^{-3}$	30	20
0,50	$4{,}33 \times 10^{-3}$	30	20
0,70	$8{,}48 \times 10^{-3}$	24	15
1,00	$1{,}37 \times 10^{-2}$	12	8
1,30	$2{,}93 \times 10^{-2}$	8	5
1,50	$3{,}90 \times 10^{-2}$	6	n.a.
1,70	$5{,}00 \times 10^{-2}$	5	n.a.
2,00*	$6{,}63 \times 10^{-2}$	3,6	n.a.

* 2,0 mm orifice not available in COMBI-FLOW series

For pilot operated valves the maximum pressure drop is limited to 20 bard. If the pressure drop during start-up is higher, it is preferred to install a bypass valve. During start-up this valve should be opened. Also the minimum pressure drop is limited. For exact figures consult factory or proceed according to the technical data and/or additional instructions given by the sales office or department.

4.9 Calibration procedure

All instruments are factory calibrated. This procedure is for recalibration or range changing only.

Calibration of flow / pressure meters / controllers requires the use of accurate digital volt or current meters, and an accurate calibration device.

General procedure:

a) Apply power to the system and allow approx. 30 minutes for the instrument to warm up and stabilize.
b) Check system on operation.
c) Remove cover during adjustment.
d) Connect digital meter to the output signal.
e) Adjust potmeter 'L' till 0% flow/pressure reads 0.010 Vdc output, while disconnecting fluid supply. In case of an absolute pressure sensor, apply vacuum to the system during adjustment.
f) Adjust potmeter 'H' till 100% flow/pressure reads 5.000 Vdc output.
g) Adjust potmeter 'M' till 50% flow reads 2.500 Vdc output (not applicable to pressure meters).
h) Repeat steps 'e' thru 'g' till the deviation between the adjusted and desired values are smaller than the F.S. accuracy needed.

Notes:

a) In case of other F.S. signal levels, recalculate the 0.010, 2.500 and 5.000 Vdc levels belonging to the 0, 50 and 100% points.
b) Potmeters 'H' and 'M' can be adjusted without shifting the 'L' adjustment.
c) Adjusting potmeter 'L' automatically results in a corresponding shift in the positions of potmeters 'H' and 'M'.
d) Potmeter 'M' can be adjusted without shifting the positions of potmeters 'L' and 'H'.
e) For the positions of the potmeters consult the instrument specific enclosure.

5 Troubleshooting

5.1 General

For a correct analysis of the proper operation of a flow/pressure meter or controller it is recommended to remove the unit from the process line and check it without applying fluid supply pressure. In case the unit is dirty, this can be ascertained immediately by loosening the compression type couplings and, if applicable the flange on the inlet side.
Furthermore remove the cover and check if all connectors are fixed properly. Energizing or de-energizing of the instrument of the instrument indicates whether there is an electronic failure.
After that, fluid pressure is to be applied in order to check behaviour.
If there should be suspicion of leakage in case of a gas unit, do not check for bubbles with a leak detection liquid under the cover as this may lead to a short-circuit in the sensor or p.c.board.

5.2 Troubleshooting summary

Symptom	Possible cause	Action
No output signal	No power supply	1a) Check power supply
	PCB failure	1b) Check cable 1c) Return to factory
	Valve blocked	1d) Clean valve (qualified personnel only)
	Filter or screen blocked	1e) Clean filter or screen
	Sensor failure	1f) Return to factory
Maximum output signal	PCB failure	2a) Return to factory
	Sensor failure	2b) Return to factory
High setpoint vs. output offset	PCB failure	3a) Return to factory
	Valve blocked	3b) Clean valve (qualified personnel only)
	Stoppage	3c) Remove cause
	Pressure not correct	3d) Check pressure
Signal lower than expected	System stoppage	4a) Remove cause
Flow is gradually decreasing	(Gas) Condensation	5a) Decrease supply pressure or increase temperature
	Valve adjustment has changed	5b) Check valve adjustment
Oscillation	Controller adjustment wrong	6a) Check controller setting
	Input pressure wrong	6b) Adjust pressure
	Valve damaged	6c) Check valve
	Volume / tubing between controller and pressure controller too small/ short	6d) Improve situation
Small flow occurs when valve is supposed to be closed	Valve is leaking	7a) Check valve

APPENDIX 1

GAS CONVERSION TABLE

Doc. no.: 9.02.071

GAS CONVERSION FACTOR

Nr.:	Name:	Symbol	Density ρ_n [g / l] 0°C, 1 atm.	Heat capacity* c_p – cal [cal / g.K] 20°C, 1 atm.	Conversion factor 20°C, 1 atm.
1	Acetylene (Ethyne)	C_2H_2	1.172	0.438	0.61
2	Air	Air	1.293	0.241	1.00
3	Allene (Propadiene)	C_3H_4	1.832	0.392	0.43
4	Ammonia	NH_3	0.7693	0.524	0.77
5	Argon	Ar	1.784	0.125	1.40
6	Arsine	AsH_3	3.524	0.133	0.66
7	Boron trichloride	BCl_3	5.227	0.136	0.44
8	Boron trifluoride	BF_3	3.044	0.188	0.54
9	Bromine pentafluoride	BrF_5	7.803	0.156	0.26
10	Butadiene (1,3-)	C_4H_6	2.504	0.405	0.31
11	Butane	C_4H_{10}	2.705	0.457	0.25
12	Butene (1-)	C_4H_8	2.581	0.415	0.29
13	Butene (2-) (Cis)	C_4H_8	2.503	0.387	0.32
14	Butene (2-) (Trans)	C_4H_8	2.503	0.421	0.30
15	Carbonylfluoride	COF_2	2.983	0.194	0.54
16	Carbonylsulfide	COS	2.724	0.175	0.65
17	Carbon dioxide	CO_2	1.977	0.213	0.74
18	Carbon disulfide	CS_2	3.397	0.152	0.60
19	Carbon monoxide	CO	1.25	0.249	1.00
20	Chlorine	Cl_2	3.218	0.118	0.82
21	Chlorine trifluoride	ClF_3	4.125	0.188	0.40
22	Cyanogen	C_2N_2	2.376	0.275	0.48
23	Cyanogen chloride	ClCN	2.743	0.185	0.61
24	Cyclopropane	C_3H_6	1.919	0.374	0.43
25	Deuterium	D_2	0.1798	1.73	1.00
26	Diborane	B_2H_6	1.248	0.577	0.43
27	Dibromo difluoromethane	Br_2CF_2	9.361	0.17	0.20
28	Dichlorosilane	SiH_2Cl_2	4.506	0.17	0.41
29	Dimethylamine	C_2H_6NH	2.011	0.417	0.37
30	Dimethylpropane (2,2-)	C_5H_{12}	3.219	0.462	0.21
31	Dimethylether	C_2H_6O	2.105	0.378	0.39
32	Disilane	Si_2H_6	2.857	0.352	0.31
33	Ethane	C_2H_6	1.355	0.468	0.49
34	Ethylene (Ethene)	C_2H_4	1.261	0.414	0.60
35	Ethylene oxide	C_2H_4O	1.965	0.303	0.52
36	Ethylacetylene (1-Butyne)	C_4H_6	2.413	0.401	0.32
37	Ethylchloride	C_2H_5Cl	2.878	0.263	0.41
38	Fluorine	F_2	1.696	0.201	0.91
39	Freon-11	CCl_3F	6.129	0.145	0.35
40	Freon-113	$C_2Cl_3F_3$	8.36	0.174	0.21
41	Freon-1132A	$C_2H_2F_2$	2.889	0.244	0.44
42	Freon-114	$C_2Cl_2F_4$	7.626	0.177	0.23
43	Freon-115	C_2ClF_5	7.092	0.182	0.24
44	Freon-116	C_2F_6	6.251	0.2	0.25
45	Freon-12	CCl_2F_2	5.547	0.153	0.37
46	Freon-13	$CClF_3$	4.72	0.165	0.40
47	Freon-13B1	$CBrF_3$	6.768	0.12	0.38
48	Freon-14	CF_4	3.946	0.18	0.44
49	Freon-21	$CHCl_2F$	4.592	0.154	0.44
50	Freon-22	$CHClF_2$	3.936	0.168	0.47
51	Freon-23	CHF_3	3.156	0.191	0.52
52	Freon-C318	C_4F_8	9.372	0.222	0.15
53	Germane	GeH4	3.45	0.16	0.56

*c_p - cal (T,p) = c_p (T + 50°C, p)

GAS CONVERSION FACTOR

Nr.:	Name:	Symbol	Density ρ_n [g / l] 0°C, 1 atm.	Heat capacity* c_p – cal[cal / g.K] 20°C, 1atm.	Conversion factor 20°C, 1atm.
54	Helium	He	0.1785	1.24	1.41
55	Helium (3-)	3He	0.1346	1.606	1.44
56	Hydrogen	H_2	0.08991	3.44	1.01
57	Hydrogen bromide	HBr	3.646	0.0869	0.98
58	Hydrogen chloride	HCl	1.639	0.192	0.99
59	Hydrogen cyanide	HCN	1.206	0.345	0.75
60	Hydrogen fluoride	HF	0.8926	0.362	0.96
61	Hydrogen iodide	HI	5.799	0.0553	0.97
62	Hydrogen selenide	H_2Se	3.663	0.109	0.78
63	Hydrogen sulfide	H_2S	1.536	0.246	0.82
64	Isobutane	C_4H_{10}	2.693	0.457	0.25
65	Isobutylene (Isobutene)	C_4H_8	2.60	0.429	0.28
66	Krypton	Kr	3.749	0.058	1.43
67	Methane	CH_4	0.7175	0.568	0.76
68	Methylacetylene	C_3H_4	1.83	0.399	0.43
69	Methylbromide	CH_3Br	4.35	0.118	0.61
70	Methylchloride	CH_3Cl	2.3	0.212	0.64
71	Methylfluoride	CH_3F	1.534	0.29	0.70
72	Methylmercaptan	CH_3SH	2.146	0.272	0.53
73	Molybdenum hexafluoride	MoF_6	9.366	0.156	0.21
74	Mono-ethylamine	$C_2H_5NH_2$	2.011	0.436	0.36
75	Monomethylamine	CH_3NH_2	1.419	0.424	0.52
76	Neon	Ne	0.9002	0.246	1.41
77	Nitric oxide	NO	1.34	0.239	0.97
78	Nitrogen	N_2	1.250	0.249	1.00
79	Nitrogen dioxide	NO_2	2.053	0.204	0.74
80	Nitrogen trifluoride	NF_3	3.182	0.194	0.50
81	Nitrosyl chloride	NOCl	2.984	0.17	0.61
82	Nitrous oxide	N_2O	1.978	0.221	0.71
83	Oxygen	O_2	1.429	0.222	0.98
84	Oxygen difluoride	OF_2	2.417	0.201	0.64
85	Ozone	O_3	2.154	0.207	0.70
86	Pentane	C_5H_{12}	3.219	0.455	0.21
87	Perchlorylfluoride	ClO_3F	4.653	0.165	0.41
88	Perfluoropropane	C_3F_8	8.662	0.22	0.16
89	Performa- ethylene	C_2F_4	4.523	0.206	0.33
90	Phosgene	$COCl_2$	4.413	0.149	0.47
91	Phosphine	PH_3	1.53	0.277	0.73
92	Phosphorous pentafluoride	PF_5	5.694	0.183	0.30
93	Propane	C_3H_8	2.012	0.456	0.34
94	Propylene (Propene)	C_3H_6	1.915	0.408	0.40
95	Silane	SiH_4	1.443	0.349	0.62
96	Silicon tetrafluoride	SiF_4	4.683	0.18	0.37
97	Sulfurylfluoride	SO_2F_2	4.631	0.175	0.38
98	Sulfur dioxide	SO_2	2.922	0.157	0.68
99	Sulfur hexafluoride	SF_6	6.626	0.175	0.27
100	Sulfur tetrafluoride	SF_4	4.821	0.192	0.34
101	Trichlorosilane	$SiHCl_3$	6.044	0.157	0.33
102	Trimethylamine	C_3H_9N	2.637	0.424	0.28
103	Tungsten hexafluoride	WF_6	13.29	0.092	0.25
104	Vinylbromide	C_2H_3Br	4.772	0.141	0.46
105	Vinylchloride	C_2H_3Cl	2.865	0.229	0.47
106	Vinylfluoride	C_2H_3F	2.08	0.305	0.49
107	Xenon	Xe	5.899	0.0382	1.38

* c_p - cal $(T,p) = c_p (T + 50°C, p)$

APPENDIX 2

Enclosures (if applicable)

Calibration certificate(s)
Declaration on contamination
Dimensional drawings
Hook-up diagram

Doc. no.: 9.17.032 A
Date: 23-07-2002

Safety Information for the Return of Contaminated Instruments and Components.

General Information

The employer (user) bears the responsibility for the health and safety of his employees. This stretches back to the people that come into touch with the instruments and components during repair and/or service of the instruments and components at the user's site or in the manufacturer's plant. The contamination of the instrument and components must be made known, and the declaration on contamination must be filled out.

Declaration on Contamination

The people that carry out the repair and/or service must be informed about the condition of the contaminated instruments and components before the work is started. The "Declaration on Contamination of Instruments and Components" serves that purpose.

This declaration must be sent direct to the supplier or a firm assigned by him. A second copy must be sent together with the forwarding documents of the consignment.

Despatch

When despatching contaminated instruments and components the instructions prior to shipment as given in the manual must be obeyed, such as:

- depressurise instrument,
- neutralise instrument by purging with gas and/or rinse with adequate solvent,
- remove filter cartridges from separate filters or integrated filters on inlet of instruments.
- seal all openings air tight,
- pack in suitable protective foil (sealed),
- transport in suitable transport containers.

Declaration on Contamination of Instruments and Components

When returning material, always describe the problem and if possible the work to be done, else a delay in repair will occur.
In case of contamination the material will only be accepted for repair if adequate cleaning has been carried out and this declaration has been filled out correctly and completely, and signed by authorized persons.

A. Type of instrument
- Model no./Article no.: .....
- Serial no.: .....
- Despatch date: .....

B. Reason of return:
.....
.....

C. The instrument was contaminated with .....
and was cleaned with .....

To safe-guard staff in the repair department take proper care of packing, if possible use the original packing box and seal the instrument adequately.

D. Is the contamination
- ❑ a. flammable
- ❑ b. toxic (toxic byproducts)
- ❑ c. poisonous
- ❑ d. corrosive
- ❑ e. inert
- ❑ f. irritant
- ❑ g. moisture sensitive
- ❑ h. oxidizer
- ❑ i. radioactive
- ❑ j. micro biological
- ❑ k. cancer suspect
- ❑ l. other, describe: .....

E. Legally valid declaration

Herewith we (I) assure, that the statements in this form are correct and complete. The despatch of the contaminated instruments and components will take place in accordance with sound and legal regulations.

Firm/Institute : .....
Street: ..... Postal Code/Town: .....
Telephone: .....
Fax: ..... Telex: .....

Name (in blockletters) .....
Position: .....

Date: ..... Stamp office: .....

Legally valid signature: .....

INSTRUCTIONS
FOR
SCRAPED SURFACE HEAT EXCHANGER

PILOT PERFECTOR
TYPE 57 BGS

WARNING

The Perfector SSHE is a pressure vessel consisting of rotating parts, hot surfaces or cold and electrical equipment.

This instruction contains several safety warnings.

All plant personnel must be familiar with the contents of these instructions, especially the safety warnings. Gerstenberg & Agger A/S will not assume any responsibility for personal injury or equipment damage caused by faulty operation.

30.08.2004

NOTICE

The information contained in this instruction is subject to change without notice.

Gerstenberg & Agger A/S makes no warranty of any kind with regard to this material and shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing performance, or use of this material.

IF PROBLEMS OCCUR

If you suspect a problem with this Perfector-SSHE, first check with the contents of this instruction and find the indicated problem before rectification.

If you are unable to solve the problem despite all efforts using this instruction, refer to Gerstenberg & Agger A/S.

THIS INSTRUCTION

In order to allow and promote the correct use of this unit, the description under different sections shall be strictly followed. This will secure the user's safety; reduce the risk of damage to Perfector-SSHE and consequent malfunction or inefficient operation.

USERS GUIDELINES

This instruction is divided into ten sections. They primarily deal with the essential information to the user of this unit. Each section comprises sub-sections, refer to the table of contents.

INSTRUCTIONS
FOR
SCRAPED SURFACE HEAT EXCHANGER
PILOT PERFECTOR
TYPE 57 BGS

TABLE OF CONTENTS

1. GENERAL

1.1 Scope

The objective of this instruction is to assist the plant personnel engaged in the installation, maintenance and daily operation of the Perfector-Scraped Surface Heat Exchanger. This instruction specifies the general requirements pertaining to the installation, operation, maintenance, inspection and service. It is therefore extremely important that all plant personnel are familiar with these instructions.

1.2 Application

The G&A Perfector -SSHE is designed for lenient heating/cooling of medium viscosity, pumpable food, dairy, fine chemical and pharmaceutical products.

1.3 Markings

Nameplate
You find a copy of nameplate in the last part of the manual.

The information provided on the nameplate should be used as reference when contacting Gerstenberg & Agger A/S.

Health and Safety Warning Signs
In order to incorporate the health and safety aspects, the following warning signs are provided on the Perfector-SSHE:

High system pressure
The unit operates under high pressure. No part of the system must be dismantled unless it is established that the system is de-pressurised and thoroughly vented.

High surface temperature/ Low surface temperature (freezing).
In cases where the surface temperature is higher than 51°C, warning sign is installed to avoid the risk of injury.

Mandatory sign
A mandatory sign is installed to indicate the necessity of protection gloves.

1.4 Protection of the Perfector

Storage and Handling

1) Store the machine in original packing until installation.

2) Place the heat exchanger on a firm foundation. Be careful with the cylindrical jacket because the jacket's stainless steel cladding dents very easily.

3) It is best to move the heat exchanger by means of a lifting truck which can be driven in under the base frame from all sides. The heat exchanger has a high gravity point, therefore secure the top of the heat exchanger at the ring bolts at the top of the heat exchanger.

   The heat exchanger must be moved slowly, with maximum attention paid to stability.

4) When the heat exchanger has been moved to the place where it is to stand, adjust the height of the legs to get the cylinders in level with a slight fall to the end of the cylinders where the product inlet is located.

1.5 Maintenance Tools and Accessories
Tool kit , item no. PL42.353

The toolkit containing all the special tools facilitates the assembling and dismantling of the Perfector. For any assembling or dismantling work, it is recommended to use only the genuine tools supplied.

1.6 Safety Warnings

1.6.1 General

This Perfector is a rotating machine. When in operation, do not touch, perform service or maintenance.

Always ensure that the Consistator rotates anti clockwise seen from the end cover.

The Perfector must not be used for heating the chlorine containing liquids and is not compatible for heating any other product than specified.

Unless specifically stated in the contract, the unit must not be installed in an explosive environment.

1.6.2 Operation

Never operate the Perfector at speeds higher than those specified or recommended by Gerstenberg & Agger A/S.
Never apply pressures and temperatures higher than the designed figures.
We strongly recommend protection devices to be installed.
The operation of this unit is limited to heating / cooling of specific liquid feeds.
Never operate the unit without the product or water in the cylinder.
Vibrations and/or forces from the pipelines must not be transferred to the Perfector.

1.6.3 Service and Maintenance

This Perfector is classified as a pressure vessel in accordance with the Pressure Equipment Directive 97/23/EC. Never attempt drilling, cutting or welding. Local inspection authority must be informed subsequent to any such work.

Service and maintenance of this unit shall only be performed by personnel skilled in the maintenance of industrial machinery, and who are familiar with the contents of this instruction.

For safe operation, use only genuine spares and replacement parts supplied by Gerstenberg & Agger A/S.

Use only the approved cleaning liquids for cleaning the Perfector parts i.e., water, dilute organic acids and CIP liquids recommended for stainless steel surfaces. When in doubt, consult Gerstenberg & Agger A/S. Do not use liquids containing chlorine under any circumstances.
In section 8 there is a list of recommended detergents.

2. DESIGN AND FUNCTIONAL DESCRIPTION

Refer to Drw. 40.147-000

2.1 Design Description

The G&A Perfector SSHE incorporates special design features ensuring ideal heating/cooling of products with effective heat transfer. The product enters at one end of the Perfector and flows horizontal in a helical pattern through the cylinder. A uniform temperature distribution is ensured by a rotor with scrapers that continuously and gently blend the product while simultaneously removing the product from the heat-transfer surface. The medium travels in a counter-current flow through the narrow annular channel.

The design mode ensures optimum performance on both medium and low viscosity products. The special surface scrapers ensure clean heat transfer surface and prevent product degradation. The rotating large diameter rotor reduces the product residence time. The special surface finish of the cylinder prevents wear and ensures long equipment life.

2.2 Functional Description

The G&A Perfector SSHE comprises a cylinder with rotor coupled directly to the drive motor. The complete unit (units) is mounted on a self-sustaining cabinet.

The jacket (item 12) is a cylindrical pressure vessel duly insulated and cladded to comply with the safe and sanitary requirements. The cylinder contains of a rotor with scraper blades.

The product enters at the front cover of the cylinder and is discharged through the outlet placed on the upper side of the cylinder opposite the inlet. (item 3). The heating/cooling medium enters from the bottom far side of the jacket with outlet at the top near side of the jacket.

The required temperature, pressure and flow are controlled through the auxiliary equipment and system.

3. TECHNICAL DATA

3.1 Design Data

	57 BGS	57 BGS
Service of the Unit	Heating	Heating/Cooling
Heating /Cooling Medium	Saturated Steam	Hot/Cold Water
Heat Transm. Surface,m^2	0,086	0,086
Product Viscosity Range, cP	> 1 Mill.	> 1 Mill.
Design Pressure, Bar g. Product/Medium Side	100/10	100/10
Test Pressure, Bar g. Product/Medium Side	130/25	130/25
Design Temperature, °C Product/Medium Side	150/170	150/170
Min. Allowed Temperature, °C	- 20	- 20
Volume, Litre Product/Medium Side	1,0/ 0,48	1,0/ 0,48
Geared Motor data Installed Power, kW Horizontal Flanged Motor, RPM Gear Ratio Fixed Rotor with Scraper RPM	 3,8 1000 Frequency con. 170-1000	 3,8 1000 Frequency con. 170-1000
Cooling cylinder active length mm	500	500
Cooling cylinder inside diameter mm	57	57
Rotor diameter mm	42	42
Rows of knives	2	2
Net Weight, kg	500	500
Floor Space, m^2	0,36/0,86	0,36/0,86

3.2 Dimensions

Refer to the unit arrangement drawing.

3.3 Material of Construction

All parts of the Perfector exposed to product are made of AISI 316 and comply with the hygienic requirements of US 3-A, EN 1672-2 and similar national directives. However, all other exposed external parts of the unit are made of AISI 304.

3.4 Noise Level, Vibrations and Emissions

At normal operating conditions the SPL at a distance of 1 meter from the unit is measured to less than 60-dB (A). This figure, however, shall be taken as guidelines. A deviation up to 5-dB (A) or more may be expected depending on conditions mentioned below:

The RPM and load factor
Motor size and type
Surroundings of the unit

With a properly mounted Perfector in accordance with the instructions, there will be no vibrations transferred to the surroundings.

There will be no emission from the unit; however, the seal flushing water may contain traces of product.

4. AUXILIARY EQUIPMENT AND SYSTEMS

4.1 Steam/Condensate System (OPTIONAL)
Drw. 42.093-110A

4.2 Hot Water (OPTIONAL)
Drw. 42.093-110A

4.3 Lubrication System

Refer to the separate instruction.

5. SETTING UP

5.1 Unpacking

The crate has relevant warning marks according to DS/ISO 780; these warnings must be respected when handling the crate. If possible, bring the crate to the place where the machine is to be installed. Gently remove top and sides of the crate, and then lift the machine in position for installation.

5.2 Installing the Perfector

Lifting procedure, see drawing no.

5.3 Installation of Auxiliary Equipment and Systems

The minimum requirements are shown on the above mentioned flow diagram, drw. 42.093-10A. For the installation of auxiliary equipment and monitoring system, refer to the piping plans and specifications valid for the plant.

6. INITIAL START-UP AND OPERATION

Before the initial start-up, it is mandatory that the procedures and activities outlined in section 5 are completed and verified by the plant supervisor.

Refer to safety warnings stated in section 1.6.

During initial start-up, the unit must be filled with water.

6.1 Checklist for Connections and Settings

Before the initial start-up of the unit, the following checks are essential for safety:

- Check that the unit is mounted in accordance with the instructions.
- Check that the motor rotates in the correct direction as marked, without rotor fitted.
- Check that product inlet connection(s) to the unit are properly tightened.
- Check that the electrical cables for the unit are connected.

6.2 Safety Instructions

Finally check and inspect:

- Motor direction of rotation.
- Level of noise and vibration

After a predetermined initial operational time, the unit is ready for continuous operation with product.

6.3 Normal Start-up and Shutdown

The normal start-up, operation and shutdown of the unit are integrated with the production-line / or manual.
Furthermore, for enhancing the operational performance of the unit, inspection, service and maintenance shall be performed as stated in this instruction.

During the normal start-up, the unit shall be operated without product, but with water for few minutes. The same is valid during the shutdown of the unit. This will ensure a clean interior with no residual product.

6.4 Emergency Shutdown or Power Failure

An emergency shutdown of the plant is normally activated due to critical and unacceptable deviation in the operation of the plant. When activated, the complete plant will stop functioning due to interlocks. Before any restart of the plant, the unit must be cleaned.

Prior to restarting the unit, ensure that the cause(s) for emergency stop has been investigated and the necessary action has been taken. The above mentioned activity should be repeated in case of power failure.

NOTE
In case of voltage drop-out

In case of motor failure, the product flow to the Perfector must be stopped and cleaning of the Perfector should be performed in accordance with this instruction.

7. SERVICE AND MAINTENANCE

7.1 Spare Parts

All parts of the Perfector unit are manufactured with great precision. Only genuine G&A spare parts must be used. Subsequent to commissioning of the unit, a spare parts quotation is submitted by G&A's Spare Parts Department. Always maintain a complete set of recommended spare (especially wear) parts on hand.
When ordering spare parts, please state the plant order number, type and size of the Perfector unit (see nameplate), and the pos. numbers of the parts required. Refer to the list of parts.

7.2 Regular Maintenance

7.2.1 Inspection of Key Components

7.2.2 Inspection of Auxiliary Equipment and Systems

7.3 Preventive Maintenance

7.3.1 General Instructions

The rotor requires special attention regarding the eccentricity. For dismantling and assembling, refer to section 9.2.

Monitoring the shaft seal with regard to leakage and a proper heat transfer is the most appropriate way to secure the proper function of the unit.

In order to avoid damage to the shaft seals, care shall be taken during dismantling and reassembling.

NOTE
The service and maintenance of the electrical motor is not a part of this instruction. It is strongly recommended that the user must consult the separate instruction for the motor.

7.3.2 Time Table – Maintenance Programme

The following time intervals for maintenance programme are recommended for the preventive maintenance of the production line

After X hours of operation	To be carried out	Refer to
Each shutdown of the plant	Visual inspection and cleaning.	Section 8
8000	Dismantle the Perfector. Inspect and clean all components. Replace all gaskets, O-rings, seals, bearings and worn parts.	Section 9.2

NOTE
The above time intervals for the preventive maintenance of the parts and components are based on ideal conditions of operation. The user shall determine these intervals and extent through frequent inspection during the first year of operation.

7.4 Operational Disturbances and Trouble Shooting

7.4.1 General Instructions

The causes of the operational disturbances around the Perfector unit apart from other factors may be related to the rotating parts, shaft seals or heat transfer efficiency. Other causes can be related to the vibration or higher power consumption on motors due to the following reasons:

- Presence of hard deposits in the cylinder.
- Rotor partially clogged and requires dismantling and cleaning.

7.4.2 Malfunction – Probable Causes and Remedy

Symptom: Motor tripping. Insufficient, poor or no heat transfer

CAUSES	REMEDY
Product outlet pipe partially clogged.	Clean the pipe.
Shaft or rotor deformed.	Check and replace.
Unit partially clogged with product. Unit frozen.	Clean the unit internals. Defrost with hot medium.
Scrapers worn.	Check and replace the scrapers.

NOTE
For each listed symptom and causes mentioned above, more than one solution is usually possible. The first solution stated is the most probable correction action for the symptom. However, if that solution does not solve the problem, perform the solutions in the order they appear until the problem is solved.

8. CLEANING AND DISINFECTING

8.1 Frequency

Equipment used for handling food products in which water is a continuous phase should be cleaned and disinfected after each period of use, and at least daily.

As it is impracticable to dismantle and clean manually all contact surfaces, cleaning-in-place is carried out by circulating suitable solutions. Nevertheless, equipment should be inspected periodically and manually cleaned using suitable brushes when appropriate. Where possible, the Perfector, pumps, valves, and pipelines should be dismantled for inspection and for manual cleaning at frequent intervals.

8.2 Wet Cleaning

The basic steps of cleaning the Perfector comprise:

- Rinsing with water to remove gross deposit. Considering the requirements, a water temperature of 40°C-70°C is recommended.
- A cleaning treatment with detergent/acid solution at an appropriate velocity (2 m/s) and temperature so that the surface is freed from deposit.
- One or more rinses with clean potable water of adequate duration on the cleaned surfaces to remove contaminants and detergent solution.

CAUTION
It is extremely important that when hot solutions are used for cleaning (or disinfecting) there should be adequate and suitable air venting of the Perfector. Liquids on the jacket side can expand and deform the jacket, if there is no possibility of expansion, i.e. inlet and outlet may not both be closed.

8.3 Common Practice and Selection

CIP (Clean-In-Place)
An automatic CIP system performs the cleaning without any manual interference. Manual cleaning of certain components and equipment can reduce the cost.

Only an automatic system can be validated due to its performance each and every time. The most appropriate way is to handle the products in completely closed cycle systems during processing and cleaning.

A CIP system will always represent additional initial investment, but the operation cost in most cases will be reduced. The application of CIP is equally important in cases when different products are heated or cooled in the unit.

The SSHE is cleaned by supplying clean water into the cylinder immediately after the interruption of feed flow through the unit. Shut-off the medium (steam, glycol or hot water) supply to the unit and let the rotor moving. Continue the flushing through the unit until the water leaving the unit is clean. The unit is now ready for connecting to the CIP system. The agitator/rotor must be running during the whole cleaning process.

8.4 Cleaning System without CIP-Facilities

In case of no available CIP-facilities, a separate piping system should be established to ensure re-circulation of cleaning fluid across the unit.

Step 1
Establish a re-circulation system with pump that draws the cleaning fluid from a balance tank and circulates it through the SSHE. The pump capacity must be sufficient to ensure a fluid flow of 2,000 litre/h. In order to prevent fouling a velocity of 2 m/sec shall be maintained in the piping.

Step 2
Open the hot water valve or steam valve and raise the temperature of the circulating water to 70°C.

NOTE
When adding the chemicals, it is important to ensure that they are thoroughly distributed in the circulating fluid.
When heating water for cleaning or rinse in the Perfector, make certain that max. Chlorine is < 1ppm in the water supply.

Step 3
Alkali Cleaning

Se table page 17 and 18.

Step 4
Acid Cleaning

Se table page 17 and 18.

NOTE
In cases where the inner cylinder is hard-chrome plated, cleaning with acid may normally not be done. Please contact Gerstenberg & Agger A/S for information.

Step 5
If the unit is not restarted immediately after cleaning, it must be drained and disinfected prior to restart. Fill the unit with hot water and raise the temperature to 90°C. Circulate the water for 8 minutes and finish with a cold flush.

NOTE
In order to establish a thorough cleaning of the unit, it is recommended to frequently inspect the interior during the first year of operation. The time intervals can be varied to suit the requirements. However, prior to changing the concentration of the chemicals, please contact Gerstenberg & Agger A/S.

Alkaline Cleaning

For normal cleaning of Perfector Units with chrome-plated cylinders, G&A only recommend the use of an Alkaline cleaning solution applied as follows:

Detergent	Concentration	Temperature °C	Duration
NaOH Caustic Soda	1% - 1.5%	60 - 80	30 minutes
Henkel, P3 - ultrasil 11			
Novadan, Alkaren 45			
Water for preparing CIP solutions and for final water flushing should be drinking water quality in accordance with EU and local regulations.			

Acid Cleaning

Perfector units with chrome plated cylinders should not normally be acid-cleaned as there is a risk for damaging the cylinder chrome layer. Gerstenberg & Agger A/S do not normally recommend acid cleaning of the chrome-plated cylinders. However, it may be necessary occasionally to remove calcareous (lactic stone) scaling and *in exceptional circumstances* the following acid cleaning agents can be used providing the risk of damage is fully understood.

Acid	Concentration	Temperature °C	Duration
H_3PO_4, Phosforic acid	**0.5%**	**50**	**10 minutes**
Henkel, P3 - Horolit 617			
Novadan, Combisyre			
After initial acid cleaning the cylinders should be opened and inspected. If the deposit has not been removed repeat the acid cleaning but make a record of the total acid cleaning time should be kept for future reference. **After acid cleaning always flush with cold water for 15-20 minutes.**			

CIP Sequences
Perfector rotors should not be run continuously during CIP, but it is recommended they are "jogged" for approximately 5 seconds every 3 minutes.

For Perfector Units with Chrome-plated Cylinders		
Step	Temperature °C	Duration
1 Cold Water Flush - to push the product out	**Ambient temperature**	**5 minutes**
2 Hot Water Flush	**50 - 60**	**10 minutes**
3 Alkaline Flush	**60 - 80**	**30 minutes**
4 Water Flush	**60 - 80**	**5 minutes**
5 Acid Flush - **WARNING only to be used in exceptional circumstances.**	**50**	**10 minutes**
6 Hot Water Flush	**60 - 80**	**10 minutes**
7 Alkaline Flush	**60 - 80**	**10 minutes**
8 Cold Water Flush	**Ambient temperature**	**15 minutes**

For Perfector Units with Stainless Steel or SAF (Duplex steel) Cylinders		
Step	Temperature °C	Duration
1 Cold Water Flush - to push the product out	Ambient temperature	5 minutes
2 Hot Water Flush	50 - 60	10 minutes
3 Alkaline Flush	60 - 80	30 minutes
4 Water Flush	60 - 80	5 minutes
5 Acid Flush	50	30 minutes
6 Cold Water Flush	Ambient temperature	15 minutes

Disinfection:
If the machine has bacteriological contamination that normal CIP cleaning is unable to remove disinfection may be necessary.

The rotors should not rotate during these procedures, but be "jogged" two or three times for 5 seconds during the operation.

Caution

If any disinfectants containing chloride compounds are used they must be drained out and the plant thoroughly rinsed with cold water. This is to prevent spot corrosion, which may shorten the life of chromium plating on the chilling tubes, and the tungsten carbide seal rings.

Disinfection

Chemical Disinfection can be carried out by circulating Henkel, P3 - Oxonian in a 0.5% solution at 60°C for 30 minutes, followed by a cold water flush for 10 minutes.

Thermal Disinfection can be attempted using hot water. Prior to this it is important to ensure that the medium is able to expand i.e. stop valves of both sides of the SSHE must not be closed at the same time. The water temperature is increased to 90°C and circulated for 10 minutes.

9. DISMANTLING, ASSEMBLING AND REPLACEMENT OF MAIN PARTS AND COMPONENTS

9.1 General Instructions

All parts, components and accessories must be treated with extreme care during dismantling or assembling. Always place the components on clean cloth, plastic foil, corrugated cardboard or similar. Do not clean components with cotton waste. Instead use non-fluffing cloth.

When tapping on a component is required, use only a wooden or plastic hammer. Never apply diametrical force to ball bearing housings in a vice or similar holding tools.

Always apply clean oil to sealing and O-rings prior to assembly. All O-rings, seals and gaskets involved during dismantling should be replaced. For proper dismantling and assembling, use only the genuine tools.

CAUTION
Before restarting the unit, always ensure that the rotor shaft rotates freely.

9.2 Dismantling and re-assembling of Perfector Unit

Dismantling

The machine must be cold, empty and clean before dismantling starts. Ensure electric motor cannot be switched on during dismantling.

Close service inlet and outlet, and ensure the supply is safely shut off.

Close rotor water flushing.

Disconnect the power cable to the machine.

Unscrew product inlet and outlet pipes.

Unscrew jacket's pipe connections.

The machine can be dismantled by means of the standard tools only.

9.2.1 Dismantling Procedure

- **End Cover Assembly**
  Item 3, Drw. 40.147-000

Remove End Cover

Unscrew the cylinder nut item 10. Carefully remove the end cover.

- **Rotor Unit**
  Item. 2 Drw. 40.147- 000

Dismantling Rotor Unit

The rotor body is anchored in the drive shaft item.18. Insert a key to hold the driveshaft and unscrew the rotor from the front end, loosen the sealbox nut item 9 at drw. 25.216-000
Now the rotor can be pulled out (use a mandrel). The complete seal box will follow the rotor.
The rotor body unit has to be placed lying on a clean, smooth and solid place. Hereafter, the complete seal box and the scraper blades can be demounted.

CAUTION! Wear protection gloves when demounting/mounting scraper blades and handling the rotor.

- **Shaft Seal Assembly**
  Item 8, Drw. 40.147- 000/ 25.216-000

Dismantling Shaft Seal

Unscrew the screws item 1 and remove the entire seal box arrangement by drawing it along and over the shaft end.
We do not recommend local repair and disassembly of the sealbox, as it requires special tools and skills.

NB: This must be done very carefully because these parts are very fragile!

- **Chilling / Heating tube item 1, Drw. 40.147- 000**

Dismantling the Chilling / Heating Cylinder:

Unscrew the front nut item 11 and draw the jacket assembly item 12 off.

Now unscrew the 6 screws item 22 and remove the cylinder / base console assembly.

9.2.2 Assembling Procedure

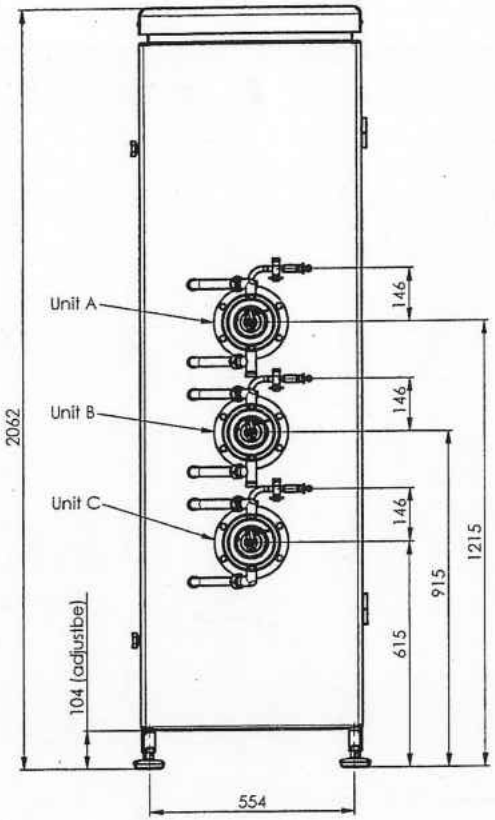
Assembly

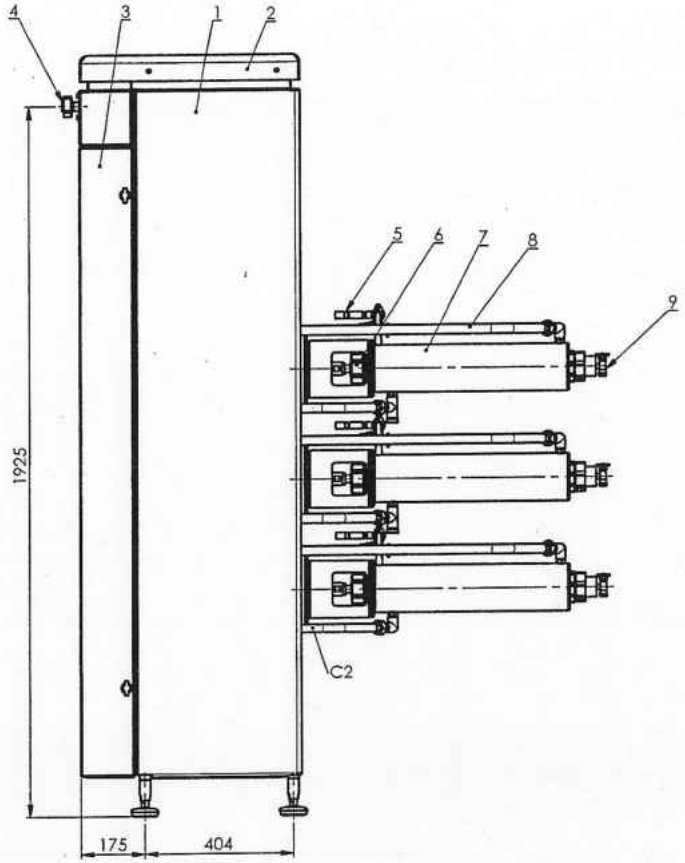
Clean components thoroughly before assembly.
During assembly, only edible fats and oils may be used for greasing the parts that come into contact with the product.

The tool set contains one box with approx. 400 g Castrol FM1. This grease is considered to be non-poisonous, but has only to be used for parts coming in contact with the product, if it is allowed by local authorities.

Mounting is generally done as disassembling in reverse order!

Please apply a suitable anti-seizing compound at all threads.





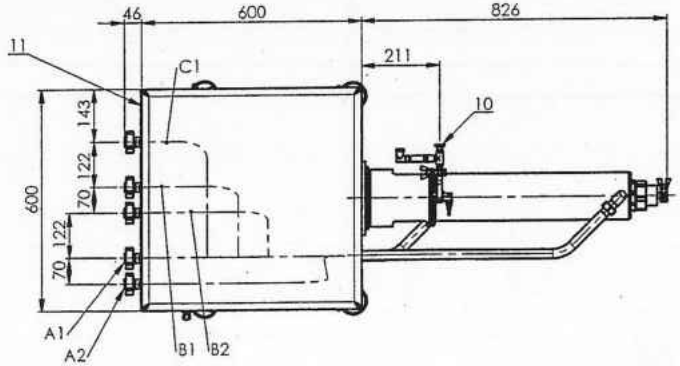
1) Stainless steel cabinet
2) Removeble top lid
3) Hinges rear door
4) Medie connestions, tube ø25x1,2
5) Temperature sensor PT100
6) Product shaft seal
7) Isolated jacket for rotor
8) Seamless tube ø25 for medie
9) Product inlet
10) Product outlet
11) Electrical connection to motors

A1) Inlet for medie, unit A
A2) Outlet for medie, unit A

B1) Inlet for medie, unit B
B2) Outlet for medie, unit B

C1) Inlet for steam, unit C
C2) Outlet for steam, unit C

Note, all dimensions in mM



GERSTENBERG & AGGER A/S
COPENHAGEN
22. VIBEHOLMSVEJ · DK-2605 BRØNDBY · DANMARK
TELEFON: 43277000 · TELEFAX: 43277003
E-mail: headoffice@gerstenbergs.com

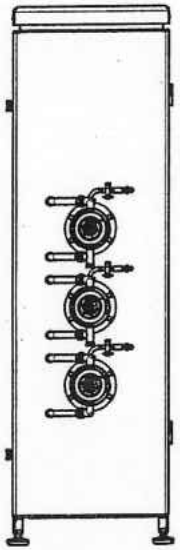
Vægt/kg: 481,189	Dato	Sign.
Målforhold 1:10	Tegn. 27-02-04	cm
	Kont. 2/3-2004	lb

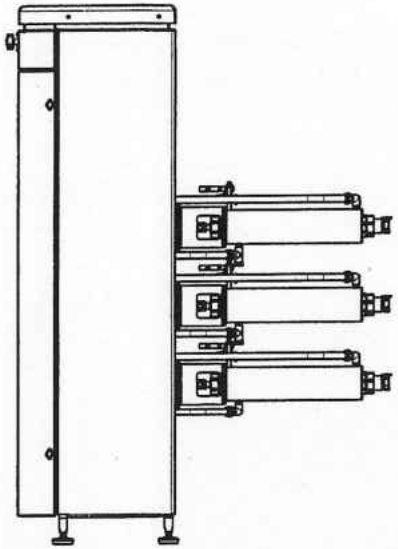
Denne tegning er kun gyldig i underskrevet stand.
This drawing is only valid when handsigned.
Any amendment must be confirmed by GERSTENBERG & AGGER A/S

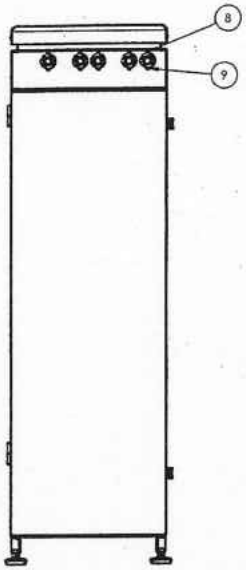
Modul Pilot Perfector 57 BGS
Målskitse
Dimension drawing

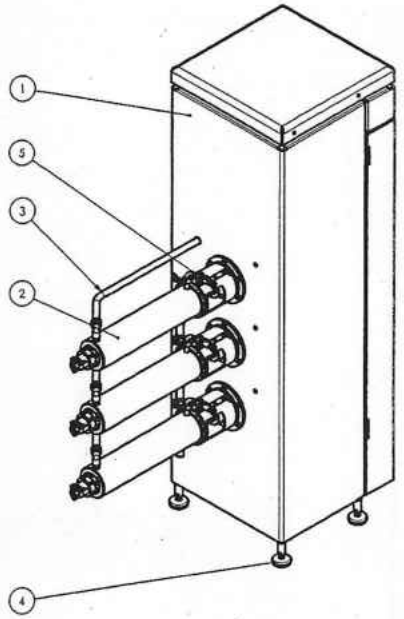
42.161 Rev.

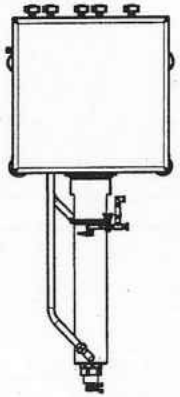
A2











0 Målskitse
Dimensions

6 Maskinskilt
Data plate

7 G&A skilt
G&A sign

10 Produktslange
Product hose

GERSTENBERG & AGGER A/S
COPENHAGEN

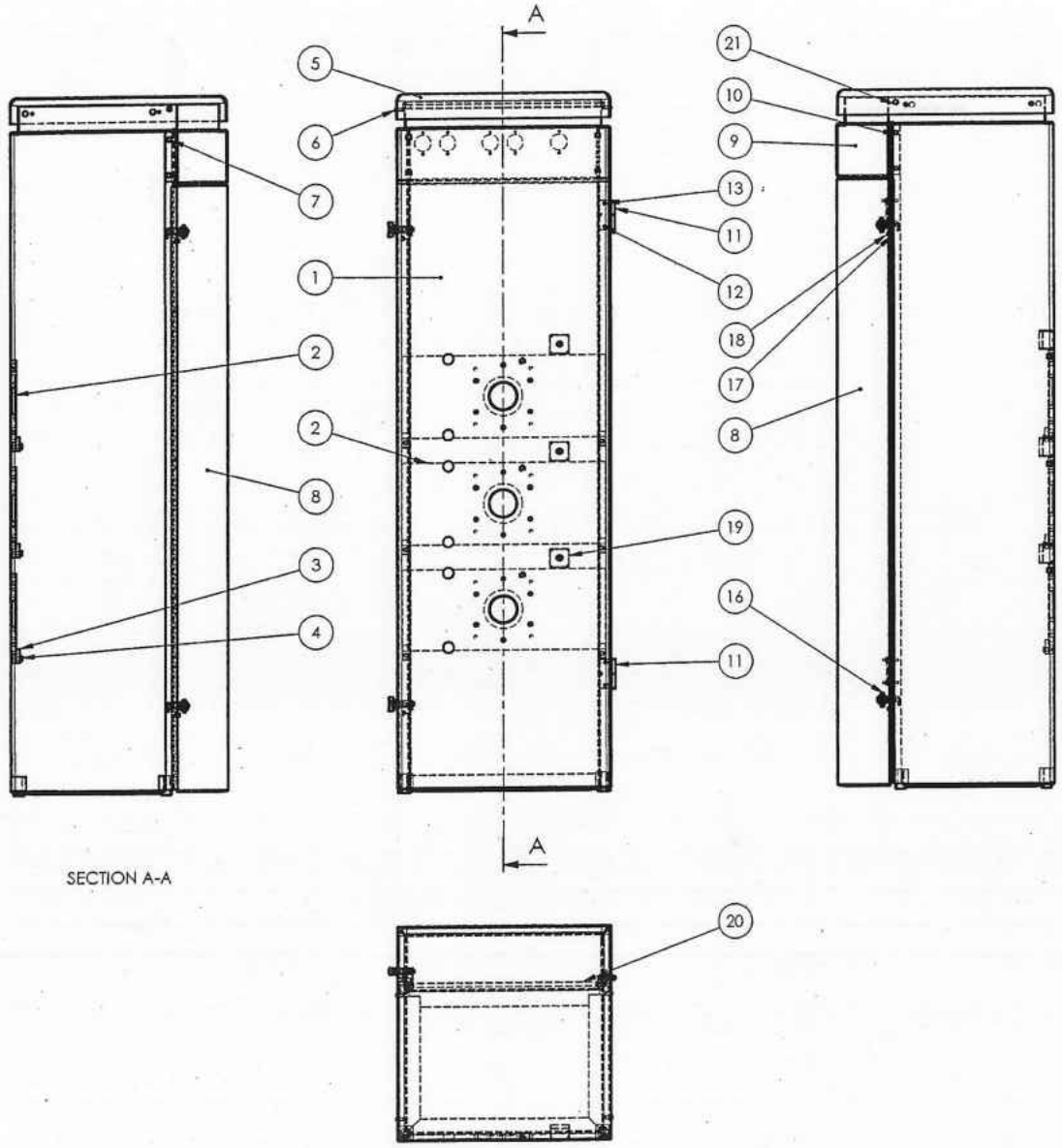
Vægt/kg: 382,925	Dato	Tegn.
Målforhold: 1:10	Tegn. 04-02-04	CM
	Kont. 11/3-2004	RD

Modul Pilot Perfector 57 BGS
Samlingstegning
Assembly

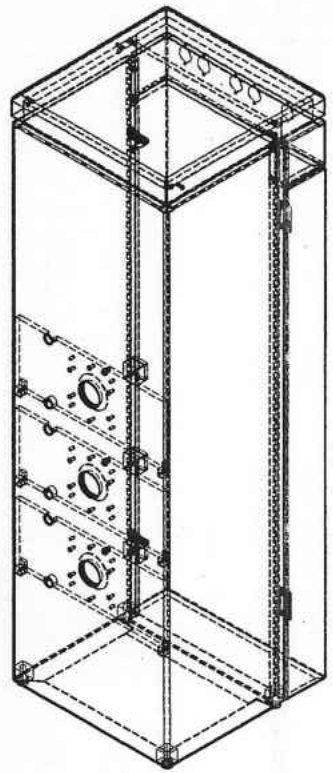
42.161-000

Rev.

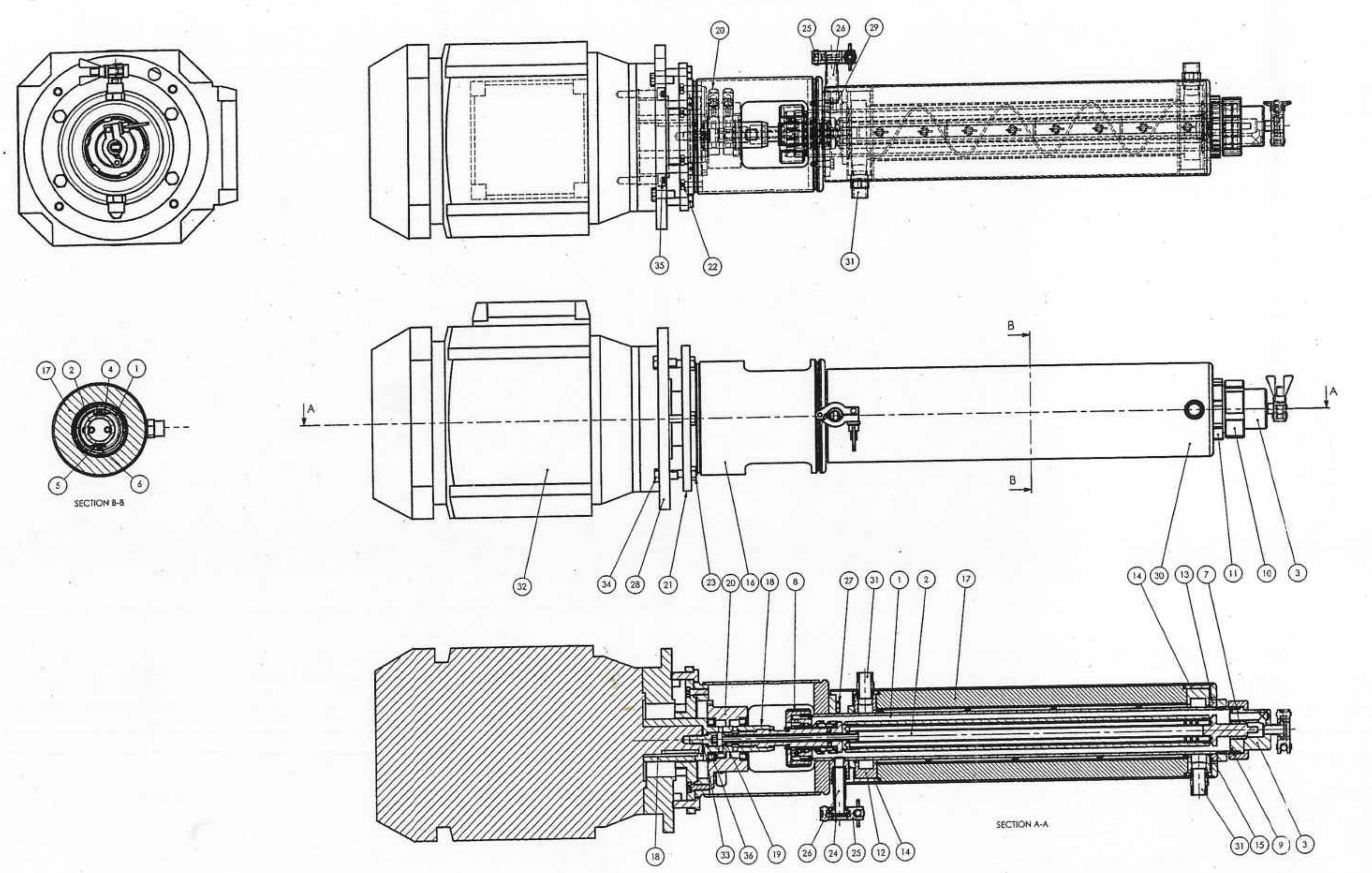
A1



SECTION A-A



GERSTENBERG & AGGER A/S COPENHAGEN 22. VIBEHOLMSVEJ - DK-2605 BRØNDBY - DANMARK TELEFON: 43277000 - TELEFAX: 43277003 E-mail: headoffice@gerstenberg.com	Vægt/kg: 166,162	Dato	Sign.
	Målforhold 1:10	Tegn. 23-02-04	cm
		Kont. 27/02-2004	llb
Modul Pilot Perfector BGS unit Komplet kabinet / Complete cabinet	Denne tegning er kun gyldig i underskrevet stand. This drawing is only valid when handsigned. Any amendment must be confirmed by GERSTENBERG & AGGER A/S		
	42.162-000		Rev.
This drawing is the property of GERSTENBERG & AGGER A/S and must not be copied without their consent.			A2



GERSTENBERG & AGGER A/S
COPENHAGEN

Vægt/kg: 60.913		Dato	Sign.
Målforhold	Tegn.	29-01-04	cm
1:2.5	Kont.	25/2-2004	lb

Module Pilot Perfector 57 BGS
Samling, Skraber enhed komplet
Assembly, Scraper unit complete

40.147-000

A1

Gerstenberg & Agger A/S

Draw.date:

Spare parts list pl42.161
Module Pilot Perfector 57 BGS

Position	Item number	Quantity	Description	Description
000	42.161-000	1,00	Assembly, Module Pilot Perfector 57B	
000	42.161	1,00	Dimension drawing for Pilot Perf.057 E	
001	pl42.162	1,00	Cabinet for pilot perfector 57 BGS	
002	pl40.147	3,00	BGS for Pilot Perf.	
003	pl42.228	1,00	Tubes anf fittings for BGS	
004	370-0239	4,00	Machin foot type M-3A M20 ø80	
005	pl41.340	3,00	Tempatarue probe PT100 in tube	
006	908-0375	1,00	Machinesign ordre see drawing	
007	280-0004	1,00	Identification plate	
008	160-0093	10,00	Screw M6*12	
009	160-0077	10,00	Nut M6 DIN934	
010	41.309-002	2,00	Product tube L= 600mm ,for Pilot Perf.	

Gerstenberg & Agger A/S

Draw.date:

Spare parts list pl42.162
Cabinet for pilot perfector 57 BGS

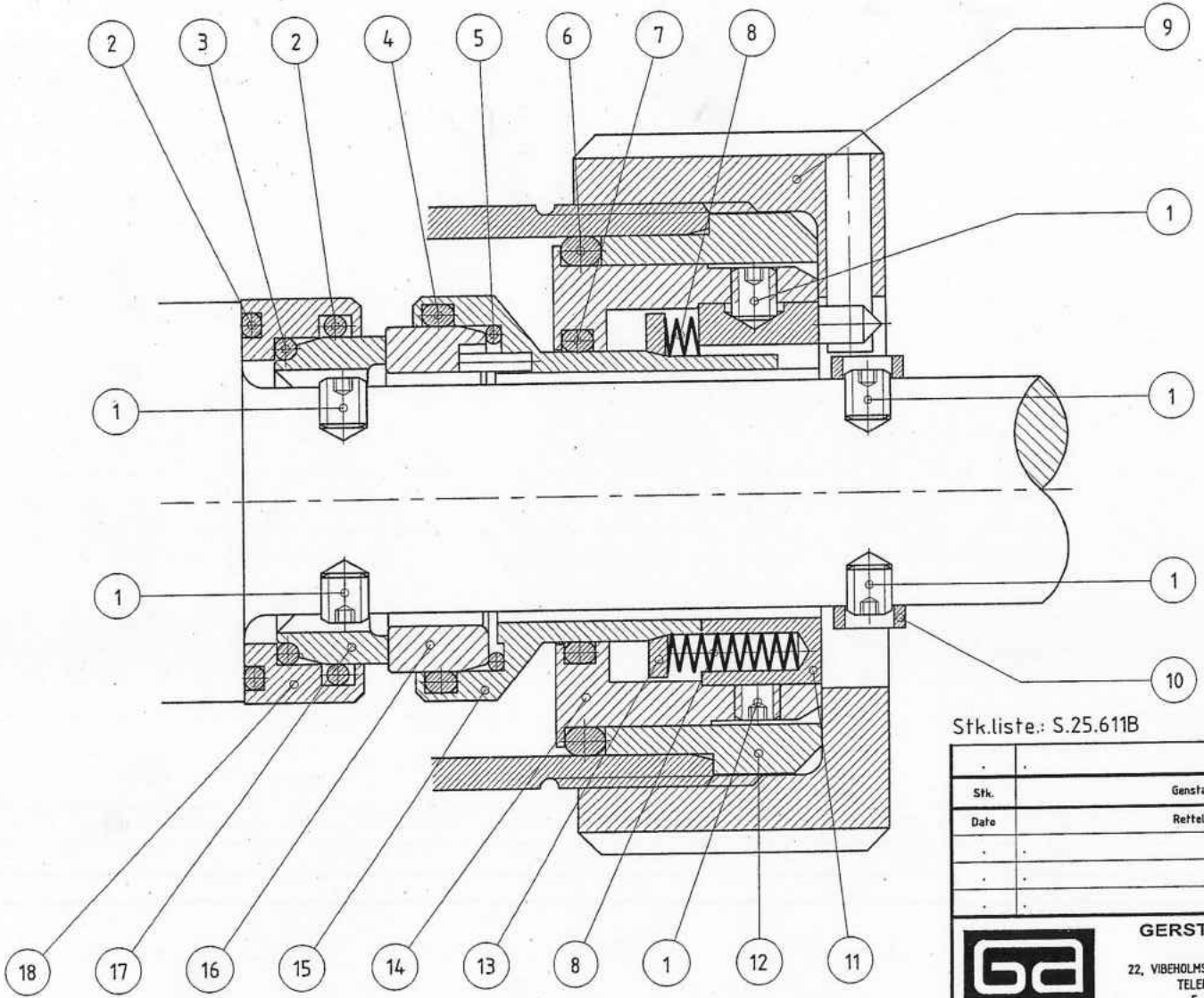
Position	Item number	Quantity	Description	Description
000	42.162-000	1,00	Assembly, Cabinet for 3x57 BGS	
001	42.142-001	1,00	Cabinet for Pilot 057 BGS	
002	42.142-002	3,00	Plate for motor 57 BGS	
003	40.061-018	6,00	Bracket w.M8	
004	160-0097	6,00	Set screw M8x20 DIN933 A2	
005	40.061-001	1,00	Top part for cabinet	
006	160-0511	4,00	Screw ISO7380 M6*16 BH-A2	
007	160-1021	7,00	Set screw M8*12 DIN 933	
008	42.142-006	1,00	Rear lid for Pilot BGS cabinet	
009	42.142-007	1,00	Console for cabinet 57 BGS	
010	160-0078	4,00	Nut M8, DIN934, A2	
011	370-0778	2,00	Dirak Hinge, screw-on type, SS	
012	160-0449	8,00	Screw M06*020 DIN7991 A2	
013	160-0077	8,00	Nut M6 DIN934	
016	pl40.863	2,00	Lock and handle for door	
017	40.061-012	2,00	nut washer ø15/M6 L=5 POM	
018	160-0788	1,00	Screw M6x10, DIN 912, A2	
019	260-0917	3,00	Connection box Polyester 50x50x40m	
020	42.142-008	1,00	Support tube for cabinet	
021	160-1029	2,00	Set screw M10*16 DIN 933	

Gerstenberg & Agger A/S

Draw.date:

Spare parts list pl40.147
BGS for Pilot Perf.

Position	Item number	Quantity	Description	Description
000	40.147-000	1,00	Scraper unit complete for 57 BGS	
001	42.133-001	1,00	Chilling tube ø57 BGS	
002	42.123-006	1,00	Rotor ø42 for Pilot Perf.BGS	
003	40.201-002	1,00	Front cover for rotor	
004	15.062-011	4,00	Knife,floating,chromeflex 1 mm	
005	15.062-012	4,00	Knife,floating,chromeflex 1 mm	
006	166-0303	16,00	Cylindrical pin ø2x20, A4	
007	18.036b-737	1,00	Bushing 24/17x22 P/450G	
008	s25.611a	1,00	HM-Shaft seal----------1*57	
009	140-0182	1,00	O-ring 49,20x3,53, NBR-70	
010	15.348-012	1,00	Nut	
011	15.063-007	1,00	Bronze nut chilling tube labo	
012	23.468d	1,00	Chilling/heating jacket	
013	23.469	1,00	Back-up ring	
014	23.470	2,00	Insulation ring	
015	140-0189	2,00	O-ring 63.50x3.53 NBR 70	
016	42.134-001	1,00	Console for rotor and chilling tube	
017	500-0768	1,00	Isolation for jacket	
018	42.135-001	1,00	Driving shaft for motor size 132 57 B(	
019	18.035d-003	1,00	Water Pipe	
020	pl40.198	1,00	Water sealing house complete	
021	42.134-002	1,00	Flange for Console 57 BGS unit	
022	160-2094	6,00	SKRUE-DIN7984-M08*025------A4	
023	160-0102	6,00	Screw M10x30, DIN933, A2	
024	220-0279	2,00	Clamp gasket MINI ø14	
025	220-0274	2,00	Clamp ring MINI ø14 AISI 316L	
026	42.123-007	1,00	Product tube with clamp liner	
027	160-0097	6,00	Set screw M8x20 DIN933 A2	
028	42.135-002	1,00	Flange for motor BGS/pilot perf.	
029	140-1081	1,00	O-ring ø12*2mm FPM 75	
030	40.147-001	1,00	Protection jacket for BGS 57	
031	100-0031	2,00	Nipple 1/2""	
032	661-0005-22	1,00	MOTOR-3KW-B14-8P-3x380-420V/5(	
033	160-0345	1,00	Screw M12*25	
034	160-0101	4,00	Screw M10x25, DIN 933, A2	
035	160-0752	4,00	Screw M10*040 DIN912 A2	
036	130-0049	1,00	Packing 18/12*2	



Stk.liste.: S.25.611B

Stk.	Genstand	Pos. Nr.	Tegnings Nr.	Materiale	Model Nr.
Dato	Rettelse	Dato	Rettelse		

GERSTENBERG & AGGER A/S
COPENHAGEN
22, VIBEHOLMSVEJ - DK-2605 BRØNDBY - DANMARK
TELEFON: 43277000 - TELEFAX: 43277003
E-mail: headoffice@gerstenbergs.com

M&forhold		Dato	Sign.
2:1	Tegn.	30/05/91	GV
	Konf.		

Erstatning for: 25.216

Perfector ϕ57
Pakdåse (komplet)
Shaft seal complete

25.216--000

Erstattet af:

Denne tegning er kun gyldig i underskrevet stand. This drawing is only valid when handsigned.

A3

Gerstenberg & Agger A/S

Draw.date:

Spare parts list s25.611b
HM-Shaft seal----------1*57

Position	Item number	Quantity	Description	Description
000	25.216-000	1,00	Assembly dwg.Sanitary Shaft Seal Pe	
001	160-0118	6,00	Stop screw M5x6, DIN 916, A2	
002	140-0234	2,00	O-ring 36.14x2.62, NBR 70	
003	140-0334	1,00	O-ring 31.60x2.40, NBR 70	
004	140-0235	1,00	O-ring 37.77x2.62, NBR 70	
005	140-0337	1,00	O-ring 33.30x2.40, NBR 70	
006	140-0182	1,00	O-ring 49,20x3,53, NBR-70	
007	140-0232	1,00	O-ring 31.42x2.62, NBR 70	
008	15.027-209	8,00	Spring 0.5x4.20x24 A2	
009	25.216-008	1,00	Union	
010	25.216-010	1,00	Ejection ring	
011	25.216a-009	1,00	Spring housing	
012	25.216-006	1,00	Guide ring	
013	25.216-007	1,00	Pressure ring	
014	25.216a-005	1,00	Guide	
015	25.216-003	1,00	Retainer for stationary seal ring	
016	25.216a-001	1,00	Stationary seal ring	
017	25.216a-002	1,00	Rotating seal ring	
018	25.216-004	1,00	Retainer for rotat. seal ring	

PILOT PERFECTOR
TYPE 57/R22 / R507 / R404A

Serial No 2513.003
Year 2004

INSTRUCTIONS
FOR
SCRAPED SURFACE HEAT EXCHANGER

PILOT PERFECTOR
TYPE 57

WARNING

The Perfector SSHE is a pressure vessel consisting of rotating parts, hot or cold surfaces and electrical equipment.

This instruction contains several safety warnings.

All plant personnel must be familiar with the contents of these instructions, especially the safety warnings. Gerstenberg & Agger A/S will not assume any responsibility for personal injury or equipment damage caused by faulty operation.

30.08.04

NOTICE

The information contained in this instruction is subject to change without notice.

Gerstenberg & Agger A/S makes no warranty of any kind with regard to this material and shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing performance, or use of this material.

IF PROBLEMS OCCUR

If you suspect a problem with this Perfector-SSHE, first check with the contents of this instruction and find the indicated problem before rectification.

If you are unable to solve the problem despite all efforts using this instruction, refer to Gerstenberg & Agger A/S.

THIS INSTRUCTION

In order to allow and promote the correct use of this unit, the description under different sections shall be strictly followed. This will secure the user's safety; reduce the risk of damage to Perfector-SSHE and consequent malfunction or inefficient operation.

USERS GUIDELINES

This instruction is divided into ten sections. They primarily deal with the essential information to the user of this unit. Each section comprises sub-sections, refer to the table of contents.

INSTRUCTIONS
FOR
SCRAPED SURFACE HEAT EXCHANGER
PILOT PERFECTOR
TYPE 57

TABLE OF CONTENTS

7. SERVICE AND MAINTENANCE

8. CLEANING AND DISINFECTING

9. DISMANTLING, ASSEMBLING AND REPLACEMENT OF MAIN PARTS AND COMPONENTS

10. COOLING SYSTEM

1. GENERAL

1.1 Scope

The objective of this instruction is to assist the plant personnel engaged in the installation, maintenance and daily operation of the Perfector -Scraped Surface Heat Exchanger. This instruction specifies the general requirements pertaining to the installation, operation, maintenance, inspection and service. It is therefore extremely important that all plant personnel are familiar with these instructions.

1.2 Application

The G&A Perfector -SSHE is designed for lenient cooling of medium viscosity, pumpable food, dairy, fine chemical, and pharmaceutical products.

1.3 Markings

Nameplate
You find a copy of nameplate in the last part of the manual.

The information provided on the nameplate should be used as reference when contacting Gerstenberg & Agger A/S.

Health and Safety Warning Signs
In order to incorporate the health and safety aspects, the following warning signs are provided on the Perfector -SSHE:

High system pressure
The unit operates under high pressure. No part of the system must be dismantled unless it is established that the system is de-pressurised and thoroughly vented.

Mandatory sign
A mandatory sign is installed to indicate the necessity of protection gloves.

1.4 Protection of the Perfector

Storage and Handling

1) Store the machine in original packing until installation.

2) Place the heat exchanger on a firm foundation. Be careful with the cylindrical jacket on the drop tank because the jacket's stainless steel cladding dents very easily.

3) It is best to move the heat exchanger by means of a lifting truck which can be driven in under the base frame from all sides. Be aware that the heat exchanger has a high gravity point.

   The heat exchanger must be moved slowly, with maximum attention paid to stability.

4) When the heat exchanger has been moved to the place where it is to stand, adjust the height of the legs to get the cylinders in level with a slight fall to the end of the cylinders where the product inlet is located.

1.5 Maintenance Tools and Accessories
Tool kit, item no. PL42.353

The toolkit containing all the special tools facilitates the assembling and dismantling of the Perfector. For any assembling or dismantling work, it is recommended to use only the genuine tools supplied.

1.6 Safety Warnings

1.6.1 General

This Perfector has rotating parts. When in operation, do not perform service or maintenance.

Always ensure that the Perfector rotates anti clockwise seen from the end cover.

The Perfector must not be used for cooling the chlorine containing liquids and is not compatible for cooling any other product than specified.

Unless specifically stated in the contract, the unit must not be installed in an explosive environment.

1.6.2 Operation

Never operate the Perfector at speeds higher than those specified or recommended by Gerstenberg & Agger A/S.
Never apply pressures and temperatures higher than the designed figures.
We strongly recommend protection devices to be installed.
The operation of this unit is limited to cooling of specific liquid feeds. Never operate the unit without the product or water in the cylinder.
Vibrations and forces from the pipelines must not be transferred to the Perfector.

1.6.3 Service and Maintenance

This Perfector is classified as a pressure vessel in accordance with the Pressure Equipment Directive 97/23/EC. Never attempt drilling, cutting or welding. Local inspection authority must be informed prior to any such work.

Service and maintenance of this unit shall only be performed by personnel skilled in the maintenance of industrial machinery, and who are familiar with the contents of this instruction.

For safe operation, use only genuine spares and replacement parts supplied by Gerstenberg & Agger A/S.

Use only the approved cleaning liquids for cleaning the Perfector parts i.e., water, dilute organic acids and CIP liquids recommended for stainless steel surfaces. When in doubt, consult Gerstenberg & Agger A/S. Do not use liquids containing chlorine under any circumstances.
In section 8 there is a list of recommended detergents.

2. DESIGN AND FUNCTIONAL DESCRIPTION

Refer to Drw. 40.201-000

2.1 Design Description

The G&A Perfector SSHE incorporates special design features ensuring ideal cooling of products with effective heat transfer. The product enters at one end of the Perfector and flows horizontal in a helical pattern through the cylinder. A uniform temperature distribution is ensured by a rotor with scrapers that continuously and gently scrape the product while simultaneously removing the product from the heat-transfer surface.

The design mode ensures optimum performance on both medium and low viscosity products. The special surface scrapers ensure clean heat transfer surface and prevent product degradation. The rotating large diameter rotor reduces the product residence time. The special surface finish of the cylinder prevents wear and ensures long equipment life.

2.2 Functional Description

The G&A Perfector SSHE comprises a cylinder with rotor coupled directly to the drive motor. The complete unit (units) is mounted on a self-supporting frame.

The cooling jacket is a cylindrical pressure vessel duly. Further it is integrated with a liquid drop tank underneath which has a jacket to avoid heating of the refrigerant during cleaning.

The cylinder contains of a rotor with scraper blades.

The product enters at the front cover of the cylinder and is discharged through the outlet situated on the upper side of the cylinder opposite the inlet (item 5).

The required temperature, pressure and flow are controlled through the auxiliary equipment and system.

3. TECHNICAL DATA

3.1 Design Data

	PERFECTOR 57
Service of the Unit	Cooling
Heating /Cooling Medium	R507
Heat Transm. Surface,m^2	0.057
Product Viscosity Range, cP	> 1 Mill.
Design Pressure, Bar g. Product/Medium Side	80/25
Test Pressure, Bar g. Product/Medium Side	143/36
Design Temperature, °C Medium Side	50
Min. Allowed Temperature, °C	- 40
Volume, Litre Product/Medium Side	0.5/16
Motor data Installed Power, kW Horizontal Flanged Motor, RPM Gear Ratio Fixed Rotor with Scraper RPM	 4.4 900 Frequency con. 100-900
Cooling Cylinder Length	430 mm
Cooling Cylinder Inside Diameter	57 mm
Rotor Diameter	44 mm
Rows of Knives	2
Net Weight, kg	500
Floor Space, m^2	0.36/0.87

3.2 Dimensions

Refer to the unit arrangement drawing.

3.3 Material of Construction

All parts of the Perfector exposed to product are made of AISI 316 and comply with the hygienic requirements of US 3-A, EN 1672-2 and similar national directives. However, all other exposed external parts of the unit are made of AISI 304.

3.4 Noise Level, Vibrations and Emissions

At normal operating conditions the SPL at a distance of 1 meter from the unit is measured to less than 60-dB (A). This figure, however, shall be taken as guidelines. A deviation up to 5-dB (A) or more may be expected depending on conditions mentioned below:

The RPM and load factor
Motor size and type
Surroundings of the unit

With a properly mounted Perfector in accordance with the instructions, there will be no vibrations transferred to the surroundings.

4. AUXILIARY EQUIPMENT AND SYSTEMS

4.1 R22 / HN3 Equipment.
Drw. 42.093-111A

5. SETTING UP

5.1 Unpacking
The crate has relevant warning marks according to DS/ISO 780, these warnings must be respected when handling the crate. If possible, bring the crate to the place where the machine is to be installed. Gently remove top and sides of the crate, and then lift the machine in position for installation.

5.2 Installing the Perfector

Lifting procedure, see drawing no 42.571

5.3 Installation of Auxiliary Equipment and Systems

The minimum requirements are shown on the above mentioned flow diagram, drw. 42.093-111A. For the installation of auxiliary equipment and monitoring system, refer to the piping plans and specifications valid for the plant.

6. INITIAL START-UP AND OPERATION

Before the initial start-up, it is mandatory that the procedures and activities outlined in section 5 are completed and verified by the plant supervisor.

Refer to safety warnings stated in section 1.6.

During initial start-up, the unit must be filled with liquid oil.

6.1 Checklist for Connections and Settings

Before the initial start-up of the unit, the following checks are essential for safety:

- Check that the motor rotates in the correct direction as marked without rotor fitted.
- Check that the unit is mounted in accordance with the instructions.
- Check that product inlet connection(s) to the unit are properly tightened.
- Check that the electrical cables for the unit are connected.

6.2 Safety Instructions

Finally check and inspect:
- Motor direction of rotation.
- Level of noise and vibration

After a predetermined initial operational time, the unit is ready for continuous operation with product.

6.3 Normal Start-up and Shutdown

The normal start-up, operation and shutdown of the unit are integrated with the production-line / or manual.
Furthermore, for enhancing the operational performance of the unit, inspection, service and maintenance shall be performed as stated in this instruction.

6.4 Emergency Shutdown or Power Failure

An emergency shutdown of the plant is normally activated due to critical and unacceptable deviation in the operation of the plant. When activated, the complete plant will stop functioning due to interlocks.

Prior to restarting the unit, ensure that the cause(s) for emergency stop has been investigated and the necessary action has been taken. The above mentioned activity should be repeated in case of power failure.

7. SERVICE AND MAINTENANCE

7.1 Spare Parts

All parts of the Perfector unit are manufactured with great precision. Only genuine G&A spare parts must be used. Subsequent to commissioning of the unit, a spare parts quotation is submitted by G&A's Spare Parts Department. Always maintain a complete set of recommended spare (especially wear) parts on hand.
When ordering spare parts, please state the plant order number, type and size of the Perfector unit (see name plate), and the pos. numbers of the parts required. Refer to the list of parts.

7.2 Regular Maintenance

7.2.1 Inspection of Key Components

7.2.2 Inspection of Auxiliary Equipment and Systems

7.3 Preventive Maintenance

7.3.1 General Instructions

The rotor requires special attention regarding the eccentricity. For dismantling and assembling, refer to section 9.2.

Monitoring the shaft seal with regard to leakage and a proper heat transfer is the most appropriate way to secure the proper function of the unit.

In order to avoid damage to the shaft seals, care shall be taken during dismantling and reassembling.

NOTE
The service and maintenance of the electrical motor is not a part of this instruction. It is strongly recommended that the user must consult the separate instruction for the motor.

7.3.2 Time Table – Maintenance Programme

The following time intervals for maintenance programme are recommended for the preventive maintenance of the production line

After X hours of operation	To be carried out	Refer to
Each shutdown of the plant	Visual inspection and cleaning.	Section 8
8000	Dismantle the Perfector. Inspect and clean all components. Replace all gaskets, O-rings, seals, bearings and worn parts.	Section 9.2

NOTE
The above time intervals for the preventive maintenance of the parts and components are based on ideal conditions of operation. The user shall determine these intervals and extent through frequent inspection during the first year of operation.

7.4 Operational Disturbances and Trouble Shooting

7.4.1 General Instructions

The causes of the operational disturbances around the Perfector unit apart from other factors may be related to the rotating parts, shaft seals or heat transfer efficiency. Other causes can be related to the vibration or higher power consumption on motors due to the following reasons:

- Presence of hard deposits in the cylinder.
- Rotor partially clogged and requires dismantling and cleaning.

7.4.2 Malfunction – Probable Causes and Remedy

Symptom: Motor tripping. Insufficient, poor or no heat transfer

CAUSES	REMEDY
Product outlet pipe partially clogged.	Clean the pipe.
Shaft or rotor deformed.	Check and replace.
Unit partially clogged with product. Unit frozen.	Clean the unit internals. Check suction valve/control pilot valve.
Scrapers worn.	Check and replace the scrapers.

NOTE
For each listed symptom and causes mentioned above, more than one solution is usually possible. The first solution stated is the most probable correction action for the symptom. However, if that solution does not solve the problem, perform the solutions in the order they appear until the problem is solved.

8. CLEANING AND DISINFECTING

8.1 Frequency

Equipment used for handling food products in which water is a continuous phase should be cleaned and disinfected after each period of use, and at least daily.

As it is impracticable to dismantle and clean manually all contact surfaces, cleaning-in-place is carried out by circulating suitable solutions. Nevertheless, equipment should be inspected periodically and manually cleaned using suitable brushes when appropriate. Where possible, the Perfector, pumps, valves, and pipelines should be dismantled for inspection and for manual cleaning at frequent intervals.

8.2 Wet Cleaning

The basic steps of cleaning the Perfector comprise:

- Rinsing with water to remove gross deposit. Considering the requirements, a water temperature of 40°C-70°C is recommended.
- A cleaning treatment with detergent/acid solution at an appropriate velocity (2 m/s) and temperature so that the surface is freed from deposit.
- One or more rinses with clean potable water of adequate duration on the cleaned surfaces to remove contaminants and detergent solution.

CAUTION
It is extremely important that when hot solutions are used for cleaning (or disinfecting) there should be adequate and suitable air venting of the Perfector. Liquids on the jacket side can expand and deform the jacket, if there is no possibility of expansion, i.e. inlet and outlet may not both be closed.

8.3 Common Practice and Selection

CIP (Clean-In-Place)
An automatic CIP system performs the cleaning without any manual interference. Manual cleaning of certain components and equipment can reduce the cost.

Only an automatic system can be validated due to its performance each and every time. The most appropriate way is to handle the products in completely closed cycle systems during processing and cleaning.

A CIP system will always represent additional initial investment, but the operation cost in most cases will be reduced. The application of CIP is equally important in cases when different products are cooled in the unit.

The SSHE is cleaned by supplying clean water into the cylinder immediately after the interruption of feed flow through the unit. Shut-off the cooling and let the rotor moving. Continue the flushing through the unit until the water leaving the unit is clean. The unit is now ready for connecting to the CIP system.

8.4 Cleaning System without CIP-Facilities

In case of no available CIP-facilities, a separate piping system should be established to ensure re-circulation of cleaning fluid across the unit.

Step 1
Establish a re-circulation system with pump that draws the cleaning fluid from a heated balance tank and circulates it through the SSHE. The pump capacity must be sufficient to ensure a fluid flow of 2,000 litre/h. In order to prevent fouling a velocity of 2 m/sec shall be maintained in the piping.

Step 2
Open the hot water valve or steam valve and raise the temperature of the circulating water to 70°C.

NOTE
When adding the chemicals, it is important to ensure that they are thoroughly dissolved and distributed in the circulating fluid.
When heating water for cleaning or rinse in the Perfector, make certain that max. chlorine is < 1ppm in the water supply.

Step 3
Alkali Cleaning

Se table page 16 and 17.

Step 4
Acid Cleaning

Se table page 16 and 17.

NOTE
In cases where the inner cylinder is hard-chrome plated, cleaning with acid may normally not be done. Please contact Gerstenberg & Agger A/S for information.

Step 5
If the unit is not restarted immediately after cleaning, it must be drained and disinfected prior to restart. Fill the unit with hot water and raise the temperature to 90°C. Circulate the water for 8 minutes and thereafter finish with a cold flush.

NOTE
In order to establish a thorough cleaning of the unit, it is recommended to frequently inspect the interior during the first year of operation. The time intervals can be varied to suit the requirements. However, prior to changing the concentration of the chemicals, please contact Gerstenberg & Agger A/S.

Alkaline Cleaning

For normal cleaning of Perfector Units with chrome-plated cylinders, G&A only recommend the use of an Alkaline cleaning solution applied as follows:

Detergent	Concentration	Temperature °C	Duration
NaOH Caustic Soda	1% - 1.5%	60 - 80	30 minutes
Henkel, P3 - ultrasil 11			
Novadan, Alkaren 45			
Water for preparing CIP solutions and for final water flushing should be drinking water quality in accordance with EU and local regulations.			

Acid Cleaning

Perfector units with chrome plated cylinders should not normally be acid-cleaned as there is a risk for damaging the cylinder chrome layer. Gerstenberg & Agger A/S do not normally recommend acid cleaning of the chrome-plated cylinders. However, it may be necessary occasionally to remove Calcareous (Lactic stone) scaling and *in exceptional circumstances* the following acid cleaning agents can be used providing the risk of damage is fully understood.

Acid	Concentration	Temperature °C	Duration
H_3PO_4, Phosforic acid	**0.5%**	**50**	**10 minutes**
Henkel, P3 - Horolit 617			
Novadan, Combisyre			
After initial acid cleaning the cylinders should be opened and inspected. If the deposit has not been removed repeat the acid cleaning but make a record of the total acid cleaning time should be kept for future reference. **After acid cleaning always flush with cold water for 15-20 minutes.**			

CIP Sequences

Perfector rotors should not be run continuously during CIP but it is recommended they are "jogged" for approximately 5 seconds every 3 minutes.

For Perfector Units with Chrome-plated Cylinders		
Step	Temperature °C	Duration
1 Cold Water Flush - to push the product out	**Ambient temperature**	**5 minutes**
2 Hot Water Flush	**50 - 60**	**10 minutes**
3 Alkaline Flush	**60 - 80**	**30 minutes**
4 Water Flush	**60 - 80**	**5 minutes**
5 Acid Flush - **WARNING only to be used in exceptional circumstances.**	**50**	**10 minutes**
6 Hot Water Flush	**60 - 80**	**10 minutes**
7 Alkaline Flush	**60 - 80**	**10 minutes**
8 Cold Water Flush	**Ambient temperature**	**15 minutes**

For Perfector Units with Stainless Steel or SAF (Duplex steel) Cylinders		
Step	Temperature °C	Duration
1 Cold Water Flush - to push the product out	Ambient temperature	5 minutes
2 Hot Water Flush	50 - 60	10 minutes
3 Alkaline Flush	60 - 80	30 minutes
4 Water Flush	60 - 80	5 minutes
5 Acid Flush	50	30 minutes
6 Cold Water Flush	Ambient temperature	15 minutes

Disinfection:

If the machine has bacteriological contamination that normal CIP cleaning is unable to remove disinfection may be necessary.

The rotors should not rotate during these procedures, but be "jogged" two or three times for 5 seconds during the operation.

Caution

If any disinfectants containing chlorine compounds are used they must be drained out and the plant thoroughly rinsed with cold water. This is to prevent spot corrosion, which may shorten the life of chromium plating on the chilling tubes, and the tungsten carbide seal rings.

Disinfection

Chemical disinfection can be carried out by circulating Henkel, P3 - Oxonian in a 0.5% solution at 60°C for 30 minutes, followed by a cold water flush for 10 minutes.

Thermal disinfection can be attempted using hot water. The CIP water temperature is increased to 90°C and circulated for 8 minutes. Finally rinse with cold water of ambient temperature.

If the water for sterilization contains more than 60 ppm chloride, Gerstenberg & Agger cannot recommend sterilization with hot water.

9. DISMANTLING, ASSEMBLING AND REPLACEMENT OF MAIN PARTS AND COMPONENTS

9.1 General Instructions

All parts, components and accessories must be treated with extreme care during dismantling or assembling. Always place the components on clean cloth, plastic foil, corrugated cardboard or similar. Do not clean components with cotton waste. Instead use non-fluffing cloth.

When tapping on a component is required, use only a wooden or plastic hammer. Never apply diametrical force to ball bearing housings in a vice or similar holding tools.

Always apply clean oil to sealing and O-rings prior to assembly. All O-rings, seals and gaskets involved during dismantling should be replaced. For proper dismantling and assembling, use only the genuine tools.

CAUTION
Before restarting the unit, always ensure that the rotor shaft rotates freely.

9.2 Dismantling and Re-assembling of Perfector Unit

Dismantling

The machine must be cold, empty and clean before dismantling starts. Ensure electric motor cannot be switched on during dismantling.

Close service inlet and outlet, and ensure the supply is safely shut off. In the case of R22 or R717, the jacket must be sucked completely empty before opening.

Close rotor water flushing.

Disconnect the power cable to the machine.

Unscrew product inlet and outlet pipes.

Unscrew jacket's pipe connections.

Disconnect rotor water flushing.

The machine can be dismantled by means of the standard tools only.

9.2.1 Dismantling Procedure

- **End Cover Assembly**
  Item 5, Drw. 40.201-000

Remove End Cover :

Unscrew the cylinder nut item 6. Carefully remove the end cover.

- **Rotor Unit**
  Item 9, Drw. 40.201- 000

Dismantling Rotor Unit:

The rotor body is anchored in the drive shaft item. 32. Insert a key to hold the driveshaft and unscrew the rotor from the front end, loosen the sealbox nut item 9 at drw. 25.216-000
Now the rotor can be pulled out (use a mandrel). The complete seal box will follow the rotor.
The rotor body unit has to be placed lying on a clean, smooth and solid place. Hereafter, the complete seal box and the scraper blades can be demounted.

CAUTION! Wear protection gloves when demounting/mounting scraper blades and handling the rotor.

- **Shaft Seal Assembly**
  Item 8, Drw. 40.201- 000/ 25.216-000

Dismantling Shaft Seal:

Unscrew the screws item 1 and remove the entire seal box arrangement by drawing it along and over the shaft end.
We do not recommend local repair and disassembly of the sealbox, as it requires special tools and skills.

NB: This must be done very carefully because these parts are very fragile!

- **Chilling / Heating tube item 1, Drw. 40.201- 000**

Dismantling the Chilling Cylinder:

Unscrew the bolts item 4 at the front and rear flange and draw the rotor out.

9.2.2 Assembling Procedure

Assembly

Clean components thoroughly before assembly.
During assembly, only edible fats and oils may be used for greasing the parts that come into contact with the product. Apply amply a suitable anti-seizing compound at all threads.

The tool set contains one box with approx. 400 g Castrol FM1. This grease is considered to be non-poisonous, but has only to be used for parts coming in contact with the product, if it is allowed by local authorities.

Mounting is generally done as disassembling in reverse order!

10. COOLING SYSTEM

10.1 General Instructions

The Perfector cooling system requires connection to a condensing unit that supplies the Perfector with liquid refrigerant at high pressure and sucks refrigerant vapour at low pressure.

The system is made in the form of a flooded evaporator with a float valve to control the level in the evaporator.

The evaporating pressure is controlled by a back pressure valve. The set point is controlled by a motorized pilot valve.

A small amount of compressor oil is dissolved in the liquid refrigerant added to the Perfector. In order to return the oil to the compressor a bleed of the refrigerant in the system is taken through a heat exchanger where the refrigerant evaporates by leading it through the heat exchanger in counterflow with the incoming hot liquid.

The bleed flow is controlled by a thermostatic regulator valve so that almost all the refrigerant has evaporated before the oil is added to the suction pipe. Thereafter the oil is led to the condensing unit together with the refrigerant gas.

The suction pipe between the Perfector and the condensing unit must be made so that it can transfer the oil vertically.

10.2 Drop Tank

The cooling system is equipped with a drop tank so that the refrigerant is removed from the cooling jacket at production stops.

At production stops the cold refrigerant will make the emulsion inside the Perfector solidify. To avoid this, the system is equipped with a drop tank. From the float valve the refrigerant is led to the drop tank which is placed beneath the cooling jacket. During operation flash gas presses the refrigerant up through a riser pipe into the cooling jacket.

When the Perfector is stopped, the supply of refrigerant is also stopped and a solenoid valve opens to connect the top of the drop tank with the top of the cooling jacket. Hereby the pressure is equalized and the refrigerant will run into the drop tank.

10.3 Precautions and First Aid

in connection with refrigerant R507

Please see enclosure from DuPont.

10.4 Adjusting of Level of Refrigerant

The liquid level in the cooling jacket is only to be so high that the chilling tube is just covered. A level at approx 1/3 of the liquid indicator is appropriate. Adjustment should be done in accordance with drawing 41.636-005 (please see enclosure).

10.5 Adjusting of Thermostatic Valve

The thermostatic valve for control of return of oil and overheating is set at 9°C in accordance with Danfoss instruction 068R9706 (please see enclosure).

10.6 Emptying of the System

Before any further service can be carried out the cooling system must be emptied of refrigerant.

Circulate hot oil through the Perfector. Close the manual stop valve at the liquid inlet. Start the Perfector and cooling at low temperature. The system is empty when the lower parts of the piping system defrost.

Close the manual stop valve in the suction pipe, stop cooling and stop the Perfector. If the pressure rises after a while, there is still liquid in the system, and the system must be emptied once again.

Moreover, in case soldering, welding or other strong heating should be necessary, the system must be evacuated further by a vacuum pump connected to the service valve in the cabinet.

10.7 Float Valve

Replacement of the orifice is to be done in accordance with Danfoss R1.02.E1.52 (please see enclosure) after the banjo nipple with adjusting spindle has been demounted.

If the orifice needle has to be replaced, the cover of the float valve must be dismounted.

NB: The orifice needle is not standard Danfoss.

10.8 Replacement of O-Ring at the Chilling Tube

Front (please see the enclosed drawing no. 40.201-000).
Dismount the front cover pos. 5 and front flange pos. 2. The O-rings pos. 3, 2 pcs., can now be removed with a small screwdriver or similar tool. Be careful not to damage the sealing surfaces.

Grease the new O-rings with oil similar to the one filled into the cooling plant. Press the O-rings into the slot one by one ex. with a strip of plastic with no sharp edges.

WARNING!
When a motor is demounted the front end of the cooling jacket ought to be supported. When the last motor is demounted the front end of the cooling jacket must absolutely be supported, as there is a risk that the unit tips over, for instance as shown on the drawing below.

10.9 Motor End (please see the enclosed drawing no. 40.201-000)

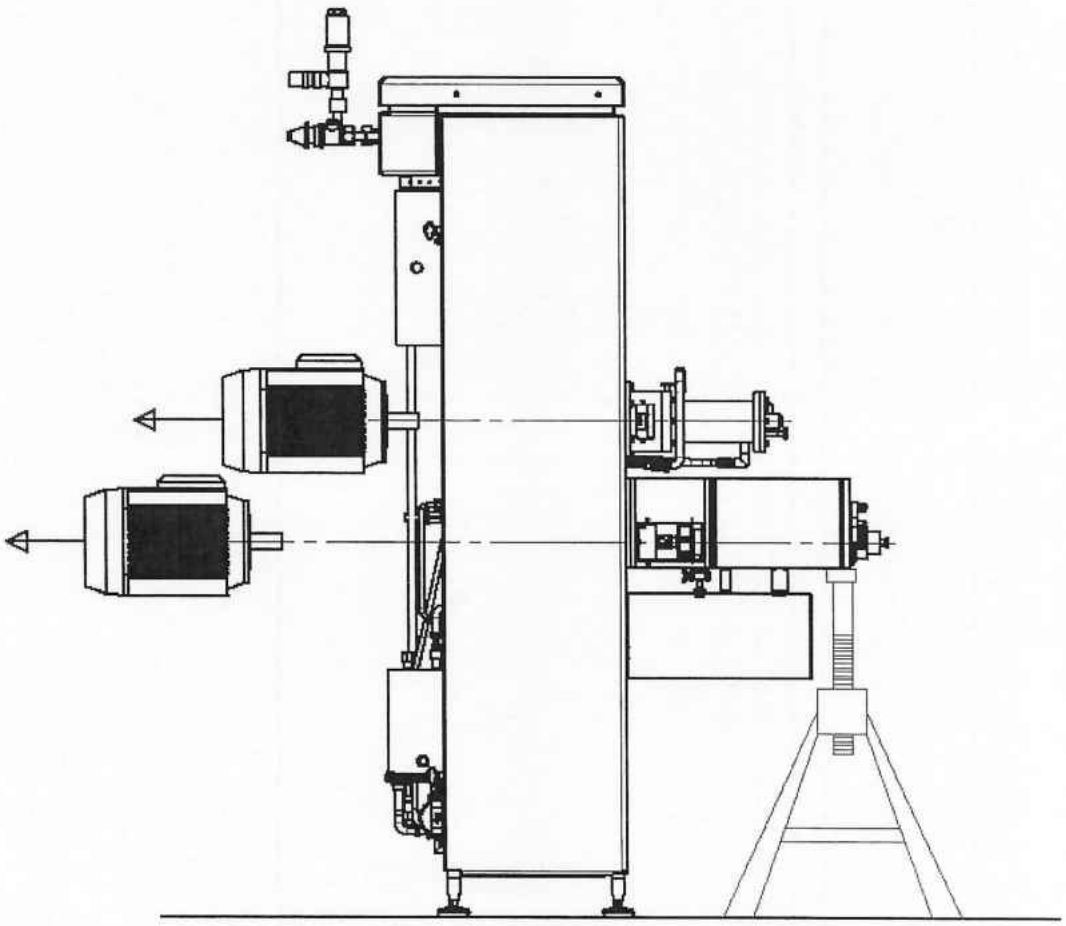
Dismount rotor, union pos. 8, water seal pos. 22, front flange pos. 2, product inlet connecting piece pos. 24 and motor. Remove the 6 screws pos. 4, and pull out the chilling tube. Grease the new O-rings with compressor cooling oil and draw them onto the chilling tube which is now led into the cooling jacket.

When the flange of the chilling tube is approx 5 cm from the cooling jacket, press the first O-ring into the slot with an L-shaped metal strip (ex. messing, copper or aluminium) with no sharp edges.

Press the chilling tube and the other O-ring into place and tighten the 6 screws evenly.

The rest of the assembling is carried out in reverse order.

Apply a suitable anti-seizing compound at all threads.



Water Attemperature Unit

Dependent on whether the Perfector unit is equipped with a pin rotor machine or not the unit is equipped with a double or single water attemperature unit.

The unit is constructed on a common bottom plate consisting of a water container (1) equipped with a temperature transmitter (2), level switch (3), heating element (1kW) (4) as well as a centrifugal pump (5).

At service the whole bottom plate can be drawn out, when the 4 screws holding the bottom plate have been removed, hoses for water supply and water outlet have been released, and power supply has been disconnected. All power and control cables between the unit and the operating panel are equipped with plug connectors.

If the heating element is to be replaced, remove the nut (6) in the connection end. If the heating element is stuck, remove also the pin in the opposite side, and drive the heating element out with a suitable mandrel.

When the water hoses are to be mounted, be sure that the connections are completely tight, as the water circulation is dependent on a siphon effect.

If the level switch is demounted, be aware that the float element is pointing in the right direction during the mounting.

At assembling apply amply a suitable anti-seizing compound at all threads.

GERSTENBERG & AGGER A/S
COPENHAGEN

Module Pilot Perfector 57
Water attemperature unit

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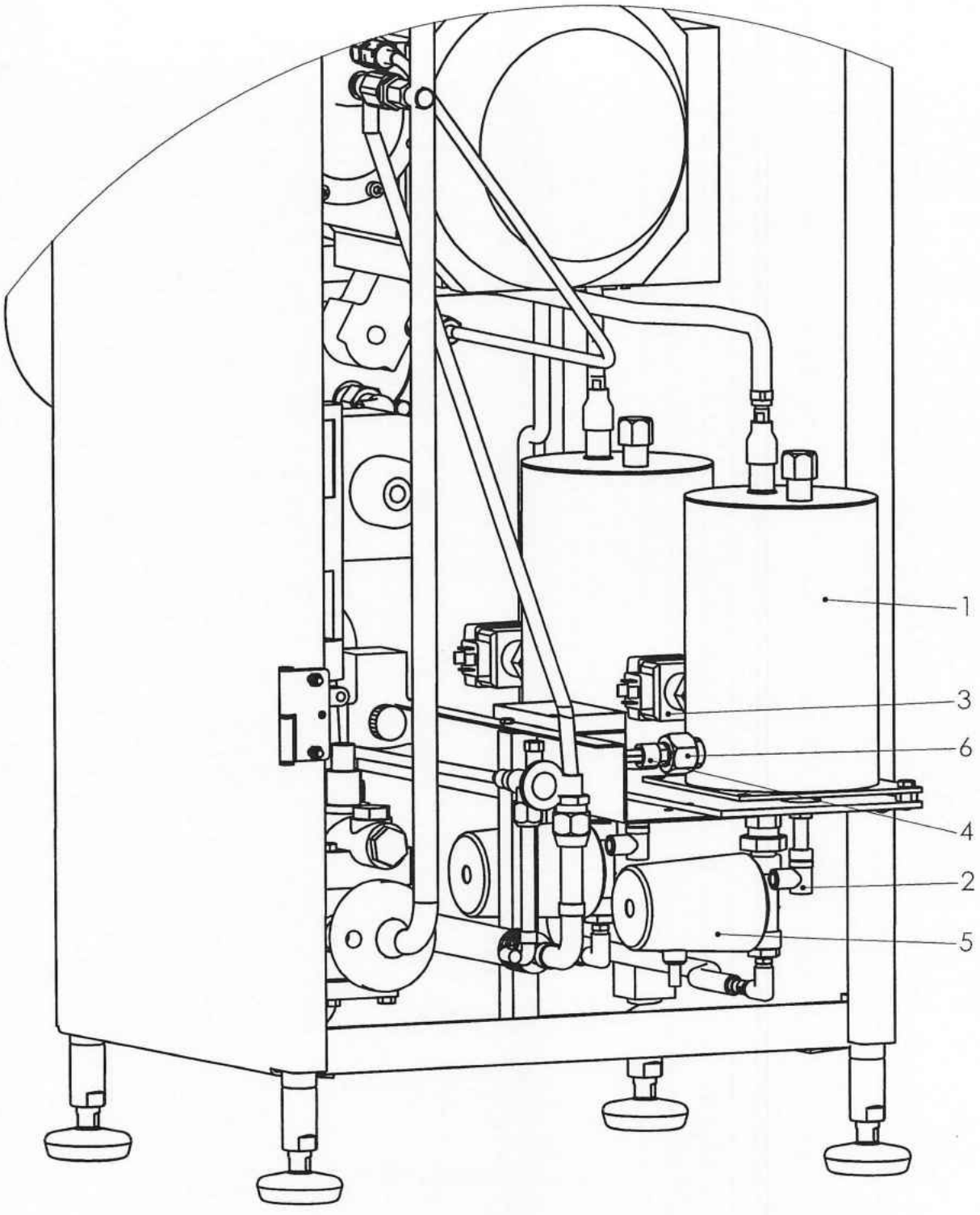

Gerstenberg Schröder	Drawings for Perfector Type 1x57/R22	No. 2513.003
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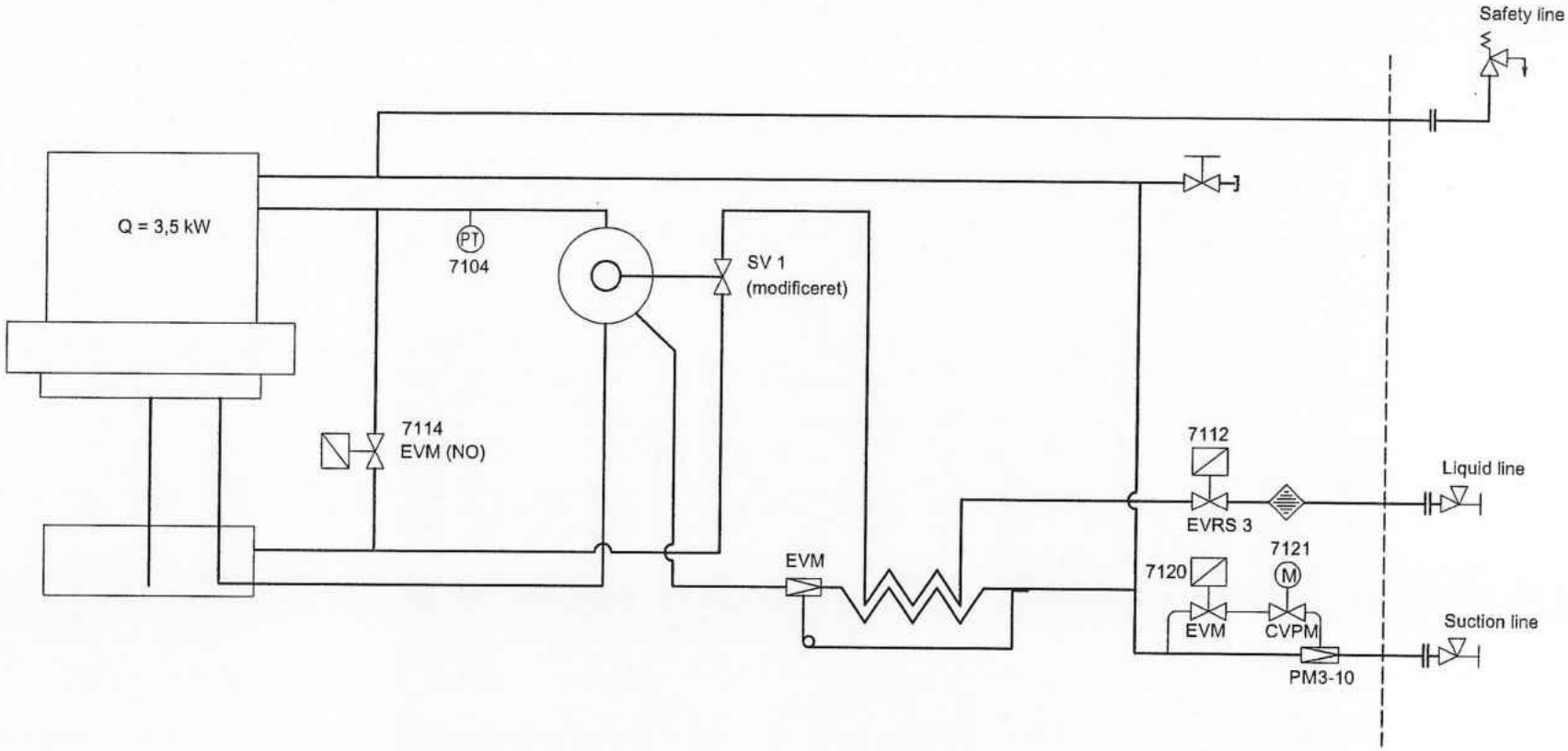
Diagram	42.537
P&I Diagram	42.093-110A
P&I Diagram	42.093-111A
Cooling System, Section View	
Module Pilot Perfector 57, Lifting	42.571
4x200 ltr Ingredients, Mixing Tank	42.093-113



item	
7114	EVM Drop valve
7112	EVRS 3 Liquid valve
7120	EVM Suction pilot valve
7121	CVPM Evaporation pressure control
	PM3-10 Suction main valve
	SV1 Float valve level control
	TX 2 Thermostatic expansion valve oil return
7104	AKS 33 Pressure transmitter evaporation pressure

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Diagram

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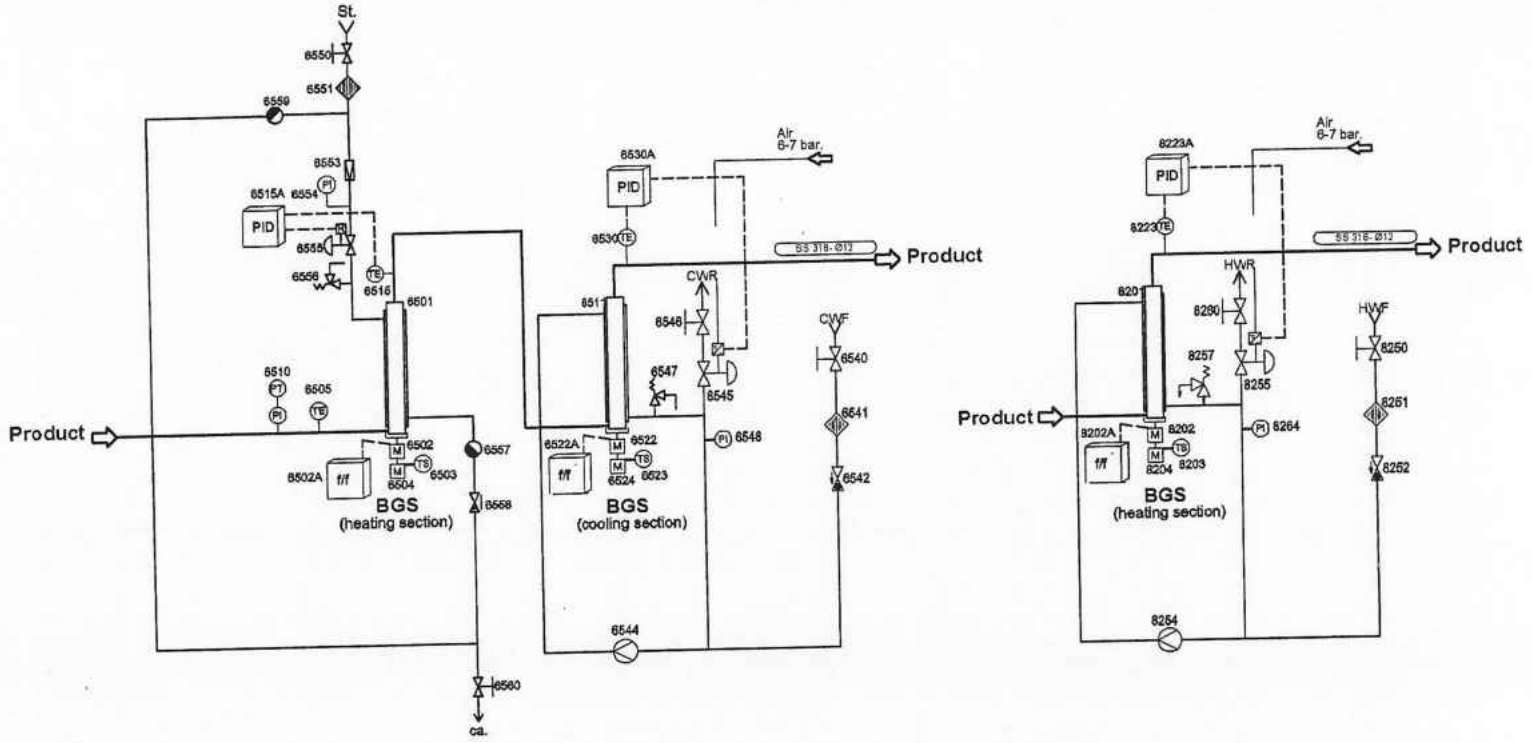

Plant no.:	Project no.:	End user:
X1	P2513	Unilever Bestfoods - U.S.A

GERSTENBERG & AGGER A/S
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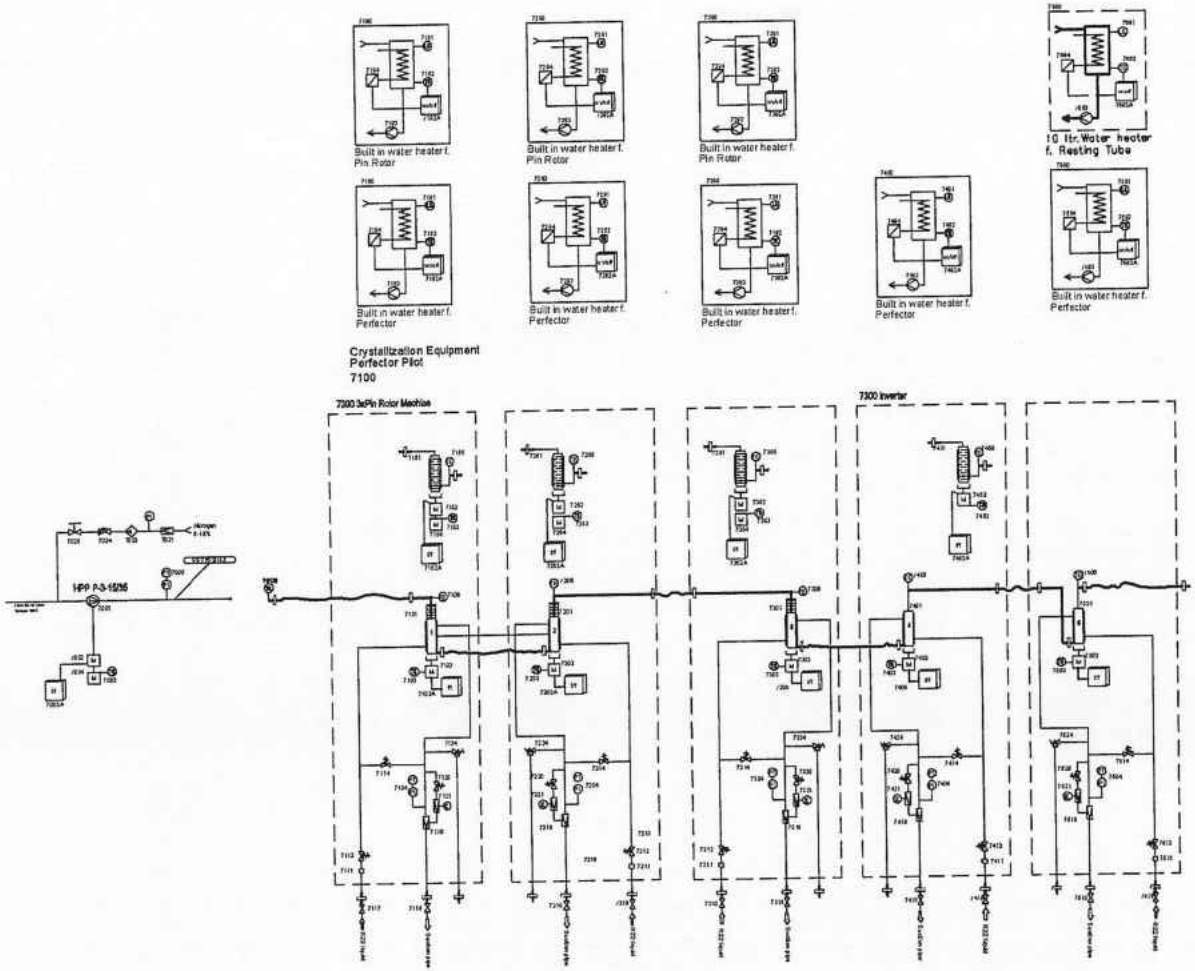
Målforhold		Dato	Sign.
1:2	Tegn.	15-01-04	ÓS
	Konf.		

P & I Diagram
Pilot Perfector
3x BGS

Denne tegning er kun gyldig i underskrevet stand.
This drawing is only valid when handsigned.
Any amendment must be confirmed by GERSTENBERG & AGGER A/S

42.093-110A

A3



WORK IN PROGRESS
PRINT Date: 25-03-04 ÓS
This drawing is currently being developed and is not complete. Consequently changes may occur prior to issuance.

Plant no.:	Project no.: P2513	End user: Unilever Bestfood U.S.A

GERSTENBERG & AGGER A/S

Date Revision		Design Date Int	24-03-04 ÓS

P&I Diagram:
Pilot Perfector

42.093-111A
A3

Regard DS.:
DS134 Color Code
DS/ISO 10628 layout

GERSTENBERG & AGGER A/S
COPENHAGEN

Module Pilot Perfector
Cooling system
Section view

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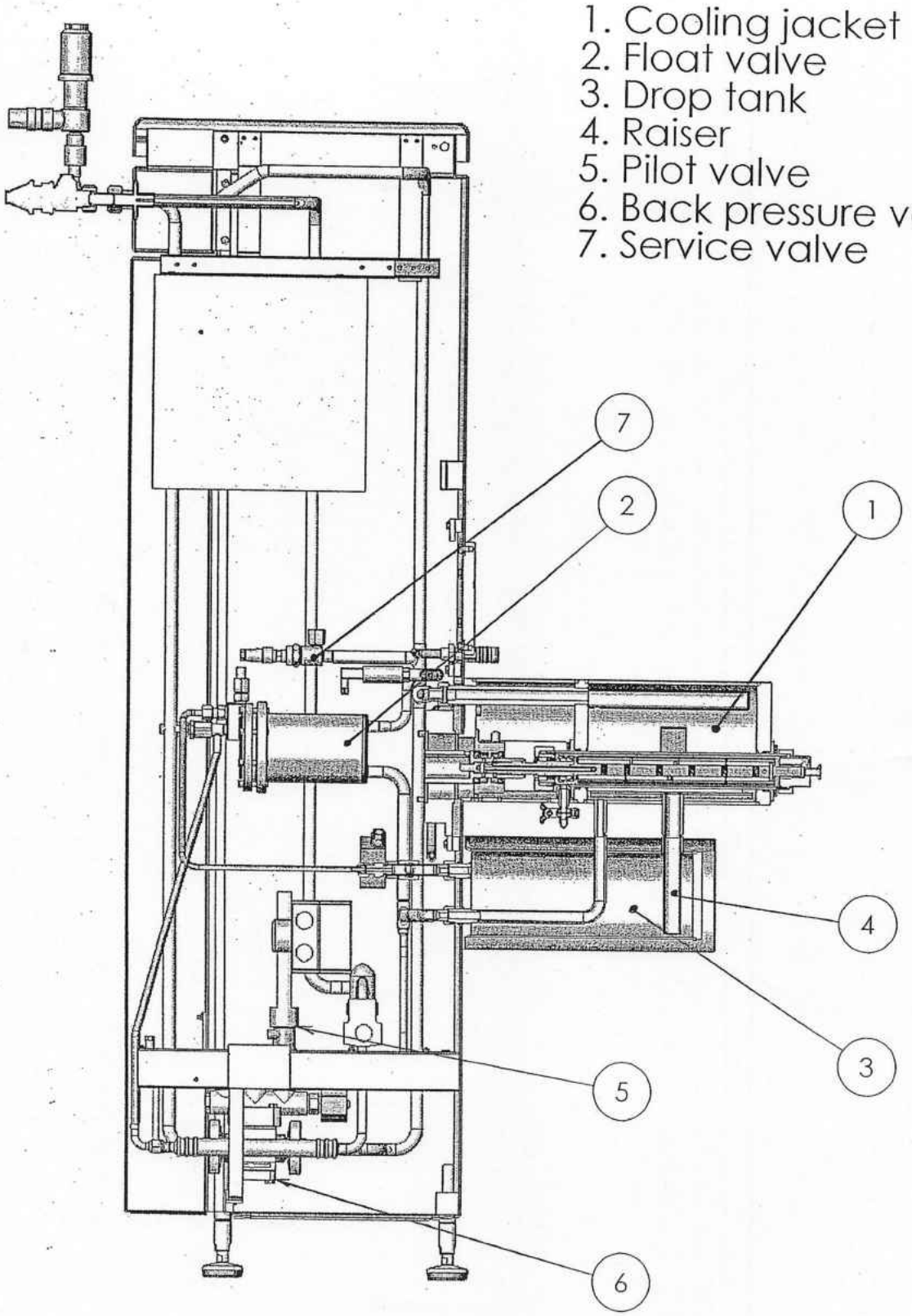
1. Cooling jacket
2. Float valve
3. Drop tank
4. Raiser
5. Pilot valve
6. Back pressure valve
7. Service valve



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COPENHAGEN

Module Pilot Perfector 57
Lifting

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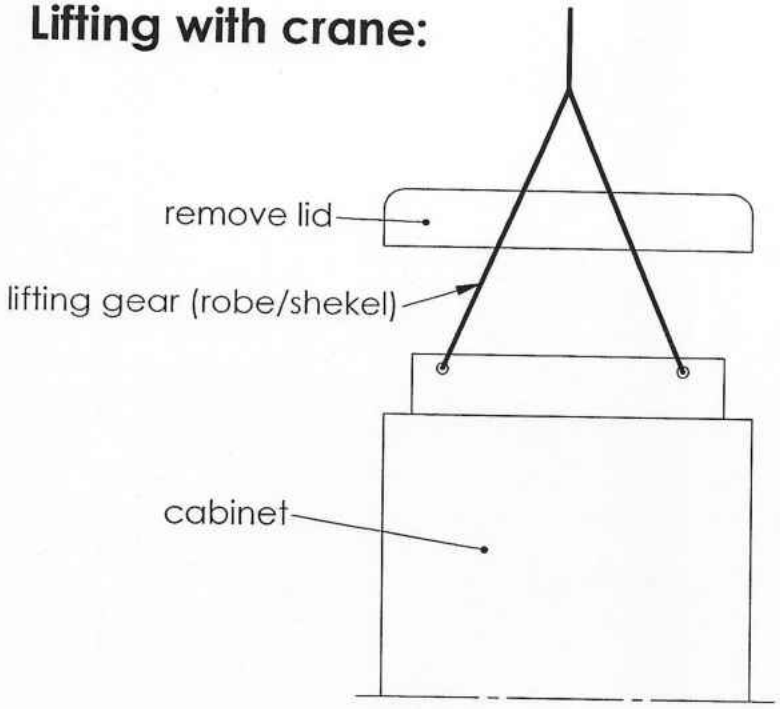
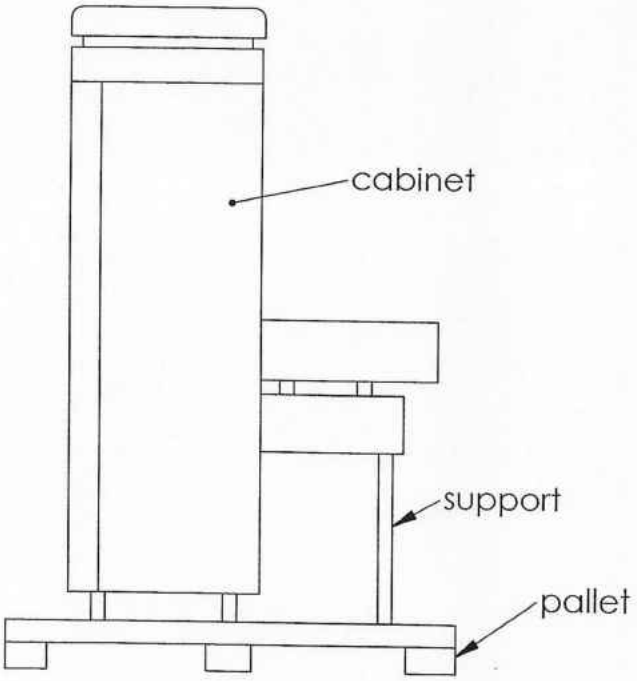
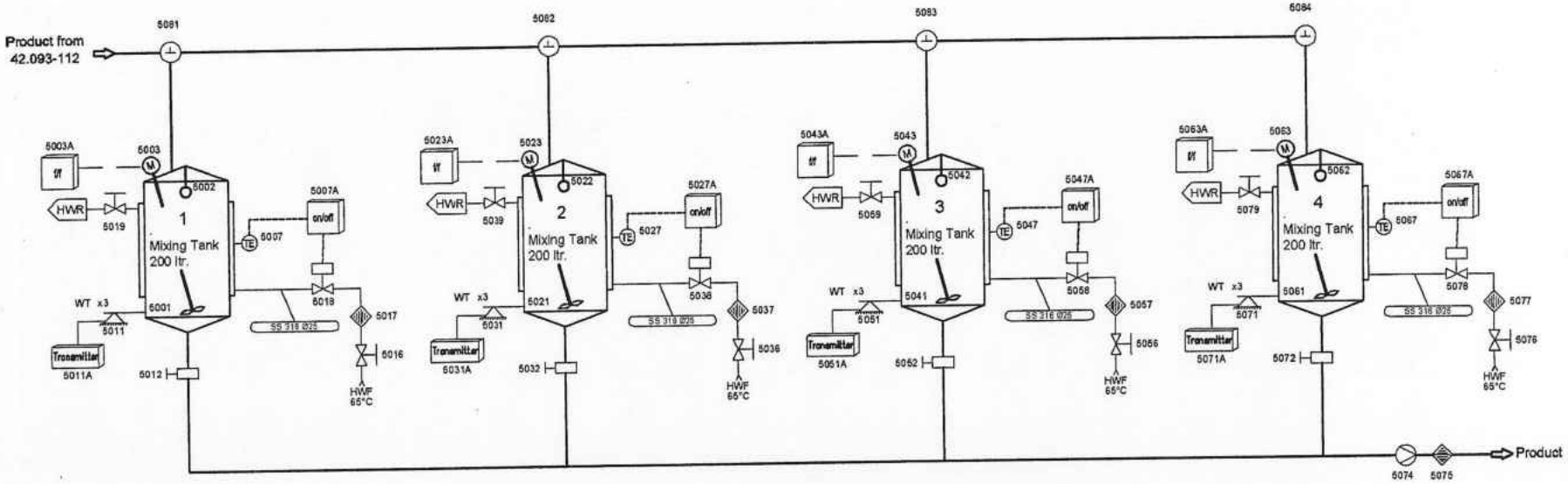
Lifting with crane:



Lifting with fork-lift:





WORK IN PROGRESS
PRINT Date: 20-01-04 ÓS
This drawing is currently being developed and is not complete. Consequently changes may occur prior to issuance.

Regard DS.:
DS134 Color Code
DS/ISO 10628 layout

Plant no.:	Project no.: 2513	End user: Unilever Bestfoods - U.S.A

GERSTENBERG & AGGER A/S

Date / Revision:

Design Date / Init.: 19-01-04 ÓS

4x200 ltr. Ingredients Mixing Tank

42.093-113

A3

Gerstenberg Schröder	Drawings and Spare Parts List for Perfector Type 1x57/R22	No. 2513.003
		Date/Drwn. 08.09.2004
		App. LLB/sja
		Page 1/1

Non – G&A Parts:

Danfoss TS
Danfoss HE 1.5
Danfoss CVPM
Danfoss AMV 425
Danfoss AMES
Danfoss PM 3-5
Danfoss AKS 33
Danfoss EVM NO
Danfoss EVM NC
Danfoss SV1, SV3

Level Switch 260-0695

Negele PT-100 Transmitter TFP 162
Negele PT-100 Transmitter TFP 160

Herl T5.FVA
Herl T21 VA DN12
Herl T37 VA DN12
Herl T37 VA S2. 1

ABB Motor 4.4 kW, 440-480V / 60Hz, 860 rpm
ABB Motor 6.4 kW, 440-480V/ 60 Hz, 1725 rpm
ABB Motor 3.5 kW, 440-480V / 60Hz, 870 rpm

Temperature Sensor TFP-160,-161,-162,-169

General Function

Temperature measurement with temperature sensors Pt100 operates on the basis of the change in resistance of platinum as a function of temperature fluctuations.
The electrical connection of these temperature sensors **TFP-160...169** is made by a 4-wire system by means of a M12 plug-in totally with stainless steel (high immunity to corrosion). As an optional alternative these temperature sensors can be connected to a 4-20mA current input by means of an integrated 2-wire input transducer **mpu** (2-wire current loop).
The temperature sensors **TFP-161** and **TFP-162** are furnished with food compatible metallic sealing systems. In conjunction with the accessory weld-in grommets **EMZ-132** or **EMK-25** respectively there will result a point of measurement without gaps and dead spaces (confirmed by EHEDG certificate).

TFP-160/050

TFP-161/050

TFP-169/101

Features

- sensor fabricated totally in stainless steel
- highly compact style
- hygienical build-in, **EHEDG**-certified
- variable with plug-in

Options

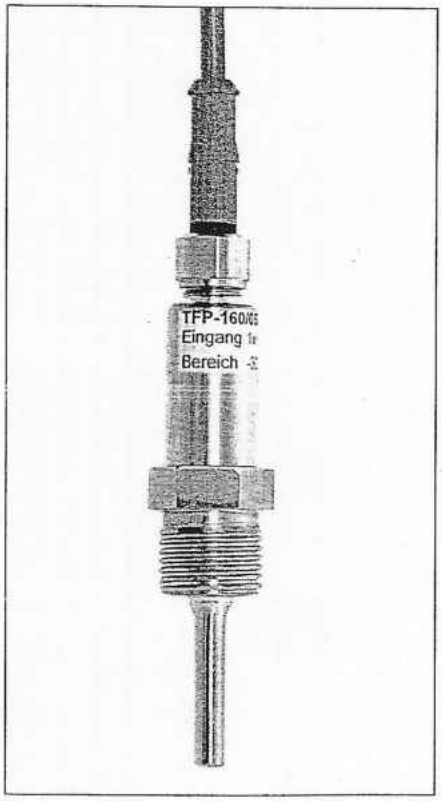
- 2-wire input transducer **mpu**
- fast sensor tip ø3mm or ø4mm
- other sensor lengths
- neck tube for high temperatures
- other sensor elements (e.g. Pt1000)
- other accuracy classes (e.g. 1/10DIN B)
- factory certificate, DKD normals based

Specification

Connector	M12 plug-in	4pin (1xPt100 4-wire, 2xPt100 2-wire)
Type of protection		IP67
Material	plug-in housing	stainless steel V2A 1.4305
	thread connection	stainless steel V4A 1.4571
	protection tube	SS V4A 1.4571 or 1.4435, ø6mm
Insertion lengths	**TFP-160, -161,-162**	50,150 and 250mm (...1000mm)
	TFP-169	100,150 and 250mm (...1000mm)
Installation	**TFP-160**	outer thread G1/2"
	TFP-161 without gaps	e.g. **EMZ-132** weld-in grommet ø30mm
	TFP-162 without gaps	e.g. **EMK-25** weld-in grommet ø25mm
	TFP-169 without gaps	e.g. **KEV-25/76** clamp screw ø25mm
Measurem. element	Pt100	class A accord. to DIN IEC 751
	tolerances class A	0°C: ±0,15K, 100°C: ±0,35K
Temperature range	plug-in / sensor tip	-50...+90°C / -50...+250°C (-30°C with mpu-m)
Operation pressure		10bar max

Option 2-Wire Input Transducer mpu-... (TFP-16./..1)

Measurement ranges	standard	-10...40°C, 0...100°C, 0...150°C
Output	2-wire loop	4-20mA corresponding to range
Supply voltage	2-wire loop	15...36V DC



*Temperature sensor **TFP-160/051** with integrated input transducer **mpu-m***

negele
INDUSTRIEELEKTRONIK
Negele Industrieelektronik GmbH & Co.KG • Raiffeisenweg 7 • D-87743 Egg a.d. Günz • Tel. +49/8333/9204-0 • Fax +49/8333/9204-49

Temperature Sensor and Build-In System

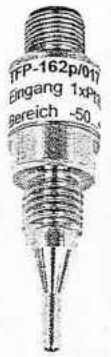
Application
- temperature measurement in pipes with small diameter
- perfectly for smart applications
- suitable for pipe diameters DN15... DN80

Application Examples
- process monitoring
- controlling of CIP- / SIP-process and the sterilisation
- temperature monitoring in hot steam- and pressure piping

Hygienic Design / Process Connection
- by using Negele build-in system EHG-... will result a measurement point which is hygienic and easy to sterilize (EHEDG, 3A-certificates)
- because of elastomere free sealing system, the connection will be without gaps and crevices
- CIP-/ SIP-cleaning up to 140°C
- food compatible materials according to FDA
- short mounting time with orbital-welder
- for all diameters DN15...80, pipe length acc. DIN/ISO
- Sensor completely made of stainless steel
- adapter available for all current process connections

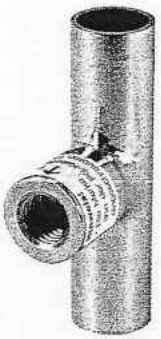
Features
- short reaction time, very compact measurement point
- elastomere free sealing system
- probe e-polished Ra<0,8µm (standard)
- available with and without integrated transmitter
- electrical connection by M12 plug-in

Options / Accessories
- ex factory cable for M12 plug-in
- transmitter for different ranges, output 4-20mA
- Pt100-Chip with other classes of accuracy, e.g. 1/3 DIN, 1/10 DIN
- external 2-wire indicator of stainless steel **doh-VA**
- material certificate according to EN 10204-3.1.B, e.g. **EHG-...**



TFP-162p/017

TFP-162p.m/017
with integrated transmitter ***mpu-m***



EHG-15/M12

Attention: Use only Negele weld-in systems, to ensure a safety function of the measurement point!

Specification

Process connection	hygienic	weld-in sleeves e.g. **EMK-25** or **EHG-15/M12**	Sensing resistor	according to ITS 90	1xPt100 class A
			Electrical connection	cable connection	M12 plug-in
	torque	5-10Nm (0,5-1kpm)			V2A (1.4305) 4pol.
Insertion length	standard	17mm	Type of protection		IP69K
Materials	head	stainless steel V2A (1.4305)	**Transmitter**		
			Temperature ranges	standard	-10...+40, 0...100°C, 0...150°C
	probe tube	V4A (1.4404)	Accuracy		<±0,2% of full scale
Temperature ranges	ambient	-50...+80°C	Temperature drift	zero, span	<0,02% of full scale
	sensor tip	-50...+200°C	Electrical connection	supply	12...36VDC
Operating pressure		max. 16bar	Output	analog	4-20mA

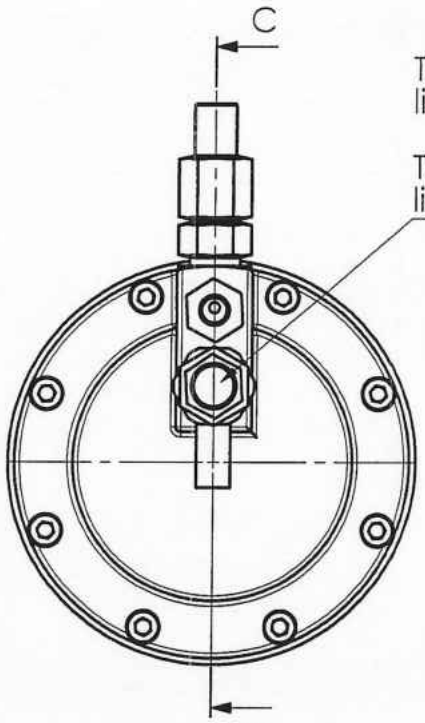
Order Code

Temperature sensor	Insertion length [mm]	Transducer	Ranges	
TFP-162p	017 special length up to 040 max., 6mm dia.	without* .m with transmitter	-10...+40°C 0...100°C, 0...150°C	*standard, no declaration neccessary.

Order example: **TFP-162p / 017 .m / 0...150°C**

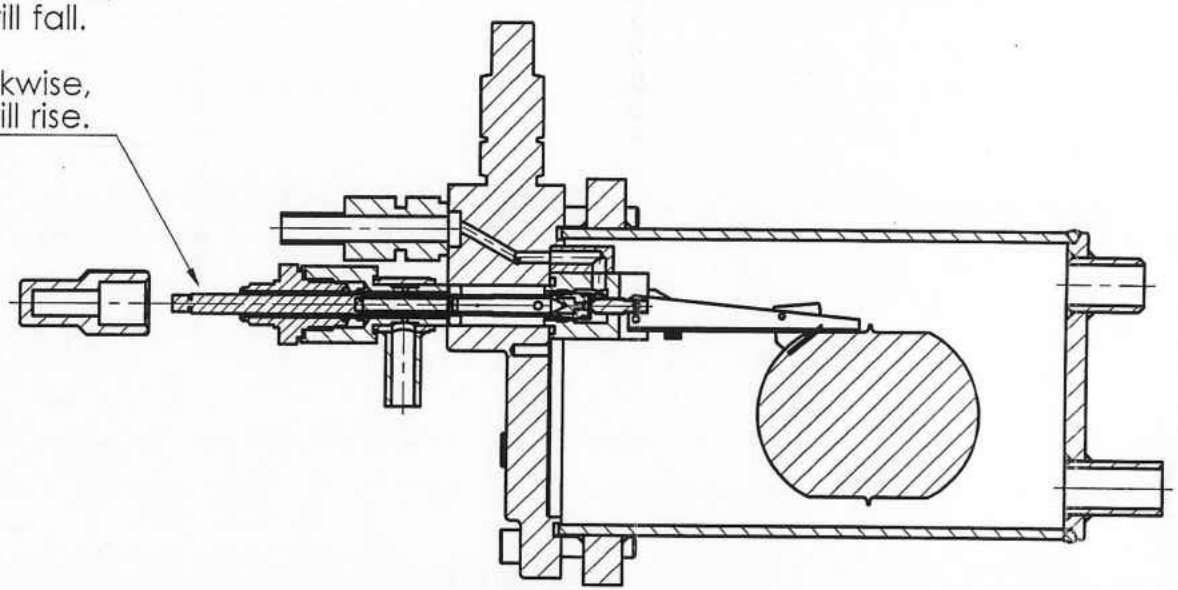
Negele Industrieelektronik GmbH & Co.KG • Raiffeisenweg 7 • D-87743 Egg a.d. Günz • Tel. +49(0)8333/9204-0 • Fax +49(0)8333/9204-49

negele MESSTECHNIK

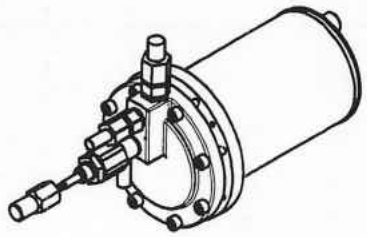


Then turn clockwise,
liquid level will fall.

Turn anticlockwise,
liquid level will rise.



C-C



GERSTENBERG & AGGER A/S
COPENHAGEN
22. VIBEHOLMSVEJ - DK-2605 BRØNDBY - DANMARK
TELEFON: 43277000 - TELEFAX: 43277003
E-mail: headoffice@gerstenbergs.com

Vægt/kg: 5,358		Dato	Sign.
Målforhold 1:2	Tegn.	30-06-04	CM
	Konf.		

Modul Pilot Perfector
Level regulator
for cooling liquid

Denne tegning er kun gyldig i underskrevet stand.
This drawing is only valid when handsigned.

Any amendment must be confirmed by GERSTENBERG & AGGER A/S

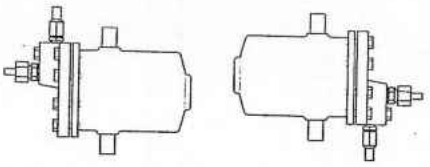
Rev.

41.636-005

A3

INSTRUCTIONS

SV



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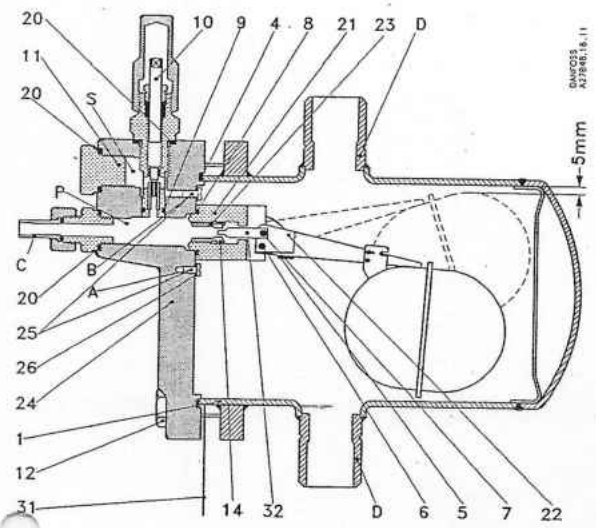

Fig. 1. SV(L)

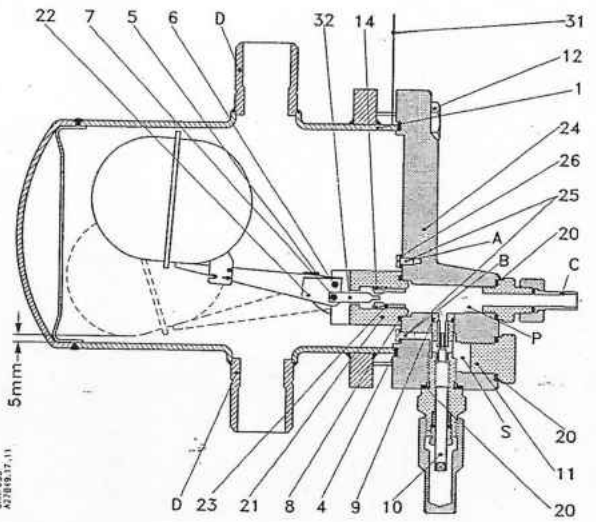

Fig. 4. SV(H)

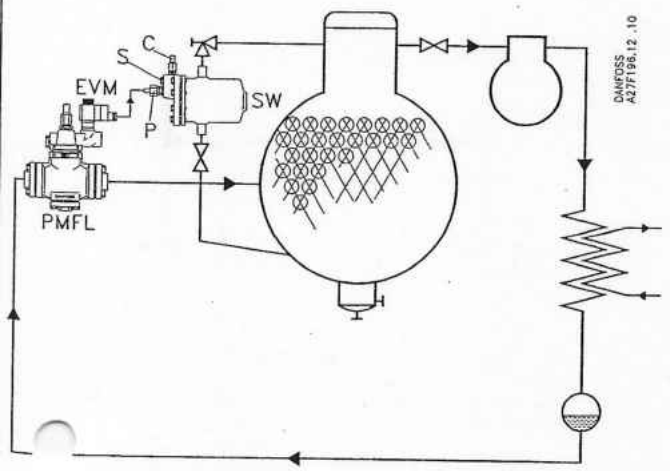

Fig. 2

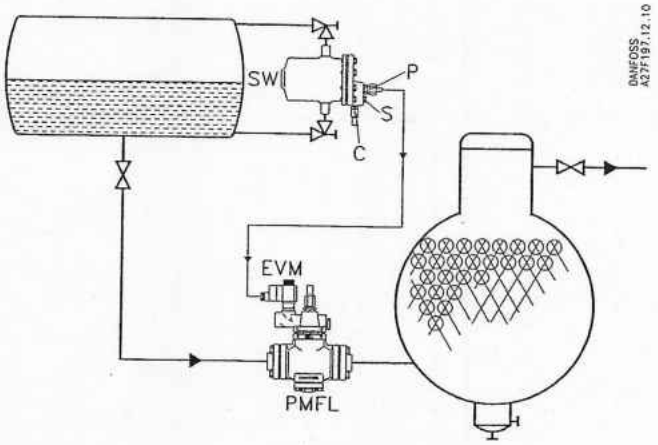

Fig. 5

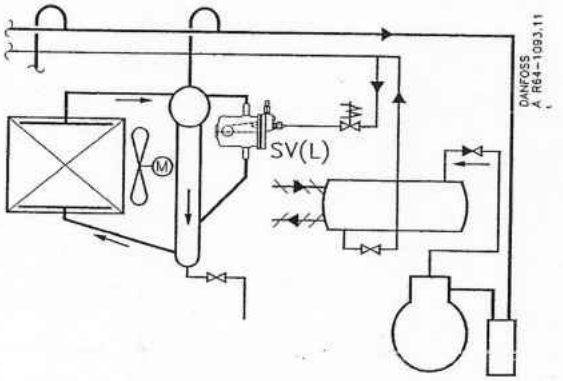

Fig. 3

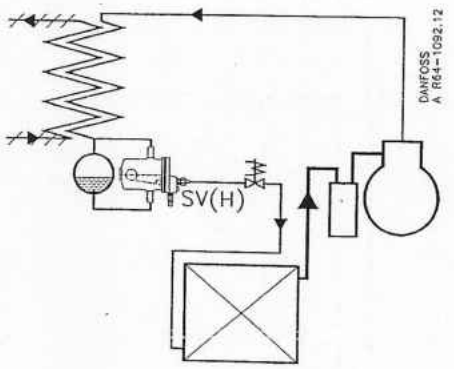

Fig. 6

[redacted]

Lavtryks- og højtryksvømmer

Tekniske data
Kølemidler: R 12, R 22, R 502 etc. samt R 717 (NH_3)
Fordampningstemperaturområde: –60°C til +65°C
Maks. driftstryk: p_e = 22 bar = 2200 kPa
Maks. prøvningstryk: p_e = 33 bar = 3300 kPa
k_v værdi for SV 1: 0.066 m³/h = 1.1 l/min
k_v værdi for SV 3:1.380 m³/h = 2.3 l/min

Konstruktion
1. Dæksel
2. Svømmerhus
3. Væsketilslutning
4. Sugedamptilslutning
5. Pilottilslutning (svejse: best.nr. 027B2034 flare: best.nr. 027B2033)
6. Svømmer
7. Vippearm
8. Dysenål
9. O-ring
10. Svømmerdyse
11. Manuel reguleringsenhed, drøvleventil (best.nr. 027B2039)
12. Bypass dyse, reguleringsdyse
13. O-ring (best.nr. 633B1057)
14. Skrue
15. Prop
16. Pakning (best.nr. 633L9155)
17. Dækselpakning (best.nr. 633L9226)
18. Skilt
19. O-ring
P. Paralleltilslutning af pos. 5 (skruen 14 i pos. A)
S. Serietilslutning af pos. 5 (skruen 14 i pos. B)

Samlet indsats (svømmerenhed + O-ring), for SV 1, best.nr. *027B2051*
Samlet indsats (svømmerenhed + O-ring), for SV 3, best.nr. *027B2053*
Tilbehørspose med dyse, dysenål, O-ring og svømmeraksler
for SV 1, best.nr. *027B2055*
for SV 3, best.nr. *027B2056*

Montering
Lavtrykssvømmer SV (fig. 1, 2 og 3)
Når SV skal anvendes som lavtrykssvømmer, monteres den med sin længdeakse vandret i højde med det ønskede væskeniveau (fig. 2).

Den manuelle reguleringsenhed 11 skal pege lodret opad. Sugedamptilslutningen 4 skal pege lodret opad.

Lavtrykssvømmeren tilsluttes fordamperen med en væskeledning 3 og en sugedampledning 4. Svømmeren 6 er ved leveringen transportsikret med en fjeder, som skal fjernes inden monteringen. Se skiltet 18.

Højtrykssvømmer SV (fig. 4, 5 og 6)
Når SV skal anvendes som højtrykssvømmer, monteres den med sin længdeakse vandret i højde med det ønskede væskeniveau (fig. 5).

Den manuelle reguleringsenhed 11 skal pege lodret nedad. Sugedamptilslutningen 4 skal pege lodret opad.

Højtrykssvømmeren tilsluttes kondensatoren/receiveren eller et lodret, rigeligt dimensioneret stykke af væskeledningen fra kondensatoren med en væskeledning 3 og en sugedampledning 4.

Svømmeren 6 er ved leveringen transportsikret med en fjeder, som skal fjernes inden monteringen. Se skiltet 18.

Lavtryks- eller højtrykssvømmeren forbindes til hovedventilen (PMFL eller PMFH) med en pilotledning, der må være maks. 3 m lang og uden væskelommer. Den indvendige diameter skal være mellem 6 og 10 mm.

Når SV(L) bruges som selvstændig ekspansionsventil (fig. 3), forbindes væsketilgangsledningen til niplen 5.
For at undgå falsk niveau, skal trykfaldet i sugedamptilslutningen være så lille som muligt.
På SV(L)1 anvendes 1 in. rør som sugedamp tilslutning.
På SV(L) 3 anvendes 1½ in. rør som sugedamptilslutning.

Når SV(H) bruges som selvstændig ekspansionsventil (fig. 6), forbindes væskeafgangsledningen til niplen 5.
Typeskiltet sidder »retvendt« på dækslet, når SV monteres med lavtryksfunktion. Skiltet er placeret således på dækslet, at overkanten angiver dækslets midte.

Pilottilslutning
Dækslet 1 er forsynet med en manuel reguleringsenhed 11 og har to muligheder, P og S, for pilottilslutning 5.
Når pilottilslutningen er anbragt i position P, går pilotstrømmen parallelt igennem bypass dysen 12 og svømmerdysen 10. Samtidig bibeholdes skruen 14 i position A, så bypass hullet B er åbent.

Når pilottilslutningen er anbragt i position S, går, pilotstrømmen i serie gennem den manuelle reguleringsenhed 11 og svømmerdysen 10. Samtidig skal skruen 14 placeres i position B.

I instruktion RI.02.F1 for PMFL vises pilottilslutningen på SV for lavtrykssvømmer systemet.

I instruktion KI.13.H1 for PMFH vises pilottilslutningen på SV for højtrykssvømmer systemet.

Indstilling og service
Pilottilslutningen er ved leveringen monteret i position P.
Når SV anvendes som pilot svømmerventil i lavtrykssystemet: PMFL + SV - eller i højtryksystemet: PMFH + SV, foretages indstillingen således som angivet i disse instruktioner.

P-montering for SV som selvstændig ventil
Ved lukket svømmerventil har SV en minimumkapacitet, der svarer til åbningsgraden af drøvleventilen 11.

S-montering for SV som selvstændig ventil
Drøvleventilen 11 fungerer på SV(L) som fordyse og på SV(H) som efterdyse med kapaciteter, der svarer til drøvleventilens åbningsgrad.
Ved lukket drøvleventil er væsketilgangen på SV(L) og væskeafgangen på SV(H) afspærret.

ENGLISH

Low pressure and high pressure float valves

Technical data
Refrigerants: R 12, R 22, R 502 etc. and R 717 (NH_3)
Evaporating temperature range:
–60°C to +65°C (–76°F to +41°F)
Max. test pressure: p_e = 22 bar = 2200 kPa (313 psig)
Max. test pressure: p_e = 33 bar = 3300 kPa (469 psig)
k_v value for SV 1: 0.066 m³/h = 1.1 l/min
(C_v factor for SV 1: 0.064 UK gal/min)
k_v value for SV 3:1.380 m³/h = 2.3 l/min

Design
1. Cover
2. Float
3. Liquid connection
4. Vapour connection
5. Pilot connection (weld: code No. 027B2034 flare: code No. 027B2033)
6. Float
7. Rocker arm
8. Orifice needle
9. O-ring
10. Float orifice
11. Manual regulating unit, throttle valve (code No. 027B2039)
12. Bypass orifice, regulating orifice
13. O-ring (code No. 633B1057)
14. Screw
15. Plug
16. Gasket (code No. 633L9155)
17. Cover gasket (code No. 633L9228)
18. Label
19. O-ring
P. Parallel connection of item 5 (screw 14 in pos. A)
S. Series connection of item 5 (screw 14 in pos. B)

Complete insert (float unit + O-ring), for SV 1, code No. *027B2051*
Complete insert (float unit + O-ring), for SV 3, code No. *027B2053*
Accessory bag with orifice, orifice needle, O- ring and float shafts
for SV 1, code No. *027B2055*
for SV 3, code No. *027B2056*

Fitting
Low pressure float valve SV (figs. 1, 2 and 3)
When SV is to be used as a low pressure float valve it must be fitted with its longitudinal axis horizontal at the same height as the liquid level required (fig. 2).

Manual regulating unit 11 must point vertically upwards. The vapour connection 4 must point vertically upwards.

The low pressure float valve is connected to the evaporator through a liquid line 3 and a vapour line 4.

When delivered, the float 6 is made secure for transport by a spring which must be removed prior to fitting. See label 18.

High pressure float valve SV (figs. 4, 5 and 6)
When SV is to be used as a high pressure float valve it must be fitted with its longitudinal axis horizontal at the same height as the liquid level required (fig. 5).
Manual regulating unit 11 must point vertically downwards. The vapour connection 4 must point vertically upwards.

The high pressure float is connected to the condenser/receiver or a vertical adequately dimensioned section of the liquid line from the condenser via a liquid line 3 and a vapour line 4.

When delivered, the float 6 is made secure for transport by a spring which must be removed prior to installation. See label 18.

The low pressure or high pressure float valve is connected to the main valve (PMFL or PMFH) with a pilot line not more than 3 m in length, without "pockets", and with an inside diameter of between 6 and 10 mm.

When an SV(L) is used as a separate expansion valve (fig. 3), the liquid inlet line is connected to nipple 5.
To avoid false level, the pressure drop in the suction vapour connection must be as small as possible.

On SV(L) 1, 1 in. tubes are used as suction vapour connection.
On SV(L) 3, 1½ in. tubes are used as suction vapour connection.

When an SV(H) is used as a separate expansion valve (fig. 6), the liquid outlet line is connected to nipple 5.

The type label is positioned on the cover the right way up for an SV fitted for low pressure function. The label is so placed on the cover that its top edge indicates the centre of the cover.

Pilot connection
The cover 1 is fitted with a manual regulating unit 11. There are two possibilities, P and S, for the pilot connection 5.

When the pilot connection is fitted in position P, the pilot flow travels in parallel through the bypass orifice 12 and float orifice 10. The screw 14 is kept in position A so that the bypass hole B is open:

When the pilot connection is fitted in position S, the pilot flow travels in series through the manual regulating unit 11 and float orifice 10. The screw 14 is then placed in position B.

Instruction RI.02.F1 for PMFL shows the pilot connection on SV for the low pressure float system.

Instruction KI.13.H1 for PMFH shows the pilot connection on SV for the high pressure float system.

Setting and service
On delivery, the pilot connection is fitted in position P.

When SV is used as a pilot float valve in the low pressure system: PMFL + SV, or in the high pressure system: PMFH + SV. Make the setting as described in these instructions.

P-mounting for SV as separate valve
With the float valve closed the SV has a minimum capacity corresponding to the degree of opening of the throttle valve 11.

S-mounting for SV as separate valve
On SV(L) the throttle valve 11 functions as a pre-orifice and on SV(H) as a post-orifice, corresponding to the degree of opening of the throttle valve.
With the throttle valve closed, the liquid inlet on SV(L) and liquid outlet on SV(H) are shut off.

DEUTSCH

Niederdruck- und Hochdruckschwimmer

Technische Daten
Kältemittel: R 12, R 22, R 502 usw. sowie R 717 (NH_3)
Verdampfungstemperaturbereich:
–60°C bis +65°C
Max. Betriebsdruck: p_e = 22 bar = 2200 kPa
Max. Prüfdruck: p_e = 33 bar = 3300 kPa
k_v-Wert für SV 1: 0.066 m³/h = 1,1 l/min
k_v-Wert für SV 3: 1.380 m³/h = 2,3 l/min

Konstruktion
1. Deckel
2. Schwimmergehäuse
3. Flüssigkeitsanschluss
4. Saugdampfanschluss
5. Pilotanschluss (Schweiss-: Bestell-Nr. 027B2034 Bördel-: Bestell-Nr. 027B2033)
6. Schwimmer
7. Kipphebel
8. Düsennadel
9. O-ring
10. Schwimmerdüse
11. Manuelle Regeleinheit, Drosselventil (Bestell-Nr. 027B2039)
12. Bypass-Düse, Regeldüse
13. O-Ring (Bestell-Nr. 633B1057)
14. Schraube
15. Stopfen
16. Dichtung (Bestell-Nr. 633L9155)
17. Deckeldichtung (Bestell-Nr. 633L9228)
18. Schild
19. O-Ring
P. Parallelanschluss von Pos. 5 (Schraube 14 in Pos. A)
S. Serieanschluss von Pos. 5 (Schraube 14 in Pos. B)

Kompletter Einsatz (Schwimmereinheit + O- Ring), für SV 1 Bestell-Nr. *027B2051*
Kompletter Einsatz (Schwimmereinheit + O- Ring), für SV 3 Bestell-Nr. *027B2053*
Zubehörbeutel mit Düse, Düsennadel, O-Ring und Schwimmerwellen:
Für SV 1, Bestell-Nr. *027B2055*
Für SV 3, Bestell-Nr. *027B2056*

Montage
Niederdruckschwimmer SV (Fig. 1, 2 und 3)
Wenn SV als Niederdruckschwimmer verwendet werden soll, ist dieser mit waagerechter Längsachse in Höhe des gewünschten Flüssigkeitstands zu montieren (Fig. 2).
Die manuelle Regeleinheit 11 muss senkrecht nach oben zeigen. Der Saugdampfanschluss 4 muss senkrecht nach oben zeigen.
Der Niederdruckschwimmer ist mit einer Flüssigkeitsleitung 3 und einer Saugdampfleitung 4 an den Verdampfer anzuschliessen. Der Schwimmer 6 ist bei Lieferung transportgesichert mit einer Feder, die vor der Montage entfernt werden muss. Siehe Schild 18.

Hochdruckschwimmer SV (Fig. 4, 5 und 6)
Wenn SV als Hochdruckschwimmer verwendet werden soll, ist dieser mit waagerechter Längsachse in Höhe des gewünschten Flüssigkeitsstands zu montieren (Fig. 5).
Die manuelle Regeleinheit 11 muss senkrecht nach unten zeigen. Der Saugdampfanschluss 4 muss senkrecht nach oben zeigen.
Der Hochdruckschwimmer ist an den Verflüsiger/Sammler oder an ein senkrechtes reichlich bemessenes Stück der Flüssigkeits leitung vom Verflüssiger mit einer Flüssigkeitsleitung 3 oder einer Saugdampfleitung 4 anzuschliessen.
Der Schwimmer 6 ist bei Lieferung transportgesichert mit einer Feder, die vor der Montage zu entfernen ist. Siehe Schild 18.
Der Niederdruck- oder Hochdruckschwimmer ist mit einer Pilotleitung an das Hauptventil (PMFL oder PMFH) anzuschliessen. Die Pilotleitung darf höchstens 3 m lang sein und keine Flüssigkeitssäcke enthalten; der innendurchmesser muss zwischen 6 und 10 mm betragen.

Wenn SV(L) als selbständiges Expansionsventil eingesetzt wird (Fig. 3), ist die Flüssigkeitseintrittsleitung an den Nippel 5 anzuschliessen.
Um ein falsches Niveau zu vermeiden, muss der Druckabfall im Saugdampfanschluss möglichst klein gehalten werden.
Für SV(L) 1 verwendet man als Saugdampfanschluss Rohre 1 in.
Für SV(L) 3 verwendet man als Saugdampfanschluss Rohre 1½ in.
Wenn SV(H) als selbständiges Expansionsventil eingesetzt wird (Fig. 6), ist die Flüssigkeitsaustrittsleitung an den Nippel 5 anzuschliessen.

Das Typenschild ist in korrekter Leserichtung auf dem Deckel angebracht, wenn Typ SV für Niederdruckfunktion montiert ist. Das Schild ist so auf dem Deckel angebracht, dass die Oberkante die Deckelmitte angibt.

Pilotanschluss
Der Deckel 1 ist mit einer manuellen [redacted]einheit 11 versehen und hat zwei Mögl[redacted]ten für Pilotanschluss 5: P und S.

Wenn der Pilotanschluss in Position P angebracht ist, fliesst der Pilotstrom parallel durch die Bypass-Düse 12 und die Schwimmerdüse 10. Gleichzeitig verbleibt die Schraube 14 in Position A, so dass das Bypass-Loch B offen ist.

Wenn der Pilotanschluss in Position S angebracht ist, fliesst der Pilotstrom in Serie durch die manuelle Regeleinheit 11 und die Schwimmerregeldüse 10. Gleichzeitig muss die Schraube 14 in Position B angebracht werden.

In der Instruktion RI.02.F1 für PMFL ist der Pilotanschluss an SV für das Niederdruck-Schwimmersystem gezeigt.

In der Instruktion KI.13.H1 für PMFH ist der Pilotanschluss an SV für das Hochdruck-Schwimmersystem gezeigt.

Einstellung und Service
Der Pilotanschluss ist bei Lieferung in Position P montiert.

Wenn SV als Pilotschwimmerventil im Niederdrucksystem, PMFL + SV – oder im Hochdrucksystem, PMFH + SV – verwendet wird ist die Einstellung so vorzunehmen, wie in diesen Instruktionen angegeben ist.

P-Montage für SV als selbständiges Ventil
Bei geschlossenem Schwimmerventil hat SV eine Mindestleistung, die dem Öffnungsgrad des Drosselventils 11 entspricht.

S-Montage für SV als selbständiges Ventil
Das Drosselventil 11 wirkt am SV(L) als Vordüse und am SV(H) als Nachdüse mit Leistungen, die dem Öffnungsgrad des Drosselventils entsprechen.

Bei geschlossenem Drosselventil sind der Flüssigkeitseintritt am SV(L) und der Flüssigkeitsaustritt am SV(H) abgesperrt.

FRANCAIS

Flotteur basse pression et haute pression

Caractéristiques techniques

Fluides frigorigènes: R 12, R 22, R 502 etc. et R 717 (NH_3)

Gamme de températures d'évaporation: −60°C à +65°C

Pression de service max.: p_s = 22 bar = 2200 kPa

Pression d'essai max.: p_e = 33 bar = 3300 kPa

Valeur k_v pour SV 1: 0,066 m³/h = 1,1 l/min

Valeur k_v pour SV 3:1,380 m³/h = 2,3 l/min

Construction

1. Couvercle
2. Boîtier de flotteur
3. Raccord de liquide
4. Raccord de vapeur d'aspiration
5. Raccord pilote
   (à souder: no de code 027B2034
   à flare: n° de code 027B2033)
6. Flotteur
7. Bras basculant
8. Pointeau d'orifice
9. Bague torique
10. Orifice de flotteur
11. Unité de régulation manuelle, vanne d'étranglement (n° de code 027B2039)
12. Orifice de dérivation, orifice de régulation
13. Bague torique (n° de code 633B1057)
14. Vis
15. Bouchon
16. Joint (no de code 633L9155)
17. Joint de couvercle (no de code 633L9228)
18. Plaque signalétique
19. Bague torique

P. Raccordement en parallèle de la réf. 5 (vis 14 en pos. A)

S. Raccordement en série de la réf. 5 (vis 14 en pos. B)

Cartouche de vanne (ensemble flotteur + joint torique) pour SV 1: N° de code *027B2051*
Cartouche de vanne (ensemble flotteur + joint torique) pour SV 3: N° de code *027B2053*. Sachet à accessoires contenant orifice et pointeau d'orifice, joint torique et arbres pour flotteur,
pour SV 1: N° de code *027B2055*
pour SV 3: N° de code *027B2056*

Montage

Flotteur basse pression SV (fig. 1, 2 et 3)
Quand le SV est utilisé comme flotteur basse pression, le monter avec son axe longitudinal place horizontalement à la hauteur du niveau de liquide désiré (fig. 2).

Orienter l'unité de régulation manuelle 11 verticalement vers le haut.
Le raccord de vapeur d'aspiration 4 doit pointer verticalement vers le haut.

Le flotteur basse pression est raccordé à l'évaporateur par une conduite de liquide 3 et une conduite d'aspiration 4.
A la livraison, le flotteur 6 est bloqué pour le transport à l'aide d'un ressort qui doit être enlevé avant le montage. Voir la plaque 18.

Flotteur haute pression SV (fig. 4, 5 et 6)
Si le SV doit servir de flotteur haute pression, il doit être monté son axe longitudinal placé horizontalement à la hauteur du niveau de liquide désiré (fig. 5).

Orienter l'unité de régulation manuelle 11 verticalement vers le bas.
Le raccord de vapeur d'aspiration 4 doit pointer verticalement vers le haut.

Le flotteur haute pression est à raccorder au condenseur/à la bouteille accumulatrice ou à une partie verticale et largement dimensionnée de la conduite de liquide venant du condenseur au moyen d'une conduite de liquide 3 et d'une conduite de vapeur d'aspiration 4.

A la livraison, le flotteur 6 est bloqué pour le transport à l'aide d'un ressort qui doit être enlevé avant le montage. Voir la plaque 18.

Le flotteur basse ou haute pression est raccordé à la vanne principale (PMFL ou PMFH) par une conduite pilote qui doit être au maximum de 3 m de longueur et sans «poche», le diamètre intérieur doit se situer entre 6 et 10 mm.

Quand SV(L) est utilisé comme détendeur indépendant (fig. 3), relier la conduite d'amenée de liquide au raccord 5.
Pour éviter un faux niveau, la chute de pression dans la conduite des vapeurs d'aspiration doit être aussi faible que possible:
Pour SV(L) 1, utiliser un tube de 1 in. comme conduite de vapeurs d'aspiration.
Pour SV(L) 3, utiliser un tube de 1½ in. comme conduite de vapeurs d'aspiration.
Quand le SV(H) est utilisé comme détendeur indépendant (fig. 6), relier la conduite de sortie de liquide au raccord 5.

A la livraison, la plaque de type est placée «à l'endroit» sur le couvercle quand le type SV est monté pour la fonction basse pression. La plaque est placée sur le couvercle de telle manière que le bord supérieur indique le milieu du couvercle.

Raccord pilote

Le couvercle 1 est muni d'une unité manuelle de régulation 11 et offre deux possibilités – P et S – pour le raccord pilote 5.

Quand le raccord pilote est placé en position P, le courant pilote passe en parallèle sur l'orifice de dérivation 12 et l'orifice 10 du flotteur. En même temps, la vis 14 est maintenue en position A de sorte que le trou de dérivation B soit ouvert.

Quand le raccord pilote est placé en position S, le courant pilote passe en série à travers l'unité manuelle de régulation 11 et l'orifice de régulation 12 du flotteur. En même temps, la vis 14 doit être placée en position B.

Pour le raccordement du pilote sur SV pour le système à flotteur basse pression, se reporter à l'instruction RI.02.F1 concernant PMFL.

Pour le raccordement du pilote sur SV pour le système à flotteur haute pression, se reporter à l'instruction KI.13.H1 concernant PMFH.

Réglage et entretien

A la livraison, le raccord pilote est monté en position P.

Quand SV est utilisé comme vanne pilote à flotteur dans le système basse pression PMFL + SV (ou dans le système haute pression PMFH + SV), procéder au réglage comme indiqué dans les instructions respectives.

Montage P du SV comme détendeur indépendant
Avec le flotteur à l'état fermé, la capacité minimale du SV correspond au degré d'ouverture de l'étranglement 11.

Montage S du SV comme détendeur indépendant
L'étranglement 11 fait fonction d'orifice amont pour SV(L) et d'orifice aval pour SV(H) et ce avec des capacités correspondant au degré d'ouverture de l'étranglement.
Lorsque l'étranglement est fermé, l'entrée de liquide sur VS(L) et la sortie de liquide sur VS(H) sont bloquées.

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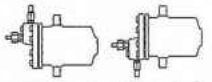
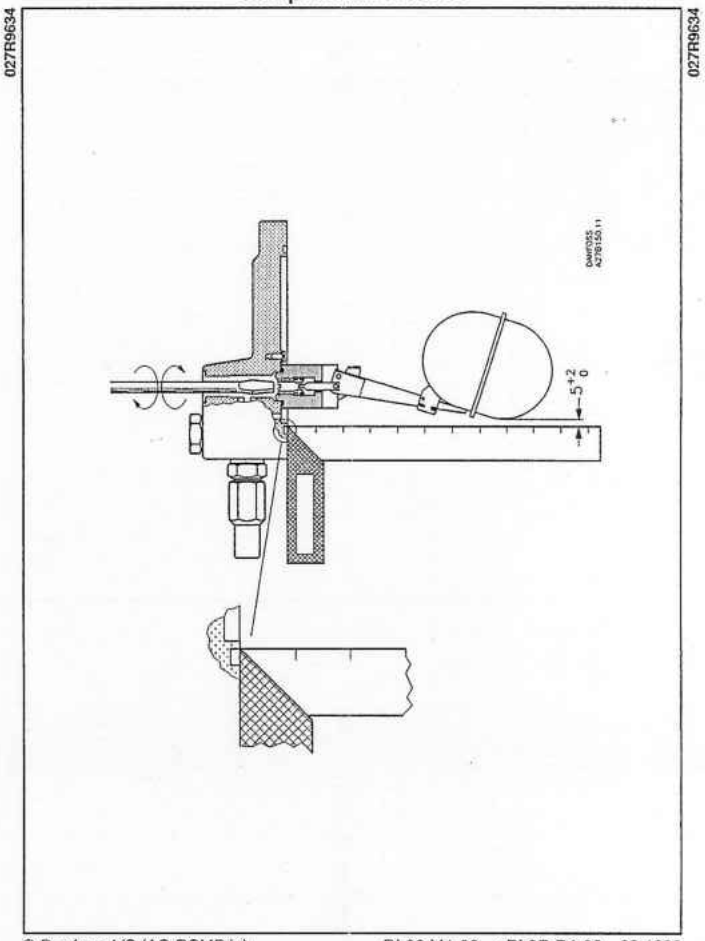
INSTRUCTIONS



SV
Complete float insert

027R9634



027R9634

~~RI.02.M1.00~~ → **RI.2B.D1.00** 03-1999

INSTRUCTIONS

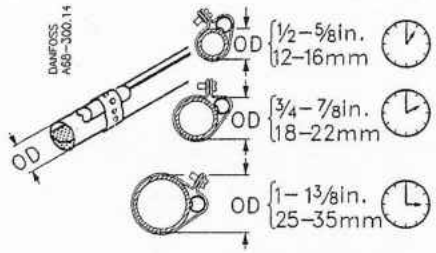
T 2/ TE 2, flare × flare

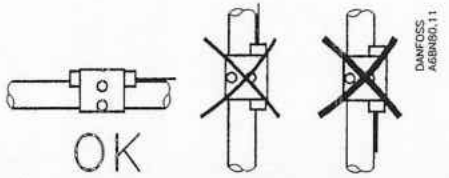
N-B

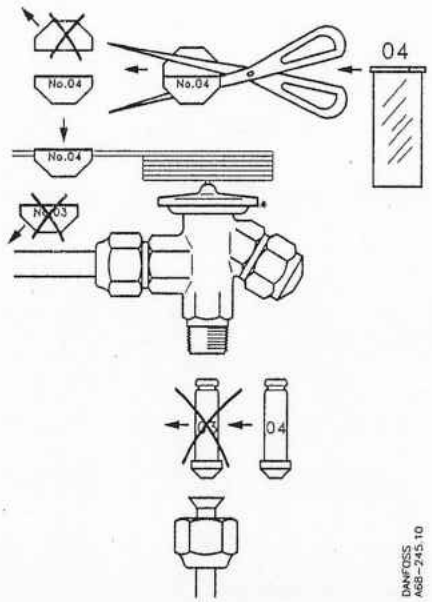
068R9706

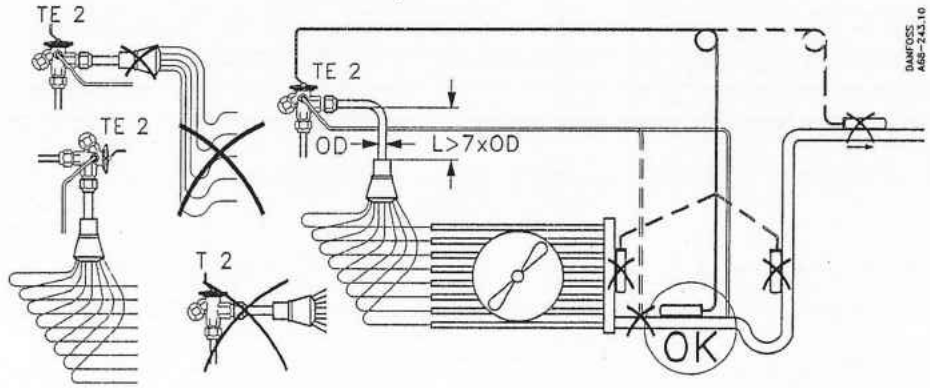
PB = 28 bar (405 psig)

p_{test} = max. 36 bar (520 psig)









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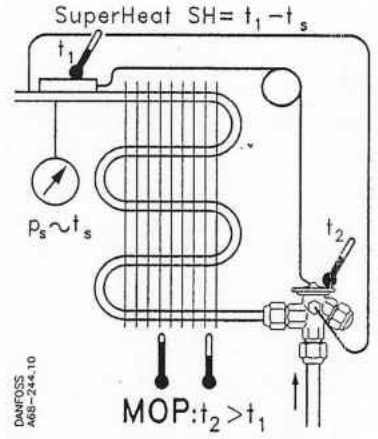
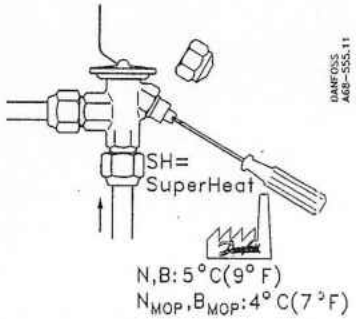
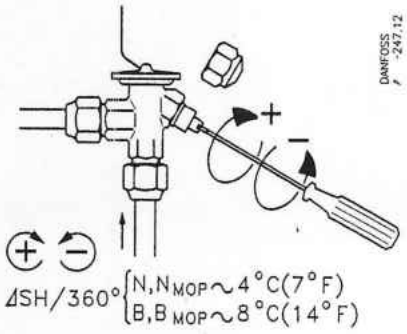
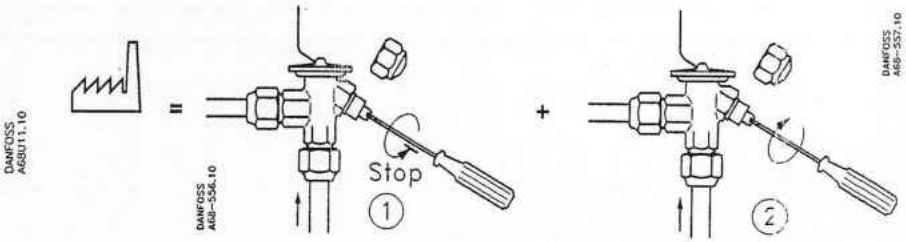
RI.1A.E3.00 01-1999

068R9706







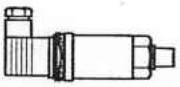
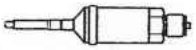
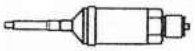
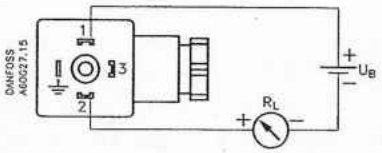
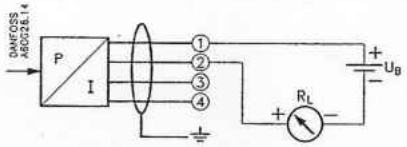
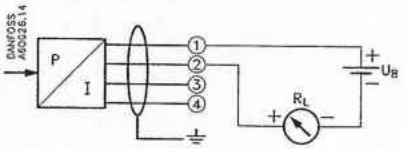
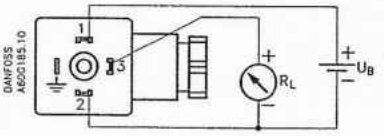
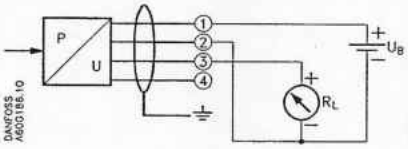
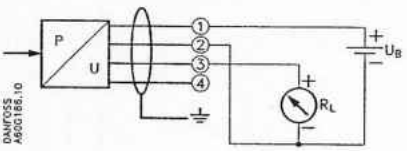
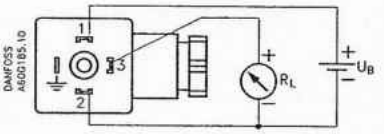
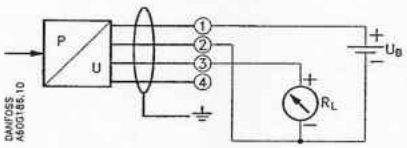
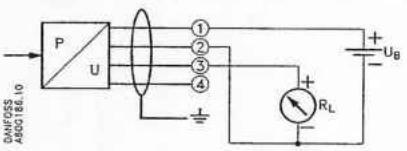


INSTRUCTIONS

Pressure Transmitters type AKS 32, AKS 32R, AKS 33, AKS 2050, AKS 3000

060R9512

060R9512

		SI - units (bar)	US - units (psig)
			
4 - 20 mA **AKS 33, AKS 3000, AKS 3050**		 ① Brun Brown Braun Brun ② Sort Black Schwarz Noir ③ Rød Red Rot Rouge ④ Orange Orange Orange Orange	 ① Rød Red Rot Rouge ② Sort Black Schwarz Noir ③ Hvid White Weiss Blanc ④ Grøn Green Grün Vert
1 - 5V, 1 - 6V, 0 - 10V **AKS 32**		 ① Rød Red Rot Rouge ② Sort Black Schwarz Noir ③ Brun Brown Braun Brun ④ Orange Orange Orange Orange	 ① Rød Red Rot Rouge ② Sort Black Schwarz Noir ③ Hvid White Weiss Blanc ④ Grøn Green Grün Vert
10 - 90% **AKS 32R, AKS 2050**		 ① Rød Red Rot Rouge ② Sort Black Schwarz Noir ③ Brun Brown Braun Brun ④ Orange Orange Orange Orange	 ① Rød Red Rot Rouge ② Sort Black Schwarz Noir ③ Hvid White Weiss Blanc ④ Grøn Green Grün Vert
⏚	Forbundet til kapsling Connected to enclosure Mit Gehäuse verbunden Laison au boîtier	Skærm: Ikke forbundet til kapsling Screen: Not connected to enclosure Schirm: Nicht mit Gehäuse verbunden Blindage: Isolé du boîtier	Skærm: Ikke forbundet til kapsling Screen: Not connected to enclosure Schirm: Nicht mit Gehäuse verbunden Blindage: Isolé du boîtier

NB!
Kabelfarver kan variere iht. specifikation
Cable colours may vary acc. to specs.
Kabelfarben können je nach Spez. variieren
Couleurs des câbles selon spécification

Forsyningsspænding / Supply voltage / Versorgungsspannung / Tension d'alimentation [UB]

Udgangssignal / Output signal Ausgangssignal / Signal de sortie	AKS 32	AKS 32R, 2050	AKS 33, 3000, 3050
4 - 20 mA			10 - 30 V d.c.
10 - 90%		nom. 5V d.c.	
1 - 5V	8 - 30V d.c.		
1 - 6V	9 - 30V d.c.		
0 - 10V	15 - 30V d.c.		

Europæisk godkendelse iht. / **European** approval according to /
Europäische Zulassung gemäß / Homologation **européenne** selon le plan CE

Australsk godkendelse iht. / **Australian** approval according to /
Australische Zulassung gemäß / Homologation **australienne** selon le plan N1297

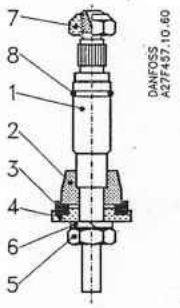


Fig. 1. Push rod assembly for PM 1 and 3, sizes 5 to 25

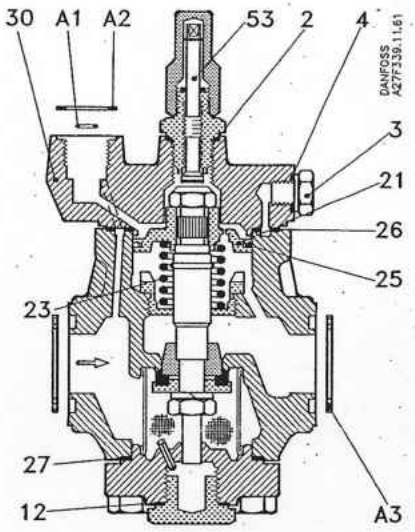


Fig. 2. PM 1, sizes 5 to 25

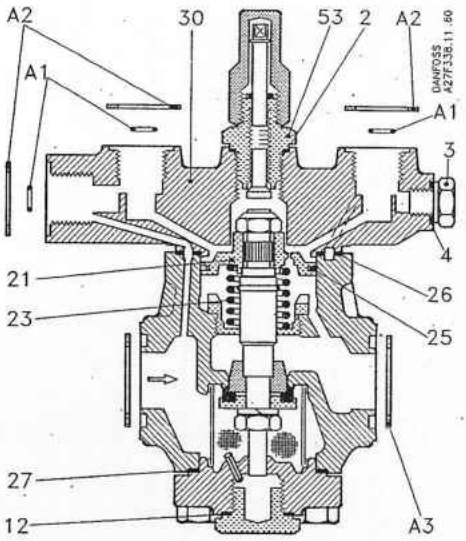


Fig. 3. PM 3, sizes 5 to 25

Description	Qty	Size 5 Code no.	Size 10 Code no.	Size 15 Code no.	Size 20 Code no.	Size 25 Code no.
Push rod assembly, fig 1		027F0160	027F0161	027F0162	027F0260	027F0261
Pos. 1 Push rod	1					
2 Cone	1					
3 Valve plate	1					
4 Clamping plate	1					
5 Nut	1					
6 Spring washer	1					
7 Nut	1					
8 Locking ring	1					
Valve plate, fig. 1		027F0683	027F0683	027F0683	027F0683	027F0683
Pos. 3 Valve plate	1					
Piston ring, figs. 2 and 3		027F0650	027F0650	027F0650	027F0650	027F0650
Pos. 25 Piston ring	1					
Piston assembly, figs. 2 and 3		027F0395	027F0395	027F0395	027F0395	027F0395
Pos. 21 Piston	1					
25 Piston ring	1					
Servo spring, figs. 2 and 3		027F0901	027F0901	027F0901	027F0901	027F0901
Pos. 23 Spring	1					
Strainer, figs. 2 and 3		027F0657	027F0657	027F0657	027F0657	027F0657
Pos. 24 Strainer	1					
Top cover, PM 1, fig. 2		027F0640	027F0640	027F0640	027F0640	027F0640
Pos. 2 Alu gasket	1					
3 Plug	1					
4 Alu gasket	1					
26 Gasket	1					
30 Top cover	1					
53 Manual operation	1					

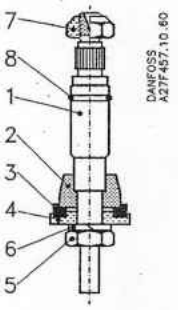


Fig. 1. Push rod assembly for PM 1 and 3, sizes 5 to 25

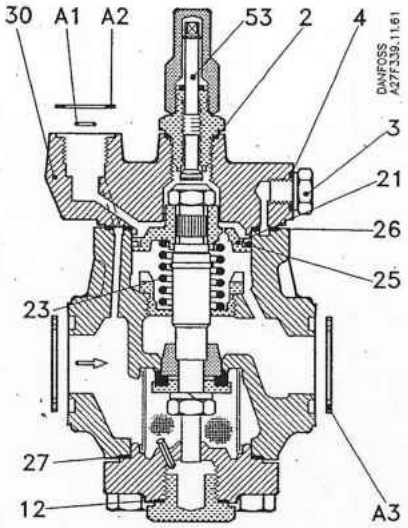


Fig. 2. PM 1, sizes 5 to 25

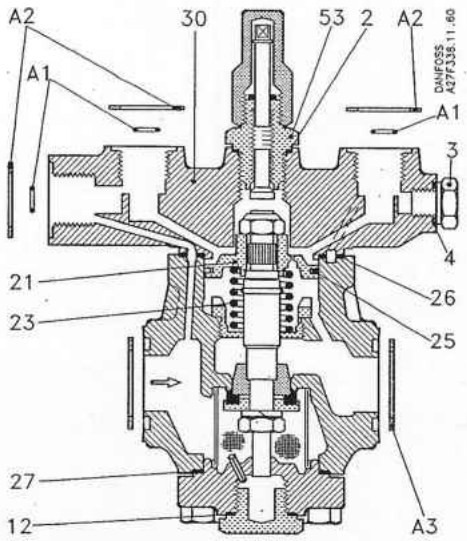
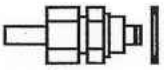
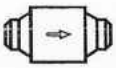
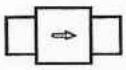


Fig. 3. PM 3, sizes 5 to 25

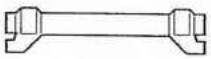
Description	Qty	Size 5 Code no.	Size 10 Code no.	Size 15 Code no.	Size 20 Code no.	Size 25 Code no.
Top cover, PM 3, fig. 3		027F0645	027F0645	027F0645	027F0645	027F0645
Pos. 2 Alu gasket	1					
3 Plug	1					
4 Alu gasket	1					
26 Gasket	1					
30 Top cover	1					
53 Manual operation	1					
Manual operation, figs. 2 and 3		027F2130	027F2130	027F2130	027F2130	027F2130
Pos. 2 Alu gasket	1					
53 Manual operation	1					
Seal kit, figs. 2 and 3		027F2170	027F2170	027F2170	027F2170	027F2170
Pos. 26 Gasket	1					
27 Gasket	1					
Seal kit, figs. 2 and 3		027F0086	027F0086	027F0086	027F0086	027F0086
Pos. 2 Alu gasket	1					
4 Alu gasket	1					
12 Gasket	1					
26 Gasket	1					
27 Gasket	1					
A1 O-ring	3					
A2 Gasket	3					
A3 Gasket	2					
Flange gaskets, figs. 2 and 3		027F2175	027F2175	027F2175	027F2175	027F2175
Pos. A3 Gasket	2					

Accessories for PMC

	Description	Qty	Code no.
	**External pilot connector**		
	Weld, PM 5 to 65, ID 12.7 mm / OD 18 mm		027F1048
	Weld, PM 80 to 125, ID 12.7 mm / OD 18 mm		027F1049
	1/4 NPT, PM 5 to 65		027B2065
	1/4 NPT, PM 80 to 125		027B2066
	Nipple assembly	1	
	Damping orifice, dia. 1.0 mm	1	
	O-ring	1	
	Gasket	1	
	**Seal kit** for external pilot connector		027F1004
	Alu gasket	4	
	Gasket	4	
	O-ring	4	
	**Blanking plug**		027F1046
	Plug	1	
	Stop plug	1	
	O-ring	1	
	Gasket	1	
	**Pressure gauge connector**, solder/weld		027B2035
	Nipple assembly	1	
	Alu gasket	1	
	**Seal kit** for solder/weld pressure gauge connector		027B2029
	Alu gasket	10	
	Alu gasket	10	
	**Pressure gauge connector**		
	cutting ring connector (Ermeto)		
	6 mm	1	027B2063
	10 mm	1	027B2064
	**Pressure gauge connector**, 1/4 NPT	1	027B2062
	**Pressure gauge connector**, flare		027B2041
	(Must not be used in ammonia systems!)		
	Nipple	1	
	Schraeder valve	1	
	Cap	1	
	Alu gasket	1	
	**Function indicator**		
	for PM/PMC 1 and 3, sizes 5 to 65		027F0085
	Function indicator assembly	1	
	Protection cap	1	
	Gasket	1	
	CVH pilot valve body		
	weld ID 12.7 mm / OD 18 mm	1	027F1047
	CVH pilot valve body		
	G 1/4 (ISO 228-1)	1	027F1160
	CVH pilot valve body		
	G 1/4 (USAS B2.1-1960)	1	027F1159
	**„Strong" spring**	1	027F0662
	for PM 1 and 3, sizes 5 to 25, approx. 45% more closing force		

INSTRUCTIONS

HE



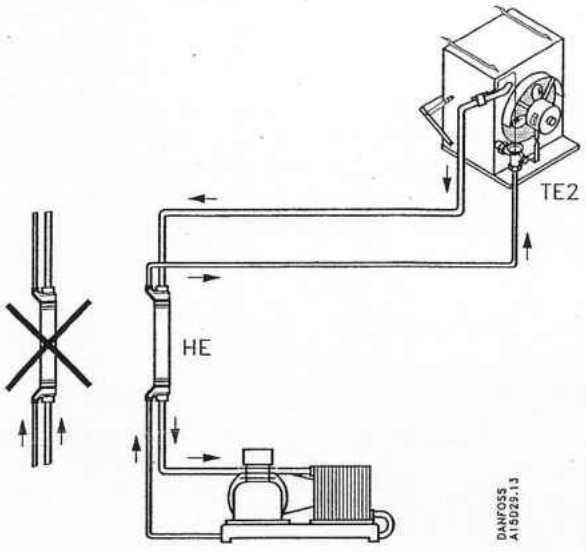


Fig. 1

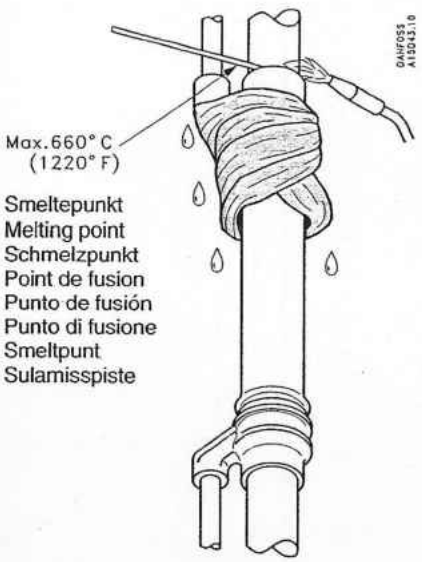


Fig. 2

015R9711

DANSK

eveksler, type HE 0.5-8, kan anvendes på
g med fluorerede kølemidler.

hovedformål på køleanlæg er:
udnytte sugegassens kuldekapacitet til
derkøling af kølemiddelvæsken.
muliggøre en bedre udnyttelse af fordam-
overfladen, idet en mindre overhedning på
spansionsventilen kan tillades.
forhindre tilrimning og kondensering af vand
sugeledning gennem en overhedning af
gegassen.
sikre en fordampning af de små væskedråber
ugegassen, så kompressorens effektivitet
øges.
monteres da som vist i fig. 1.
eudvekslerenkan også anvendes som
ekondensator for en luftkølet kondensator i
de af overbelastning og monteres
ykrøret.

ering
n monteres vilkårligt. Dog skal de to medier
øbe i modstrøm.
n fra en termostatisk ekspansionsventil
astgøres til sugeledningen før varme-
sleren.

g skal foretages efter omvikling med våd

midler: max. smeltepunkt 660°C
till. tryk: 28 bar

ENGLISH

The heat exchanger type HE 0.5-8 can be fitted on plants using fluorinated refrigerants.

When installed on refrigerating plants, the main object of the heat exchanger is
- to utilize the refrigeration capacity of the suction gas to subcool the refrigerant liquid.
- to allow improved utilization of the evaporator surface, since a lower superheat is permissible at the expansion valve.
- to prevent frosting-up and condensation of water on the suction line by superheating the suction gas.
- to ensure evaporation of any small liquid drops held in the suction gas, resulting in increased compressor efficiency.
  In this case, HE is fitted as shown in fig. 1.

To act as an auxiliary condenser for an aircooled condenser in the case of overloading. In this case HE is fitted in the delivery pipe.

Fitting
Type HE can be fitted in any position. The two media must, however, **always** be in counterflow. The bulb of a thermostatic expansion valve must be fixed to the suction line ahead of the heat exchanger.

Soldering to be done only after winding with a wet cloth.

Solders: max. melting point 660°C (1220°F)
Maximum permissible pressure:
28 bar (400 psig)

DEUTSCH

Die Wärmeaustauscher Typ HE 0.5-8 können an Anlagen mit fluorierten Kältemitteln verwendet werden.

An Kälteanlagen verwendet dienen sie hauptsächlich:
- zur besseren Ausnützung der Kälteleistung des Sauggases zum Unterkühlen der Kältemittelflüssigkeit
- zur besseren Ausnützung der Verdampferoberfläche, da eine kleine Uberhitzung am Expansionsventil statthaft ist
- um Bereifen und Kondensieren von Wasser an der Saugleitung, durch Überhitzen des Sauggases zu verhindern
- um Verdampfen der kleinen Flüssigkeitstropfen im Sauggas sicherzustellen, so dass die Nutzwirkung des Kompressors gesteigert wird.

HE ist dann so zu montieren, wie in Abb. 1 dargestellt.

Die Wärmeaustauscher können auch als Hilfsverflüssiger für einen ventilatorbelüfteten Verflüssiger im Falle von Überlastung verwendet werden und ist dann im Druckrohr zu montieren.

Montage
HE kann beliebig montiert werden, doch müssen die beiden Medien **immer** in Gegenstrom laufen. Der Fühler eines thermostatischen Expansionsventils ist vor dem Wärmeaustauscher an der Saugleitung zu befestigen.

Vor dem Einlöten muß die Lötstelle mit einem nassen Lappen umwickelt werden.

Lötmittel: max. Schmelzpunkt 660°C
Max. zul. Druck: 28 bar

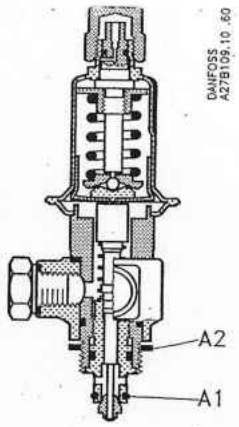


Fig.1
CVC, pressure controlled; with signal connector

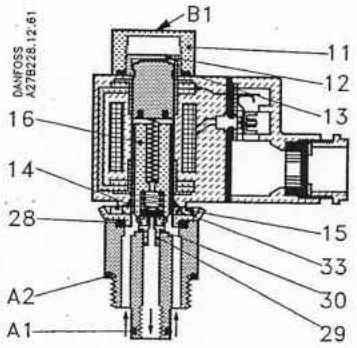


Fig.2
EVM(NC) with flange connection of armature tube, previous design

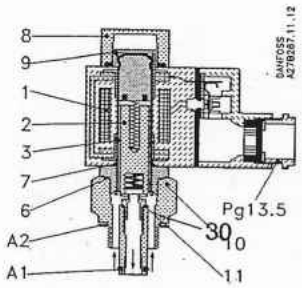


Fig.3
EVM(NC) with plug-in connection of armature tube

Description	Qty	Code no.
CVC		
Seal kit, fig. 1		027F0666
Pos. A1 O-ring	1	
A2 Gasket	1	
EVM(NC), previous design		
Service kit, fig. 2		032F0201
Pos. 11 Nut	1	
12 Snap fastener	1	
13 O-ring	1	
14 O-ring	1	
15 Screw	4	
16 NC armature assembly, teflon	1	
28 Rubber gasket	1	
29 Orifice	1	
30 Alu gasket	1	
A1 O-ring	1	
A2 Gasket	1	
EVM(NC)		
Service kit, fig. 3		032F1116
Pos. 11 Nut	1	
12 Snap fastener	1	
13 O-ring	1	
14 O-ring	1	
15 Alu gasket	1	
16 Armature assembly, teflon	1	
29 Orifice	1	
30 Alu gasket	1	
A1 O-ring	1	
A2 Gasket	1	
EVM(NC)		
Seal kit, fig. 1 and 2		018Z0093
Pos. 11 Nut	1	
12 Snap fastener	1	
13 O-ring	1	
14 O-ring	1	
B1 Label	1	
EVM(NC)fig. 1 and 2		
Seal kit		032F0209
Pos. 13 O-ring	1	
14 O-ring	1	
28 Rubber gasket	1	
30 Alu gasket	1	
A1 O-ring	1	
A2 Gasket	1	
EVM(NC) fig. 1 and 2		
Seal kit		027F0666
Pos. A1 O-ring	1	
A2 Gasket	1	

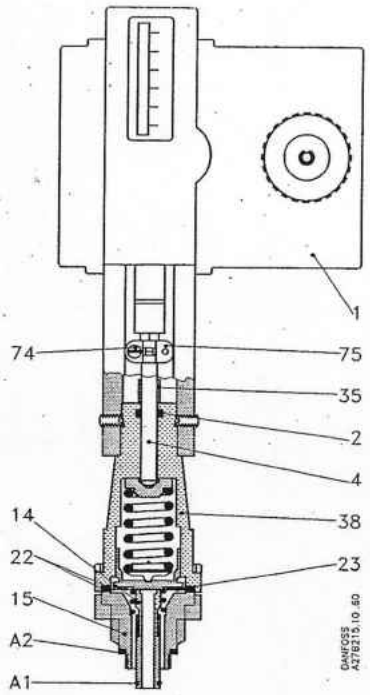


Fig. 1. CVPM

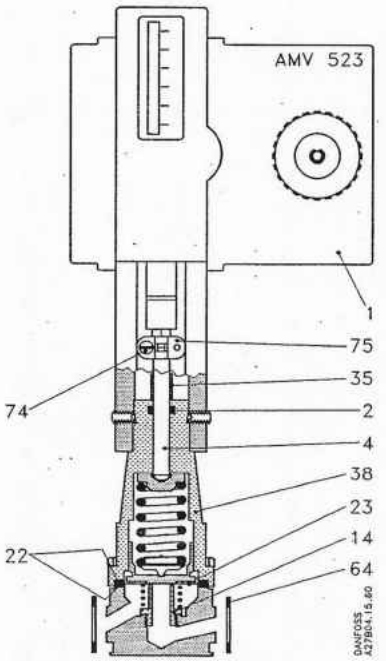


Fig. 2. CVMM

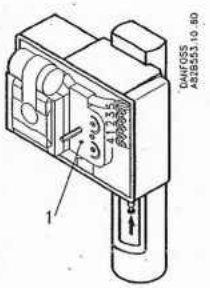


Fig. 3. Motor with AMEK module

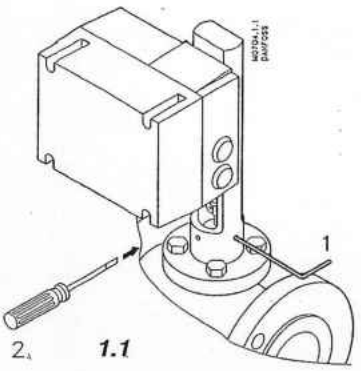
Description	Qty	Code no.
CVPM		
motor pilot valve		
Seal kit, fig. 1		027F0666
Pos. A1 O-ring	1	
A2 Gasket	1	
Repair kit, fig. 1		027B2059
Pos. 2 O-ring	1	
4 Spindle	1	
35 Safety bush	1	
74 Screw	2	
75 Coupling	2	
Repair kit, fig. 1		027B0164
Pos. 14 Orifice	1	
15 Body	1	
22 Gasket	2	
23 Diaphragm	2	
Pilot valve, fig. 1		027B1170
Pos. 38 CVPM pilot valve assy without motor	1	
230 V motor, fig. 1		082B3517
Pos. 1 AMV 523 motor		
1		
24 V motor, fig. 1,		082B3515
Pos. 1 AMV 523 motor		
1		
AMEK module, fig. 3		082B3301
Pos. 1 AMEK module	1	
CVMM		
motor pilot valve		
Repair kit, fig. 2		027B2059
Pos. 2 O-ring	1	
4 Spindle	1	
35 Safety bush	1	
74 Screw	2	
75 Coupling	2	
Repair kit, fig. 2		027B0162
Pos. 14 Orifice	1	
22 Gasket	2	
23 Diaphragm	2	
Pilot valve, fig. 2		027B1037
Pos. 38 CVMM pilot valve assy without motor	1	
230 V motor, fig. 2		082B3517
Pos. 1 AMV 523 motor	1	
24 V motor, fig. 2,		082B3515
Pos. 1 AMV 523 motor	1	
Flange gaskets, fig. 2		020-2133
Pos. 64 Gasket	2	
AMEK module, fig. 3		082B3301
Pos. 1 AMEK module	1	

Instructions

AMES 230/240 V (082B3329)
AMES 24 V (082B3328)

082R9069

082R9069



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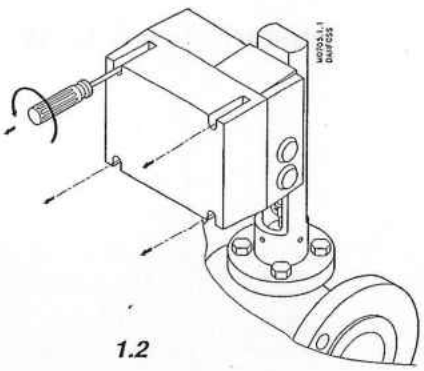

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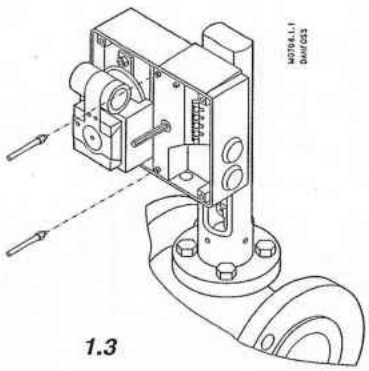

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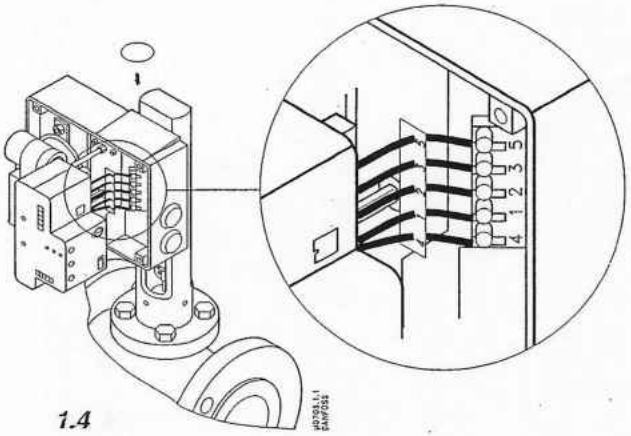

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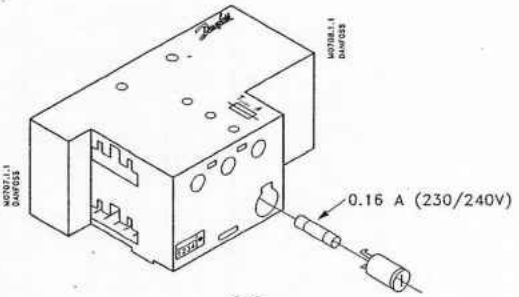

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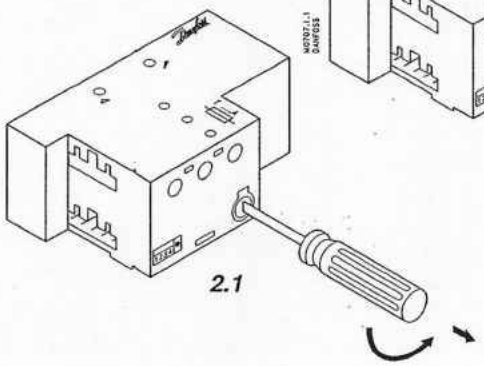
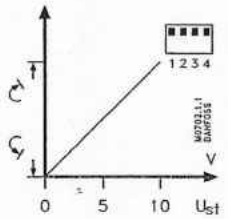


2.1

3.1



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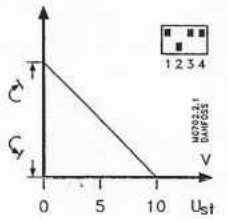
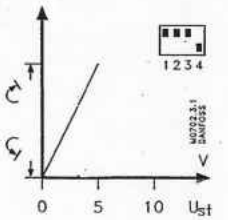


3.3



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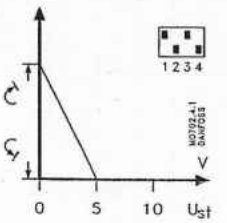
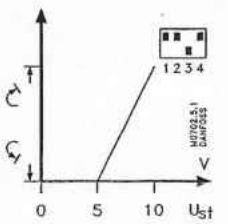


3.5



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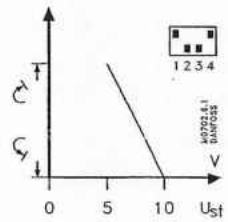

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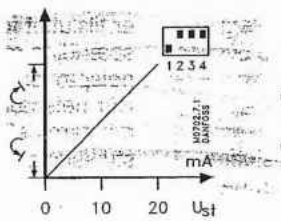

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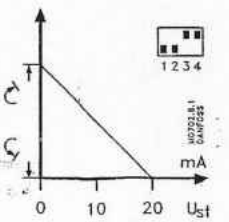


$U_{st} = U_{уир}$
V = B
mA = мА

TYP 8181 / TYPE 8181

SCHWIMMER-FÜLLSTANDSSCHALTER MIT REED RELAY

ON/OFF LEVEL SWITCH WITH FLOAT AND REED RELAY

Einleitung

Wir gratulieren zum Erwerb des Füllstandssensors Typ 8181. Der Sensor dient dazu, den Füllstand einer Flüssigkeit zu kontrollieren. Er ist in 12 Ausführungen verfügbar; Folgende Parameter legen die Ausführung fest:

- Material des Sensors: PP oder Edelstahl
- Typ des Aussengewindes (siehe Abb. auf der nächsten Seite): G 3/4, NPT 3/4 oder Rc 3/4
- horizontale oder vertikale Ausführung.

Vergewissern Sie sich, dass die Werkstoffe des Schalters mit dem zu messenden Medium kompatibel sind.

Für Schäden aus unsachgemässem oder nicht bestimmungsgemässem Gebrauch haftet der Hersteller nicht. An dem Gerät dürfen keine Umbauten oder Veränderungen vorgenommen werden.

Introduction

Congratulations on having purchasing the level switch type 8181.
The switch makes it possible to control the level of a liquid. 12 versions of the switch are available, depending on:

- the material : PP or stainless steel
- the type of threading (see schematics on the next page): G 3/4, NPT 3/4 or Rc 3/4
- the type of mounting desired: horizontal or vertical.

Ensure the materials the switch is made of are compatible with the measured medium.

There will be no manufacturer warranty for damages caused by unexpected handling or wrong usage of the device. The warranty on the device becomes invalid if any modification or change is made on the device.

Verkabelung (Fortsetzung)

Die Schutzkappe des Sensors entnehmen, bevor Sie den 2508-Stecker aufbauen.

Um den 2508-Stecker auszubauen (siehe folgende Abb.):
- Schraube 1 entnehmen und den Stecker öffnen.
- Teil 2 von Teil 3 trennen.
- Gemäß Verkabelungsplan auf voriger Seite verkabeln.
- Während des Aufbaus kann Teil 3 bei 90°-Stufen in Teil 2 eingesteckt werden.

Wiring (continued)

Remove the protection cap from the sensor to be able to mount the 2508 connector.

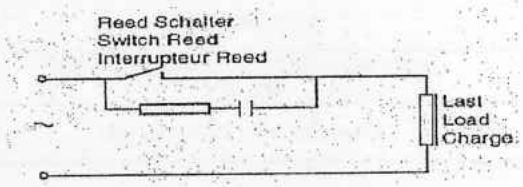
To dismantle the 2508 connector, follow the instructions (see also figure below):
- Remove screw 1 to open the connector.
- Separate parts 2 and 3.
- Wire according to the wiring plan on the previous page.
- When mounting back, part 3 can be inserted into part 2 by 90°-steps.

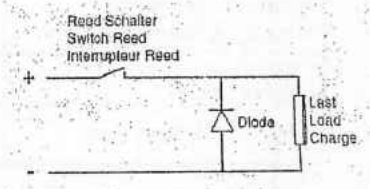
Anschluss-Hinweise

1) Ist der Reed-Kontakt an eine **induktive** Last angeschlossen (Motor, Relaisspule, Elektromagnet,...), werden seine Kontakte bei der Öffnung der Kontakte einer hohen induzierten Spannung unterworfen (Belastungskreis). Diese induzierten Spannungen können den Reed-Kontakt beschädigen. Deshalb empfehlen wir, den Kontakt mittels eines RC-Gliedes (bei Wechselspannung) oder einer Freilaufdiode (bei Gleichspannung) zu schützen (siehe beide Abbildungen

Wiring precautions

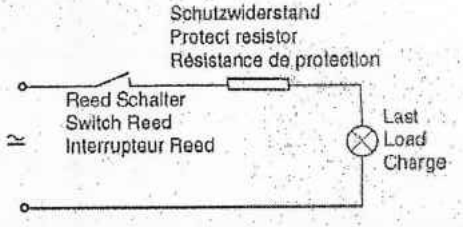
1) If the reed contact is connected to an **inductive** load (motor, relay coil, solenoid,...), its contacts are subject to high induced voltages when the contacts are opened (load circuit). These induced voltages may damage the Reed contact. It is thus recommended to protect the relay using an RC circuit (alternating current) or a recovery diode (direct voltage) (see both figures hereafter).





2) Ist der Reed-Kontakt an eine **kapazitive** Last angeschlossen (Glühlampe, Kondensator,...), werden seine Kontakte einem hohen Anschwingstrom unterworfen. Deshalb empfehlen wir, den Kontakt mittels einem Schutzwiderstand zu schützen (siehe folgende Abbildung).

2) If the reed contact is connected to a **capacitive** load (incandescent lamp, capacitor,...), its contacts are subject to high inrush currents. It is thus recommended to protect the relay using a protective resistor (see next figure).).



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Typ 8181
Type 8181

Arbeitsprinzip (Fortsetzung)

Der Schwimmerschalter wird durch Änderungen des Flüssigkeitsstandes geöffnet oder geschlossen und betätigt dabei den Reed-Kontakt. Dieses Relais kann einen Fernalarm auslösen oder an einen Regler angeschlossen sein.

Die Verbindung zum Alarm oder zum Regler wird über einen im Lieferumfang enthaltenden 2508-Stecker hergestellt (siehe Verkabelung Seite 6).

Operating principle (continued)

The float actuates the Reed contact depending on the variations of the liquid level. The reed relay can trigger off a remote alarm or be connected to a controller.

The alarm or the controller is connected to the switch through the supplied 2508-connector (see wiring p.6).

AMES 230 V
Netspændingens fase og nul kan tilsluttes vilkårligt, fordi netspændingen tilsluttes en transformator i AMES 230 V-modulet.

6. Indjustering af ventilens vandring („Stroke" set) i AMES-modulets hukommelse

Manuel indjustering af AMES-modulet
(Anvendes normalt ved enkeltvis indjustering af motorventiler)
- Ca. 5 sek. efter at netspændingen er tilsluttet, vil den røde lysdiode (ved funktionsomskifteren) lyse (fig. 6.1).
- Tryk „Stroke" set knappen ind med en skruetrækker (fig. 6.1).
- Lysdioden blinker medens motoren gennemkører en lukke/åbne-cyklys.
- Når ventilens vandring er registreret i AMES-modulets hukommelse lyser dioden igen konstant, og den manuelle indjustering er afsluttet.

Automatisk indjustering af AMES-modulet
(Anvendes normalt ved samtidig indjustering af flere motorventiler)
- Klip lusen på undersiden af AMES-modulet inden montering af modulet (fig. 6.2). (Bemærk: det er fortsat muligt at indjustere et AMES-modul manuelt når lusen er klippet).
- Tænd for netspændingen indtil den røde lysdiode (ved funktions-omskifteren) lyser konstant.
- Sluk for netspændingen i min. 6 sek. (lysdioden slukker).
- Tænd for netspændingen mellem 1 og 5 sek. (lysdioden skal forblive slukket).
- Sluk for netspændingen i min. 6 sek.
- Tænd for netspændingen. Lysdioden blinker og AMES-modulet starter den automatiske indjustering.
- Når den automatiske indjustering er registreret i AMES-modulets hukommelse lyser dioden igen konstant, og den automatiske indjustering er afsluttet.

Bemærk: Når lusen er klippet vil AMES-modulet åbne og lukke ventilen helt op og i, både i forbindelse med den automatiske indjustering og i forbindelse med eventuelle strømsvigt under drift. Vær derfor opmærksom på risikoen for skoldning når AMES-moduler med klippet lus anvendes til regulering af fx varmt brugsvand.

ENGLISH

1. Mounting the AMES module on AMV 323/423/523

A) Mount AMV motor on valve (fig. 1.1).
B) Remove lid from AMV motor (fig. 1.2).
C) Fit staybolts supplied with the AMES module (fig. 1.3). If replacing a module, the staybolts must also be replaced.
D) If the AMES module is to be set up using mains voltage, follow the instructions in section 6: *Automatic setting up of AMES module.*
E) Mount the AMES module in the motor by pushing it half in over the staybolts. Connect module leads in motor terminal board (fig. 1.4) and then push module fully into place. *Note: Before connecting the control signal from the regulator to the AMES 24 V module, mains voltage must be connected correctly as described in section 5. Mains voltage.*

2. Fuse (230 V~ only)

A) The fuse can be removed/replaced by turning the fuse holder in the direction of the arrow (figs. 2.1 and 2.2).

3. Function switch setting

Fig. 3.1 (U_{st} = 0 -10 V, factory setting)
The AMV motor spindle travels upwards on rising control voltage.
Fig. 3.2 (U_{st} = 0 - 10 V)
The AMV motor spindle travels downwards on falling control voltage.
Fig. 3.3 (U_{st} = 0 - 5 V)
The AMV motor spindle travels upwards on rising control voltage.
Fig. 3.4 (U_{st} = 0 - 5 V)
The AMV motor spindle travels downwards on rising control voltage.
Fig. 3.5 (U_{st} = 5 - 10 V)
The AMV motor spindle travels upwards on rising control voltage.
Fig. 3.6 (U_{st} = 5 - 10 V)
The AMV motor spindle travels downwards on rising control voltage.
Fig. 3.7 (U_{st} = 0 - 20 mA)
The AMV motor spindle travels upwards on rising control current.
Fig. 3.8 (U_{st} = 0 - 20 mA)
The AMV motor spindle travels downwards on rising control current.

4. Control voltage

Normal operation
The control signal from the regulator must be connected to terminals 12 and 41 (U_{st} 2) on the AMES module (fig. 4.1)

Operation with on/off override
The control signal from the regulator must be connected to terminals 12 and 41 (U_{st} 2) on the AMES module. The override signal (e.g. from a clock or frost thermostat) must be connected to terminals 12 and 40 (U_{st} 1) (fig. 4.1). Always use the contact set that has low contact resistance.

Note: Plug in the module only when mains voltage is connected and checked as described in section 5. Mains voltage.

5. Mains voltage

AMES 24 V
Terminal 6 **must** be connected to phase (L) and terminal 7 **must** be connected to neutral (N) (fig. 4.1). Do **not** swap the leads when connecting mains voltage to the AMES 24 V module; it will damage the module. Using an measuring instrument, check as shown in fig. 5.1 to make sure that 24 V mains is connected correctly. If the measured voltage exceeds 3 V~, mains voltage is incorrectly connected. When mains voltage is correctly connected, plug in the regulator control signal (fig. 5.2).

AMES 230 V
There are no special instructions regarding lead connection for mains voltage, i.e. mains voltage is connected to a transformer in the AMES 230 V module.

6. Valve travel setting ("Stroke" set) in the AMES module memory

Manual setting of AMES module
(Normal when adjusting motor valves individually).
- Approx. 5 s after mains voltage is connected, the red LED (by the function switch) lights up (fig. 6.1).
- Press in the "Stroke" set button with a screwdriver (fig. 6.1).
- The LED will flash while the motor runs through a close/open cycle.
- When the valve travel has been registered in the AMES module memory, the LED again lights up constantly and manual setting is complete.

Automatic setting of AMES module
(Normal when setting several motor valves at same time).
- Before mounting the AMES module, clip the jumper on its underside (fig. 6.2). (Note: it is still possible to set the AMES module manually after the jumper has been clipped).
- Switch on mains voltage until the red LED (by the function switch) lights up constantly.
- Switch off mains voltage for a minimum of 6 s. (LED goes out).
- Switch on mains voltage for between 1 and 5 s. (The LED should remain out).
- Switch off mains voltage for a minimum of 6 s.
- Switch on mains voltage. The LED will flash and the AMES module starts automatic setting.
- When automatic setting is registered in the AMES module memory, the LED lights up again constantly and automatic setting is complete.

Note: When the jumper is clipped, the AMES module opens and closes the valve completely, both in connection with automatic setting and with possible current failure during operation. Therefore BE CAREFUL - there is a risk of scalding when e.g. an AMES module with clipped jumper is used for regulating service hot water.

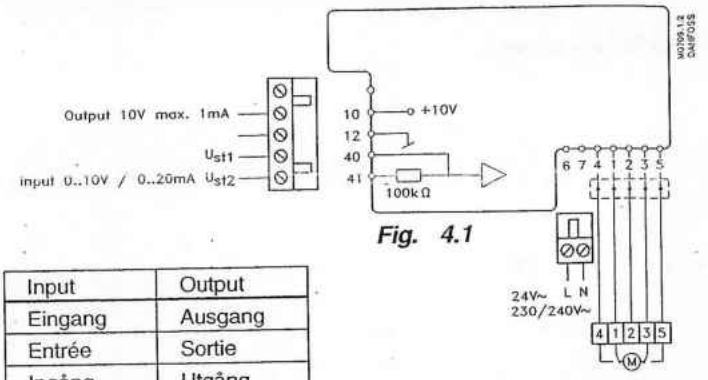

Fig. 4.1

Input	Output
Eingang	Ausgang
Entrée	Sortie
Ingång	Utgång
entrada	salida
Ingang	Uitgang
sisääntulo	ulostulo

$U_{st} = U_{упр}$
V = В
mA = мА
max. = макс.

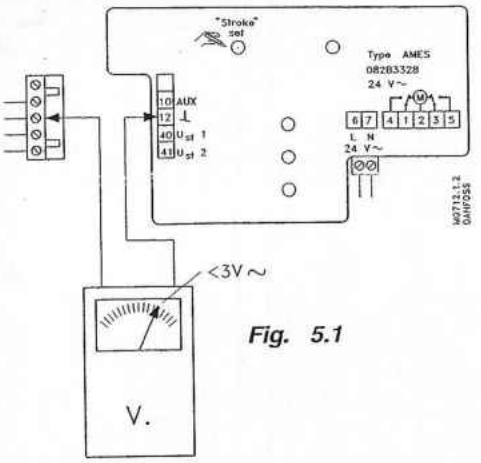

Fig. 5.1

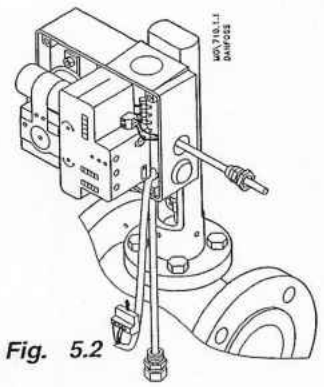

Fig. 5.2

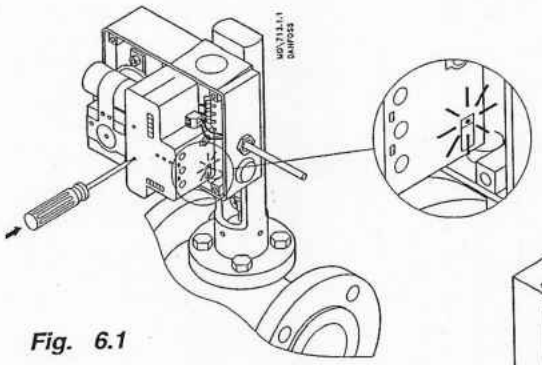

Fig. 6.1

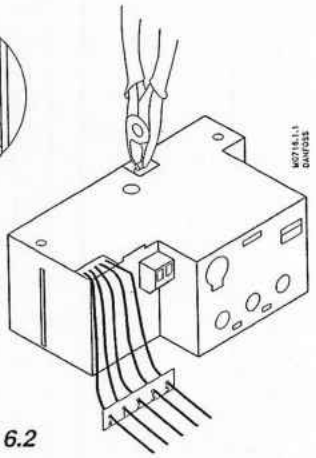

Fig. 6.2

DANSK

1. Montering af AMES modul på AMV 323/423/523

A) Monter AMV-motoren på ventilen (fig. 1.1).
B) Fjern låget fra AMV motoren (fig. 1.2).
C) Monter de stagbolte der følger med AMES modulet (fig. 1.3). Ved eventuel udskiftning af et modul skal stagboltene også udskiftes.
D) Hvis AMES-modulet skal indjusteres via netspændingen skal instruktionerne i afsnit 6, *Automatisk indjustering af AMES-modulet,* følges.
E) Monter AMES modulet i motoren ved at skubbe det halvt ind over stagboltene. Monter modulets ledninger i motorens klemrække (fig. 1.4), og skub herefter modulet helt på plads.
NB: Inden styresignalet fra regulatoren tilsluttes AMES 24 V-modulet, skal netspændingen være tilsluttet korrekt som beskrevet under punkt 5. Netspænding.

2. Sikring (kun 230 V~)

A) Sikringen kan udskiftes ved at dreje sikringsholderen i pilens retning (fig. 2.1 og 2.2).

3. Indstilling af funktionswitch

Fig. 3.1 (U_{st} = 0 - 10 V, fabriksindstilling)
AMV motorens spindel bevæger sig opad ved stigende styrespænding.
Fig. 3.2 (U_{st} = 0 - 10 V)
AMV motorens spindel bevæger sig nedad ved stigende styrespænding.
Fig. 3.3 (U_{st} = 0 - 5 V)
AMV motorens spindel bevæger sig opad ved stigende styrespænding.
Fig. 3.4 (U_{st} = 0 - 5 V)
AMV motorens spindel bevæger sig nedad ved stigende styrespænding.
Fig. 3.5 (U_{st} = 5 - 10 V)
AMV motorens spindel bevæger sig opad ved stigende styrespænding.
Fig. 3.6 (U_{st} = 5 - 10 V)
AMV motorens spindel bevæger sig nedad ved stigende styrespænding.
Fig. 3.7 (U_{st} = 0 - 20 mA)
AMV motorens spindel bevæger sig opad ved stigende styrestrøm.
Fig. 3.8 (U_{st} = 0 - 20 mA)
AMV motorens spindel bevæger sig nedad ved stigende styrestrøm.

4. Styrespænding

Normal drift
Styresignalet fra regulatoren tilsluttes klemme 12 og klemme 41 (U_{st} 2) på AMES modulet (fig. 4.1).

Drift med on/off overstyring
Styresignalet fra regulatoren tilsluttes klemme 12 og klemme 41 (U_{st} 2) på AMES-modulet. Overstyringssignalet (fx fra et ur eller fra en frosttermostat) tilsluttes klemme 12 og klemme 40 (U_{st} 1) (fig. 4.1). Anvend altid kontaktsæt med en lav kontaktmodstand.

NB.: Montere først stikket i modulet når netspændingen er tilsluttet og kontrolleret som beskrevet i afsnit 5. Netspænding.

5. Netspænding

AMES 24 V
Klemme 6 **skal** tilsluttes fase (L) og klemme 7 **skal** tilsluttes nul (N) (fig. 4.1).
Netspændingen til AMES 24 V-modulet må **ikke** tilsluttes omvendt, så ødelægges modulet.
Kontroller med et måleinstrument, som vist på fig. 5.1, om 24 V netspændingen er tilsluttet forkert. Hvis den målte spænding overskrider 3 V~ er netspændingen tilslutte forkert.
Når netspændingen er tilsluttet korrekt monteres stikket med regulatorens styresignal (fig. 5.2)

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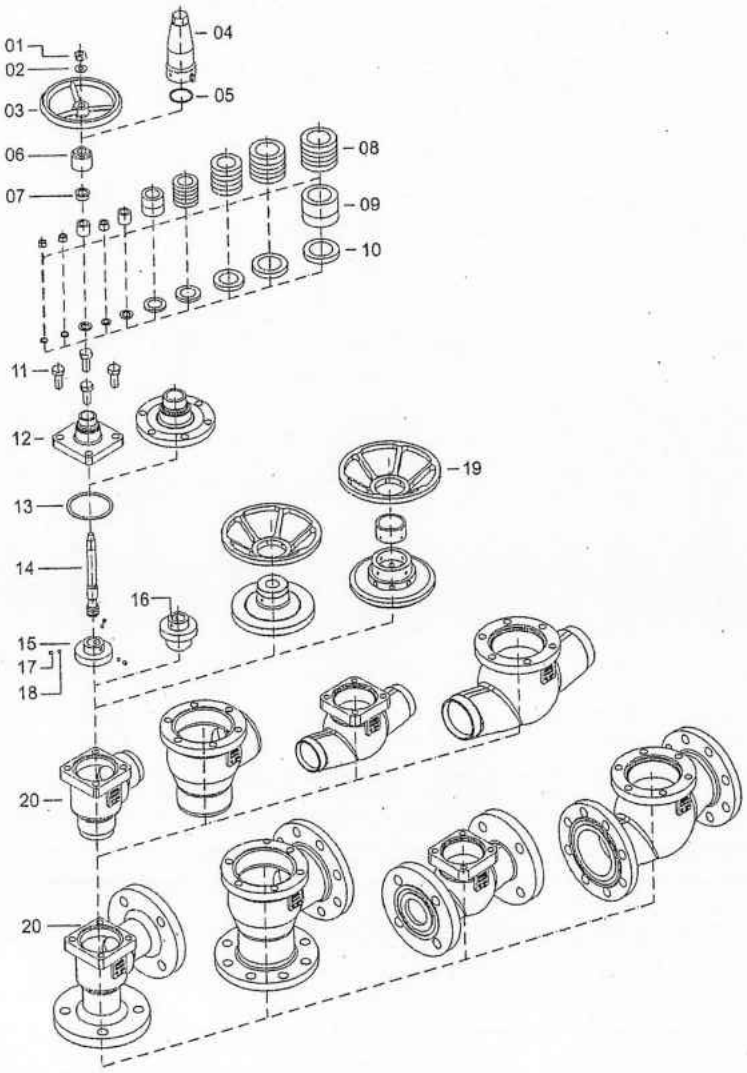

Shut-off valves, control valves

No	Designation:	Kit:	Reference size:	DN 15	DN20	DN25	DN32	DN40	DN50	DN65	DN80
01	Nut	A	Nominal Ø	M8	M8	M10	M10	M10	M10	M16	M16
02	Thrust washer	A	Size [mm]	8.4x15.7	8.4x15.7	10.6x19.6	10.6x19.6	10.6x19.6	10.6x19.6	17.4x29.8	17.4x29.8
03	Handwheel	A	External Ø [mm]	Ø 80	Ø 80	Ø 100	Ø 100	Ø 140	Ø 140	Ø 250	Ø 250
04	Cap	B, E	Width acr. flats (SW) Length [mm]	SW 22 99	SW 22 99	SW 24 126	SW 24 126	SW 24 126	SW 24 126	SW 36 198	SW 36 198
05	Cap seal	B, E	Size [mm]	29x34x2	29x34x2	35.5x39.5x2	35.5x39.5x2	35.5x39.5x2	35.5x39.5x2	61x69x2	61x69x2
06	Union nut		Width acr. flats (SW)	SW 19	SW 19	SW 24	SW 24	SW 24	SW 24	SW 41	SW 41
07	Thrust washer		Size [mm]	10x16	10x16	14x22	14 x 22	14 x 22	14 x 22	24 x 38	24 x 38
08	Packing (number)	C	Size [mm] (number)	10x16x12 (1)	10x16x12 (1)	14x22x20 (1)	14x22x20 (1)	14x22x20 (1)	14x22x20 (1)	24x38x17,5 (2)	24x38x17,5 (2)
09	Spacer	C	Height [mm]	-	-	-	-	-	-	-	-
10	Bottom ring		Size [mm]	10x16x3	10x16x3	14x22x3	14x22x3	14x22x3	14x22x3	24x38x3	24x38x3
11	Bonnet screws (number)	E	Nominal Ø x Length (number)	M8x20 (4)	M8x20 (4)	M10x25 (4)	M10x25 (4)	M10x35 (4)	M12x35 (4)	M16x45 (4)	M16x45 (4)
12	Bonnet	E	Edge length [mm]	□ 56	□ 56	□ 70	□ 70	□ 80	□ 90	□ 142	□ 142
13	Bonnet seal	E	Size [mm]	42x36x2	42x36x2	58x49x2	58x49x2	65x55x2	78x68x2	128x116x2	128x116x2
14	Shut-off valve spindle	D, E	External -Ø [mm] thread	10 M12x1.5	10 M12x1.5	14 M18x2	14 M18x2	14 M18x2	14 M18x2	24 Tr30x6	24 Tr30x6
14	Control valve spindle	D, E	External -Ø [mm] thread	10 M12x1.5	10 M12x1.5	14 M18x2	14 M18x2	14 M18x2	14 M18x2	24 M30x2	24 M30x2
15	Cone; shut-off val.	D, E	External -Ø [mm]	29	32	37	44	52	63	80	95
16	Cone, control val.	D, E	External -Ø [mm]	19	24	35	37	45	53	65	81
20	Housing		Nominal diameter	DN15	DN20	DN25	DN32	DN40	DN50	DN65	DN80

Nr	Designation:	Kit:	Reference size:	DN100	DN125	DN150	DN200	DN250	DN300	DN350	DN400
01	Nut	A	Nominal Ø	M16	M16	M20	M20	M20	M20	M20	M20
02	Washer	A	Size [mm]	17.4x29.8	17.4x29.8	17.4x29.8	17.4x29.8	17.4x29.8	17.4x29.8	17.4x29.8	17.4x29.8
03	Handwheel	A	External -Ø. [mm]	Ø 250	Ø 320	Ø 400	Ø 400	Ø500	Ø500	Ø500	Ø500
04	Cap	B, E	Width acr. flats (SW) Length [mm]	SW 36 198	SW 46 203	SW 46 301	SW 46 301	SW 55 367	SW 55 367	SW 55 447	SW 55 447
05	Cap seal	B, E	Size [mm]	61x69x2	72x82x2	88x106x2	88x106x2	107x116x2	107x116x2	107x116x2	107x116x2
06	Union nut		Width across flats (SW)	SW 41	SW 46	SW 46	SW 46	SW 65	SW 65	SW 65	SW 65
07	Thrust washer		Size [mm]	24 x 38	26 x 42	32 x 52	32 x 52	40 x 60	40 x 60	40 x 60	40 x 60
08	Packing (number)	C	Size [mm] (number)	24x38x17,5 (2)	26x42x8 (5)	32x52x10 (5)	32x52x10 (5)	40x60x10 (5)	40x60x10 (5)	40x60x10 (5)	40x60x10 (5)
09	Spacer	C	Height [mm]	-	-	-	-	-	-	17 und 25	17 und 25
10	Bottom ring		Size [mm]	24x38x3	26x42x3	32x52x3	32x52x3	40x60x5	40x60x5	40x60x5	40x60x5
11	Bonnet screws (number)	E	Nominal Ø x Length (number)	M16x45 (4)	M20x55 (6)	M16x55 (8)	M20x60 (8)	M20x90 (16)	M20x90 (16)	M20x100 (20)	M20x100 (20)
12	Bonnet	E	Edge length [mm]	□ 142	Ø224	Ø256	Ø320	Ø461	Ø461	Ø582	Ø582
13	Bonnet seal	E	Size [mm]	128x116x2	167x150x2	198x180x2	255x228x2	390x342x2	390x342x2	510x460x2	510x490x2
14	Shut-off val. spindle	D, E	External n-Ø [mm] thread	24 Tr30x6	26 Tr32x6	32 Tr40x7	32 tr40x7	40 Tr52x6	40 Tr52x8	40 Tr52x8	40 Tr52x8
14	Control val. spindle	D, E	External -Ø [mm] thread	24 M30x2	26 M32x2	32 M40x2	32 M40x2	-	-	-	-
15	Cone; shut-off val.,	D, E	External -Ø [mm]	108	144	172	210	280	328	380	438
16	Cone, control val.	D, E	External -Ø [mm]	93	145	176	210	-	-	-	-
20	Housing		Nominal diameter	DN100	DN125	DN150	DN200	DN250	DN300	DN350	DN400

Spare part sets: (Kit)

A: Handwheel, nut, washer
B: Cap, cap seal
C: Packing, spacer
D: Spindle, ball (18), grub screw (17), cone, supporting cage (19)
E: Bonnet, bonnet seal, bonnet screws, spindle, cone, grub screw (17), ball (18), supporting cage (19)

The housings are available in straight-way or angle form. From a nominal diameter of 250, a supporting cage is provided. From a nominal diameter of 250, valves are available either with or without double cone.

16.02.19

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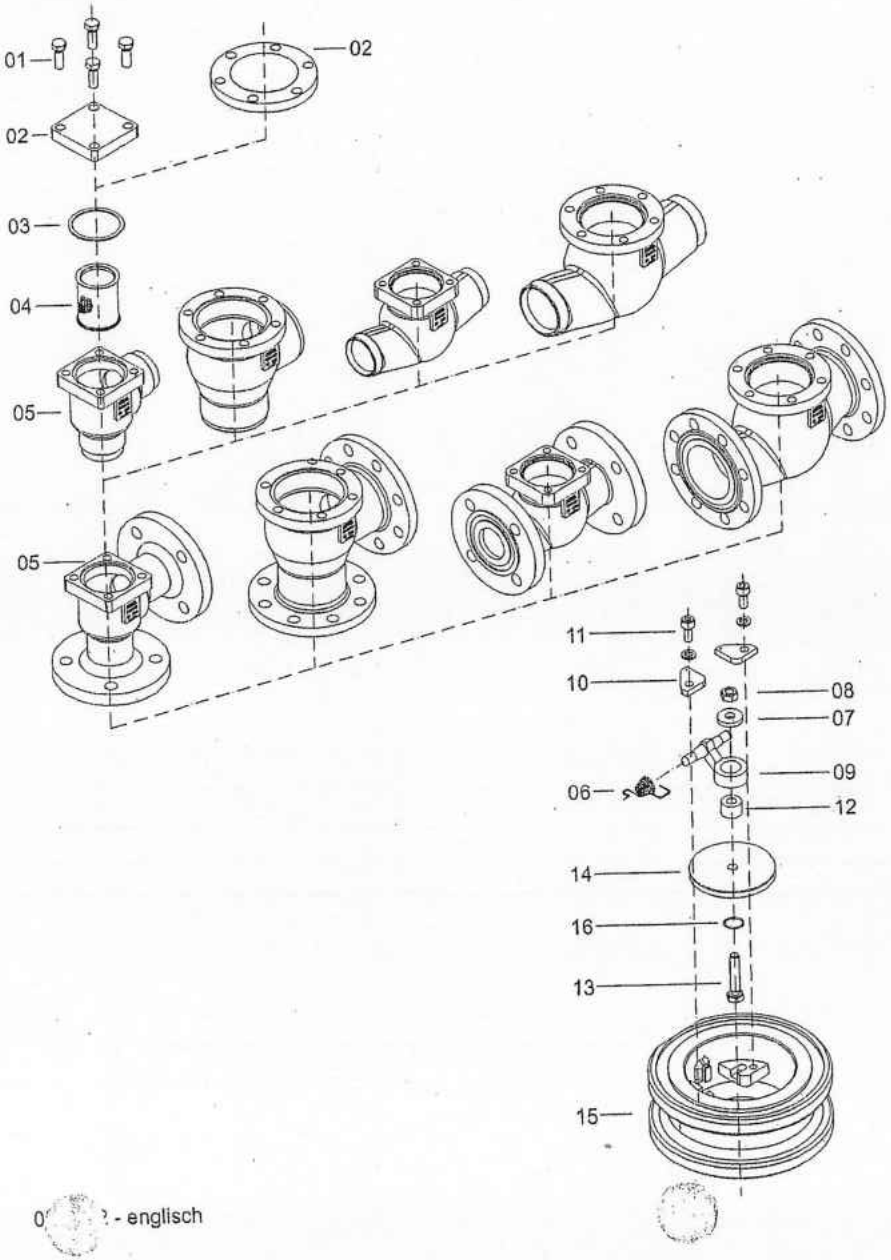

Filter

No	Designation	Kit:	Reference size:	DN 15	DN20	DN25	DN32	DN40	DN50	DN65	DN80
1	Bonnet screws (number)	A	Nominal Ø x Length (number)	M8x20 (4)	M8x20 (4)	M10x25 (4)	M10x25 (4)	M10x35 (4)	M12x35 (4)	M16x45 (4)	M16x45 (4)
2	Bonnet	A	Edge length [mm]	□56	□56	□70	□70	□80	□90	□142	□142
3	Bonnet seal	A	Size [mm]	42x36x2	42x36x2	58x49x2	58x49x2	65x55x2	78x68x2	128x116x2	128x116x2
4	Screen insert	A	External Ø [mm]	43,5	46,5	62	66	70,5	72,5	89	103,5
5	Housing		Nominal diameter	DN15	DN20	DN25	DN32	DN40	DN50	DN65	DN80

Nr	Designation:	Kit:	Reference size:	DN100	DN125	DN150	DN200	DN250	DN300
1	Bonnet screws (number)	A	Nominal Ø x Length (number)	M16x45 (4)	M20x55 (6)	M16x55 (8)	M20x60 (8)	M20x90 (16)	M20x90 (16)
2	Bonnet	A	Edge length [mm]	□142	Ø224	Ø256	Ø320	Ø461	Ø461
3	Bonnet seal	A	Size [mm]	128x116x2	167x150x2	198x180x2	255x228x2	390x342x2	390x342x2
4	Screen insert	A	Height [mm]	126,5	149	180	218	282	316
5	Housing		Nominal diameter	DN100	DN125	DN150	DN200	DN250	DN300

Spare part sets: (Kit)

A: Screen insert, bonnet seal, bonnet screws, bonnet

Check valves R1S

Nr	Designation:	Kit:	Reference size:	DN50	DN65	DN80	DN100	DN125	DN150	DN200	DN250	DN300
6	Spring	A, C	Model No.	Shown by model number (rating plate)								
7	Washer		Model No.	Shown by model number (rating plate)								
8	Nut		Model No.	Shown by model number (rating plate)								
9	Lever	A	Model No.	Shown by model number (rating plate)								
10	Clamp		Model No.	Shown by model number (rating plate)								
11	Screw		Model No.	Shown by model number (rating plate)								
12	Adapter		Model No.	Shown by model number (rating plate)								
13	Screw		Model No.	Shown by model number (rating plate)								
14	Washer	A, B	Model No.	Shown by model number (rating plate)								
15	Housing		Model No.	Shown by model number (rating plate)								
16	Seal	A, B	Model No.	Shown by model number (rating plate)								

Spare part sets: (Kit)

A: Washer, seal, spring, lever
B: Washer, seal
C: Spring

16.02.21

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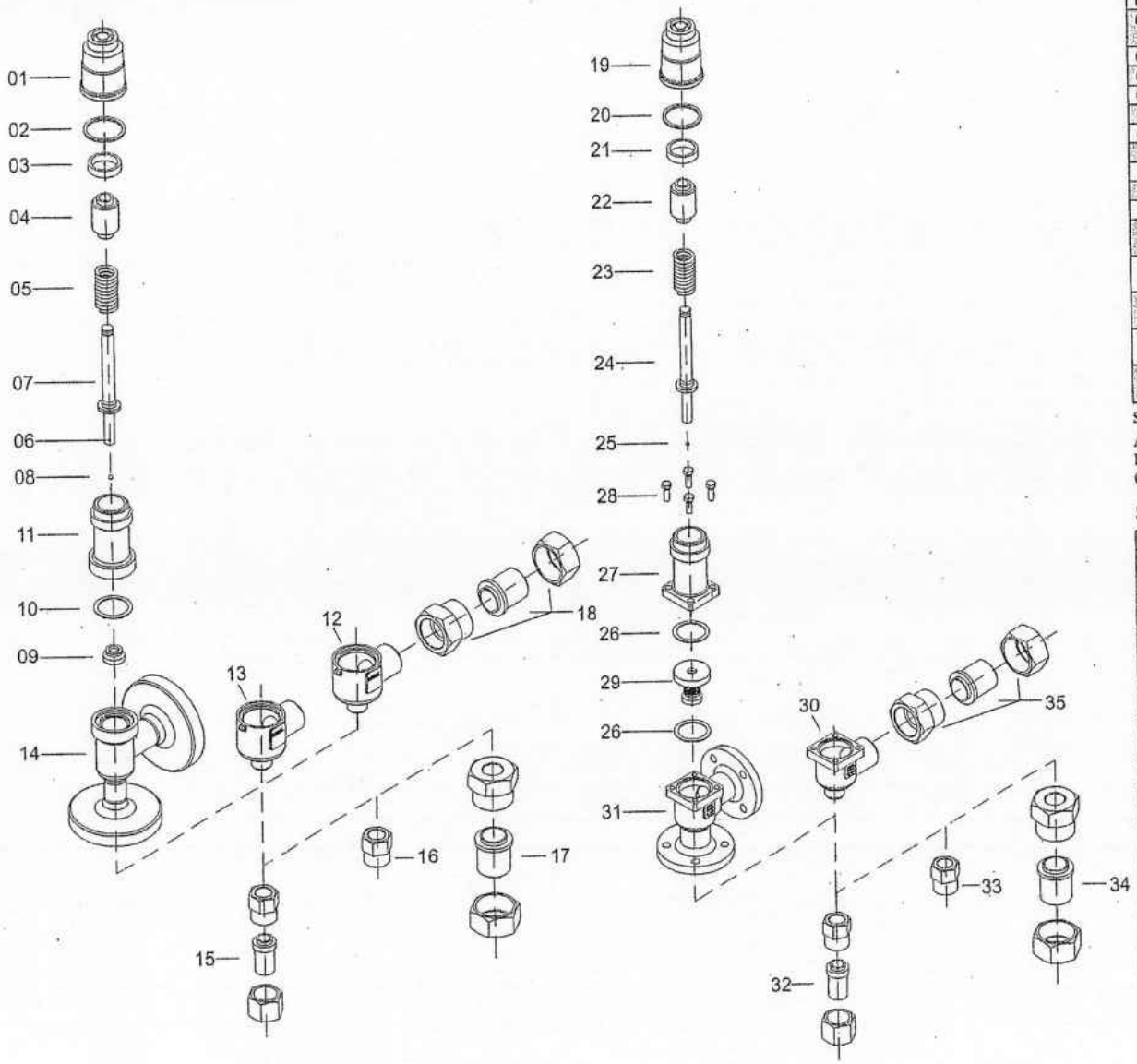

Safety valves T21/T21VA/T21MPT/T21F

No	Designation	Kit:	Reference size:	DN15	DN20	DN25
01	Cap	C	Width across flats, length [mm]	Wrench size 27 65		
02	Cap seal	A, B, C	Size [mm]	36x42x2		
03	Lock ring	C	External Ø [mm]	32		
04	Spacer	C	Width across flats (SW) Length [mm]	SW 17 47		
05	Helical spring	B, C	Spring No.	30;31;32;33;34;40;41;42		
06	Split-pin	C	Ø x length [mm]	Ø 3,2 x 40		
07	Spindle	C	Length [mm]	114,5 or 142		
08	Ball	C	Ø [mm]	5		
09	Cone	C	External Ø, height [mm]	Ø 28 ; 21		
10	Bonnet seal	A, B, C	Size [mm]	39x45x2		
11	Bonnet	C	External Ø x length [mm]	45 x 71 or 45 x 81		
12	Housing G		Inlet connection	G ½"		
13	Housing MPT		Inlet connection	MPT ½"		
14	Housing flange		Inlet connection	DN15 Groove	DN20 Nut	DN25 Nut
14	Inlet B		External Ø [mm] welding socket	20	-	-
15	Inlet C		External Ø [mm] welding socket	22	-	-
16	Inlet D		External Ø [mm] welding socket	-	-	34
17	Outlet B		External Ø [mm] welding socket	-	-	34

Spare part sets: (Kit)

A: Bonnet seal, cap seal, cone
B: Bonnet seal, cap seal, cone, helical spring
C: Cap, cap seal, lock ring, thrust washer, helical spring, split-pin, ball, bonnet seal, bonnet, bonnet screws, cone

Safety valves T21.FA, T21VA.FA, T21F.FA, T21VA.F.FA

No	Designation:	Kit:	Reference size:	DN15	DN20	DN25
18	Cap	C	Width across flats, length [mm]	Wrench size 27 65		
19	Cap seal	A, B, C	Size [mm]	36x42x2		
20	Lock ring	C	External Ø [mm]	32		
21	Thrust washer	C	Width across flats (SW) Length [mm]	SW 17 47		
22	Helical spring	B, C	Spring No.	30;31;32;33;34;40;41;42		
23	Spindle	C	Length [mm]	143,5		
24	Ball	C	Ø [mm]	5		
25	Bonnet seal	A, B, C	Size [mm]	39x45x2		
26	Bonnet	C	Edge length [mm]	□ 47		
27	Bonnet screws	C	Size [mm]	M6 x 35		
28	Bellow unit	A, B, C	External Ø of cone [mm]l	Ø 28		
29	Housing G		Inlet connection	G ¼"		
30	Housing flange		Inlet connection	DN15 Groove		
31	Inlet B		External Ø [mm] welding socket	20		
32	Inlet C		External Ø [mm] welding socket	22	-	-
33	Inlet D		External Ø [mm] welding socket	-	-	34
34	Outlet B		External Ø [mm] welding socket	-	-	34

* Includes ball, bellow unit, adapter

Spare part sets: (Kit)

A: Bonnet seal, cap seal, bellow unit
B: Bonnet seal, cap seal, bellow unit, helical spring
C: Cap, cap seal, lock ring, thrust washer, helical spring, split-pin, ball, Bonnet seal, Bonnet, Bonnet screws, bellow unit

16.02.22

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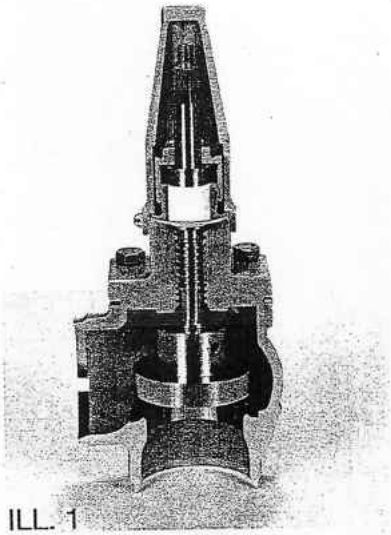
Tightening torques [Nm] for Herl valves: Screws/stuffing boxes and gland nuts/valve spindles

Valve size		Screws for flanged valve bonnets				Union nut	Gland nuts/glands				Valve spindles	
DN	inch	Sizes	Material	Width across flats [mm]	M_D *	Screwed valve upper part	K80P (graphite with PTFE)		PTFE		Single seat	Double seat***
							G	F	G	F		
6						60	5		8			
8						70	5		8			
10						70	5		8			
12						70	5		8			
15	½	M8	8.8 A2.70	13	24 19	70	5	8	8	12	3,5	
20	¾	M8	8.8 A2.70	17	45 33	70	5	8	8	12	3,5	
25	1	M10	8.8 A2.70	17	45 33	240	5	15	20	20	22	
32	1 ¼	M10	8.8 A2.70	17	45 33	240	5	15	20	20	22	
40	1 ½	M10	8.8 A2.70	17	45 33			15		20	26	
50	2	M12	8.8 A2.70	19	80 56			15		20	29	
65	2 ½	M16	8.8 A2.70	24	200 140			40		100	110	
80	3	M16	8.8 A2.70	24	200 140			40		100	110	
100	4	M16	8.8 A2.70	24	200 140			40		100	110	
125	5	M20	8.8 A2.70	30	385 270			50		140	120	
150	6	M16	8.8 A2.70	24	200 140			90		140	160	
200	8	M20	8.8 A2.70	30	385 270			90		140	240	
250	10	M20	8.8 A2.70	30	385 270			100		180	750	800
300	12	M20	8.8 A2.70	30	385 270			100		180	1250	1000
350	14	M20	8.8 A2.70	30	385 270			100		180	1550	1200
400	16	M20	8.8 A2.70	30	385 270			100		180	2030	1400

* Coefficient of friction: 0.125 (smooth surfaces, screws lightly oiled **G** = Valves with screwed upper parts **F** = Valves with flanged upper parts
** Closure against 25 bar below shut-off element, from DN 250 and higher against 21 bar *** Closure against 21 bar above shut-off element, below shut-off element DN250: 14 bar, DN 300: 13 bar, DN 350: 10 bar, DN 400: 7 bar

Mounting Instructions for Stuffing Boxes of HERL Shut-Off Valves

On HERL Shut-Off Valves equipped with stuffing box packings, the packing can be shut off to the medium with the spindle backseating, and thus relieved.

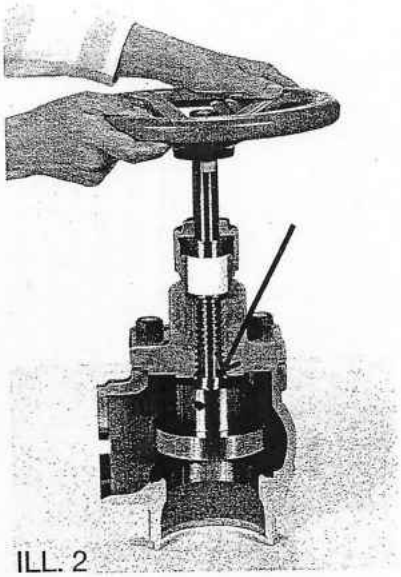


ILL. 1

For the valve positions "Open" and "Closed", we recommend:

1. Valve "Open" (backseating closed)

1.1 Turn the spindle **with the handwheel provided** in the direction "Open" (counter-clockwise) until the contact of the spindle on the metallic back seat of the upper section prevents further turning (ill. 2). Following this, turn the spindle clockwise one half turn. Then a powerful jerk counter-clockwise achieves backseating. To prevent accidental movement of the spindle, the handwheel should be removed.

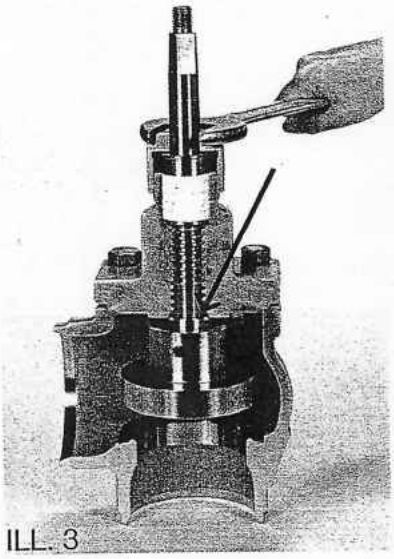


ILL. 2

1.2 In this case, the stuffing box packing is inoperative. The backseating assumes the sole sealing function.

1.3 **Never tighten the stuffing box nut in this position,** but instead loosen it by 1 to 2 turns beforehand. Wait approx. 1 min to allow the fluid previously caught or compressed to escape (ill. 3).

1.4 If pressure develops again against the stuffing box nut from the inside, repeat step 1.3 by turning the stuffing box nut another 1-2 turns.

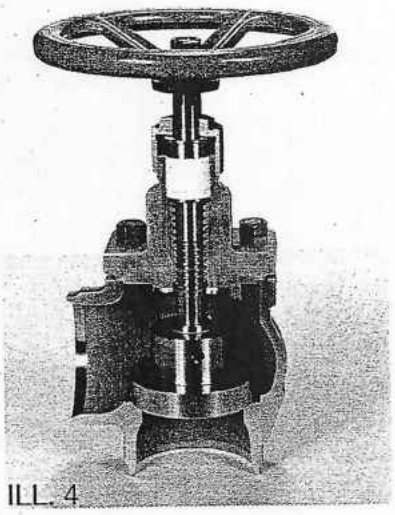


ILL. 3

1.5 When the caught fluid has escaped, retighten the stuffing box nut "with feeling".

1.6 If the shut-off valve is now left in the "Open" position, the spindle chamber is doubly secured against leaks.

1.7 If the shut-off valve is moved into the "Closed" position (clockwise), the adjusted stuffing box packing is free of leaks in the spindle area.



ILL. 4

2. Valve "Closed" (backseating)

2.1 The sealing function is carried out solely by the stuffing box packing (ill. 4).

2.2 If it is necessary to tighten the stuffing box nut here, we recommend tightening the packing "with feeling" with short breaks of approx. 1 min.

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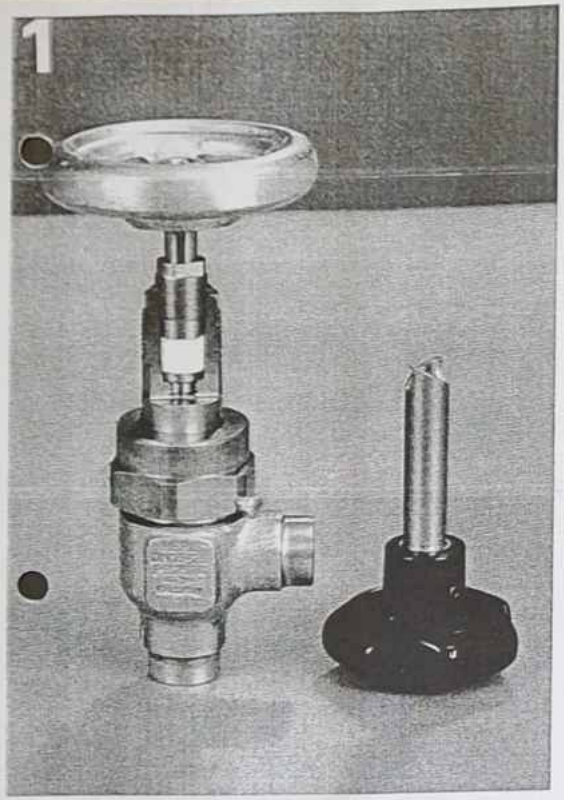
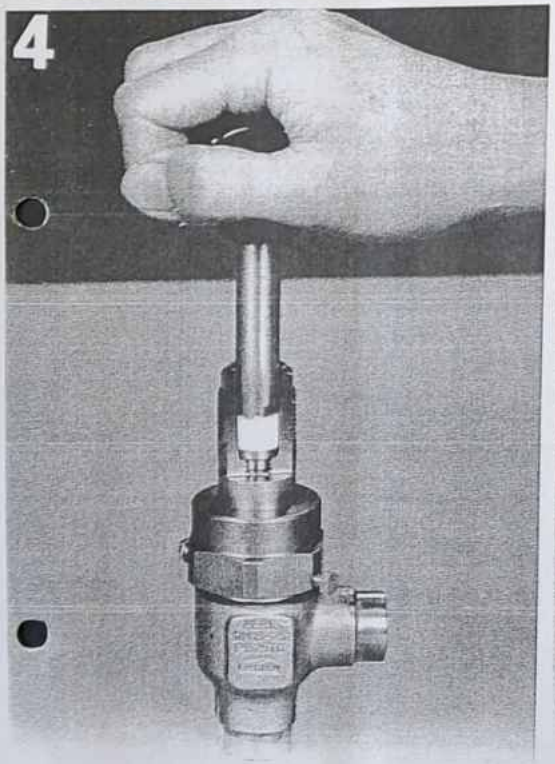
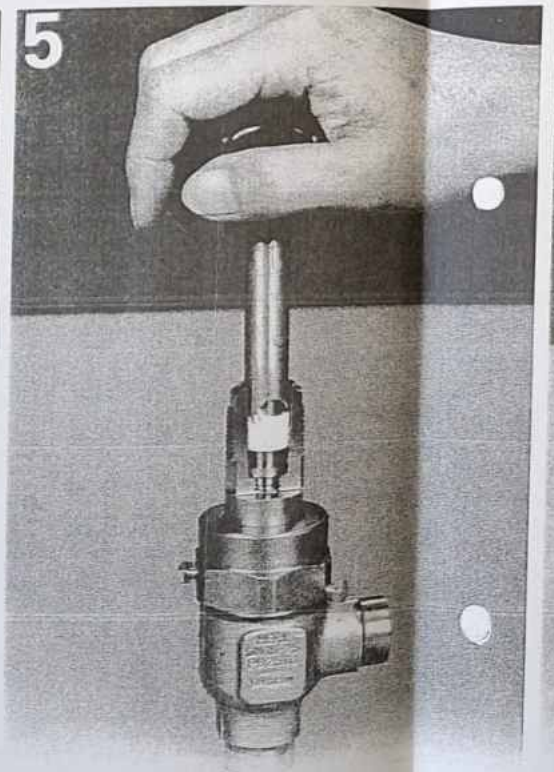
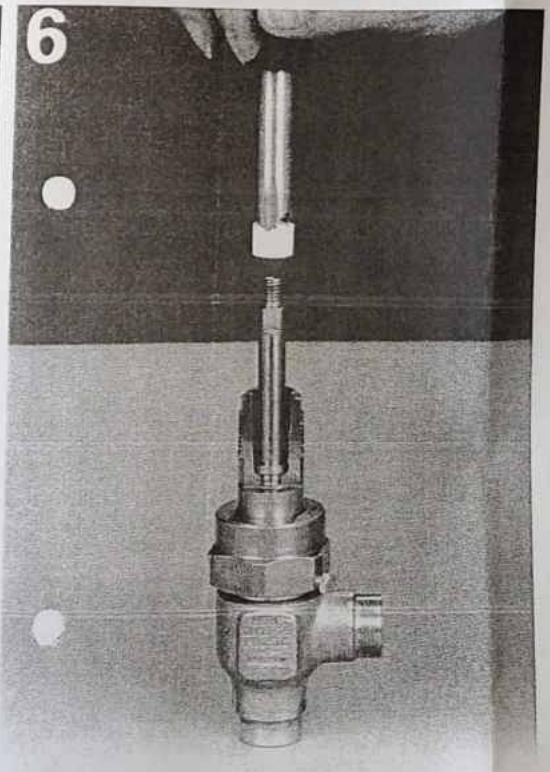








Anleitung zum Austauschen von Packungsröhrchen* in HERL-Ventilen

Erforderliches Werkzeug ist ein Packungszieher der Fa. HERL (Bild1). Folgende Arbeitsschritte sind erforderlich:

1. Demontage der Kappe (falls vorhanden). Das seitliche Loch in der Kappe darf dabei nicht verstopft sein, damit das eventuell unter Druck stehende Kältemittel nach den ersten Umdrehungen aus der Kappe entweichen kann. Die demontierende Person muß dabei so arbeiten, daß sie nicht unmittelbar mit austretendem Kältemittel in Berührung kommt.
2. Montage des Handrades.
3. Ventil ganz öffnen, wieder um 90° schließen und anschließend mit einem Ruck gegen die Rückdichtung öffnen. (Zur Sicherheit des ausreichenden Abdichtens der Rückdichtung)
4. Demontage des Handrades und des Druckstückes. (Bild 2)
5. Ansetzen des Packungziehers durch vorsichtiges Einführen in das Oberteil (Bild 3).
6. Eindrehen des Packungsziehers in das Packungsröhrchen durch Drehen nach links bei gleichzeitigem Druck nach unten (Bild 4).
7. Ziehen des Packungsröhrchens durch Anheben des Packungsziehers bei gleichzeitiger Drehbewegung nach links, dabei Festhalten des Ventils. (Bild 5).
8. Montage des neuen Röhrchens.
9. Montage des Druckstückes und des Handrades bzw. der Kappe.

* (ebenfalls anzuwenden für O-Ringe)

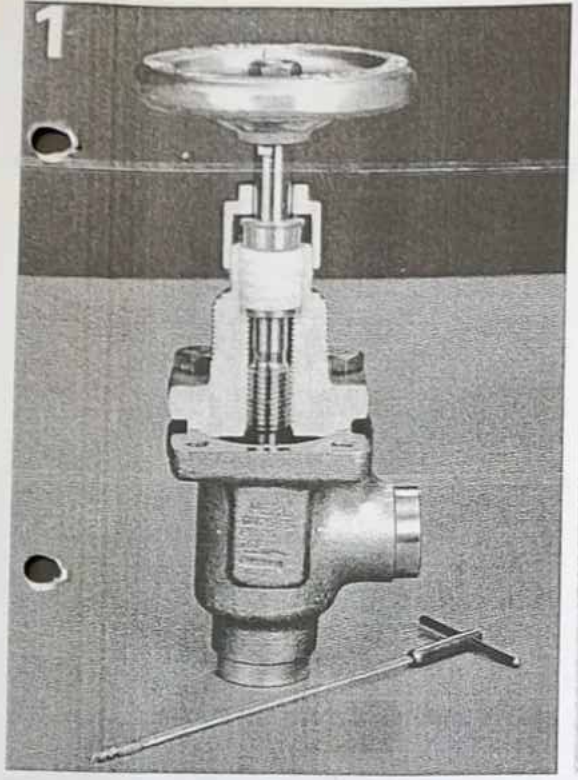
Instruction for the Replacement of Packing Tubes* in HERL-valves

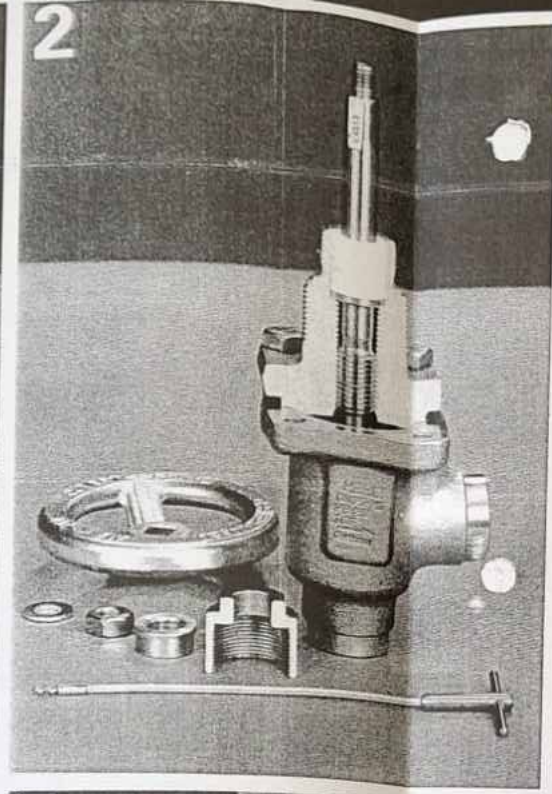
The required tool is a HERL packing extractor (ill. 1). The following steps are necessary:

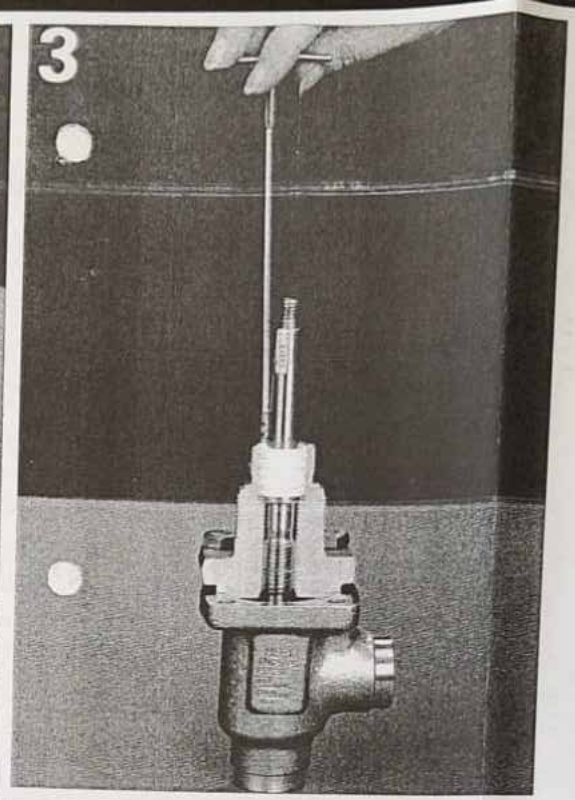
1. If present, remove the cap. In this process, the hole in the side of the cap must not be clogged so that the refrigerating agent which might be under pressure can escape from the cap following the initial rotations. The person performing this work must avoid coming into direct contact with the escaping refrigerating agent.
2. Mount the handwheel.
3. Open the valve completely, and close it again by 90°. Then open it with a jerk against the backseating (to ensure that the backseating tightens adequately).
4. Remove the handwheel and the thrust piece (ill. 2).
5. Position the packing extractor by carefully inserting it into the upper part (ill. 3).
6. Screw the packing extractor into the packing tube by turning it to the left while simultaneously pressing down (ill. 4).
7. Pull up the packing tube by lifting the packing extractor and simultaneously turning it to the left while holding the valve (ill. 5).
8. Fit in the new tube.
9. Fit in the thrust bearing and the handwheel, respectively the cap.

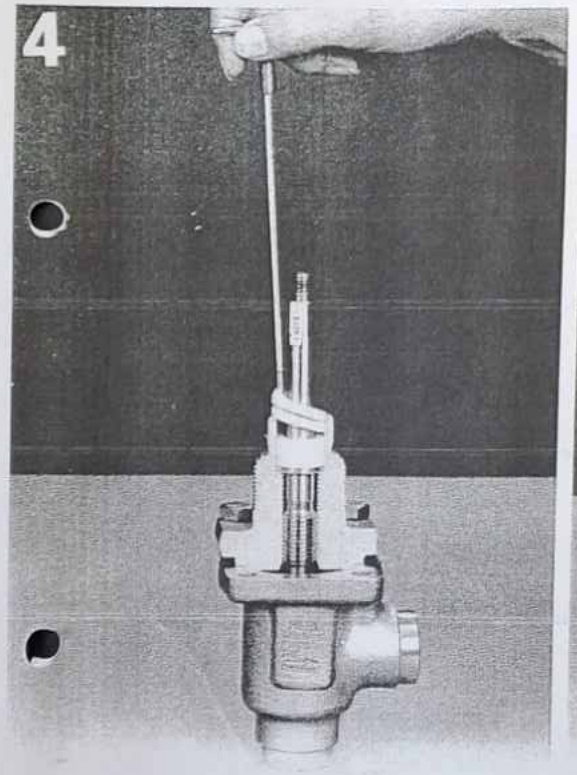
* (also applicable for O-Rings)

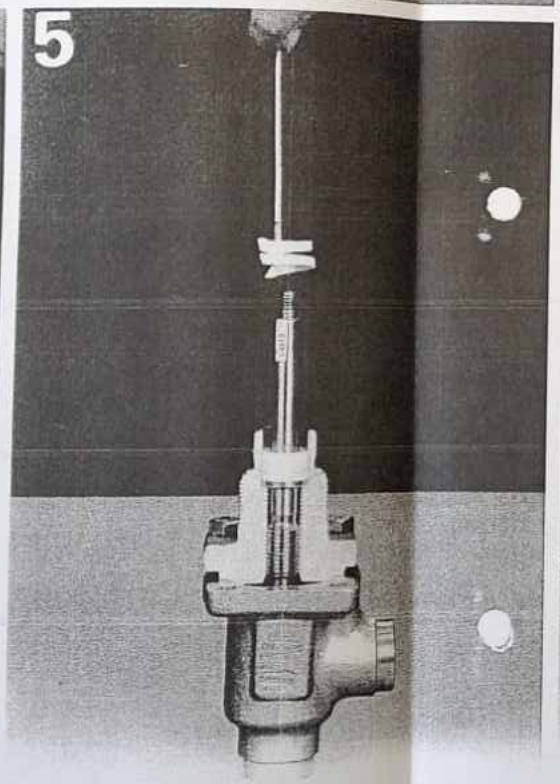
HERL

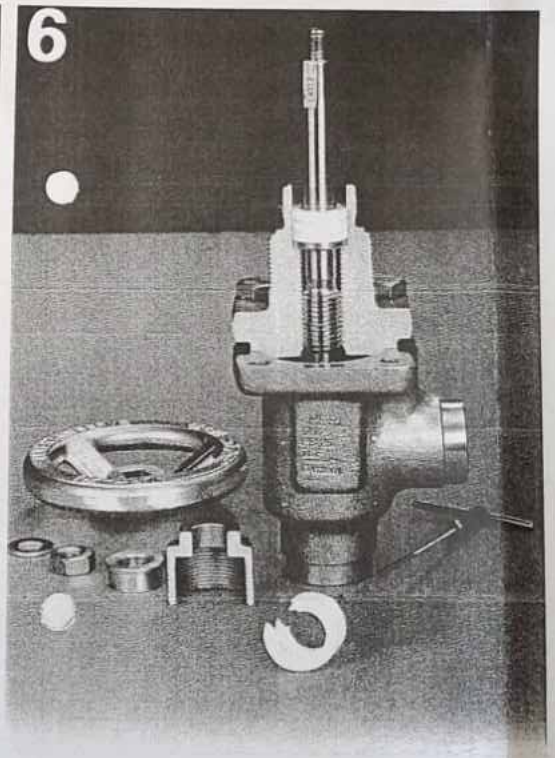












Anleitung zum Austauschen von Packungen* in HERL-Ventilen

Erforderliches Werkzeug ist ein Packungszieher der Fa. HERL (Bild1). Folgende Arbeitsschritte sind erforderlich:

1. Demontage der Kappe (falls vorhanden). Das seitliche Loch in der Kappe darf dabei nicht verstopft sein, damit das eventuell unter Druck stehende Kältemittel nach den ersten Umdrehungen aus der Kappe entweichen kann. Die demontierende Person muß dabei so arbeiten, daß sie nicht unmittelbar mit austretendem Kältemittel in Berührung kommt.
2. Montage des Handrades.
3. Ventil ganz öffnen, wieder um 90° schließen und anschließend mit einem Ruck gegen die Rückdichtung öffnen. (Zur Sicherheit des ausreichenden Abdichtens der Rückdichtung)
4. Demontage des Handrades, der Stopfbuchsmutter und der Stopfbuchsbüchse. (Bild 2)
5. Ansetzen des Packungziehers möglichst am äußeren Rand der Packung um ein Verletzen der Spindeloberfläche zu vermeiden.
6. Eindrehen des Packungsziehers in die Packung durch Drehen nach rechts (Bild 3).
7. Ziehen der oberen Packungsringe durch Anheben des Packungsziehers bei gleichzeitigem Festhalten des Ventils. (Bild 4+5).
8. Entfernen aller weiteren Ringe auf gleiche Art und Weise.
9. Montage der neuen Ringe (Anzahl Ringe pro Packungseinheit beachten!).
Es muß beachtet werden, daß die Öffnung der aufeinanderliegenden Ringe immer um 90° versetzt montiert wird.
10. Montage der Stopfbuchsbüchse, Stopfbuchsmutter und des Handrades bzw. der Kappe.

* (ebenfalls anzuwenden für O-Ringe)

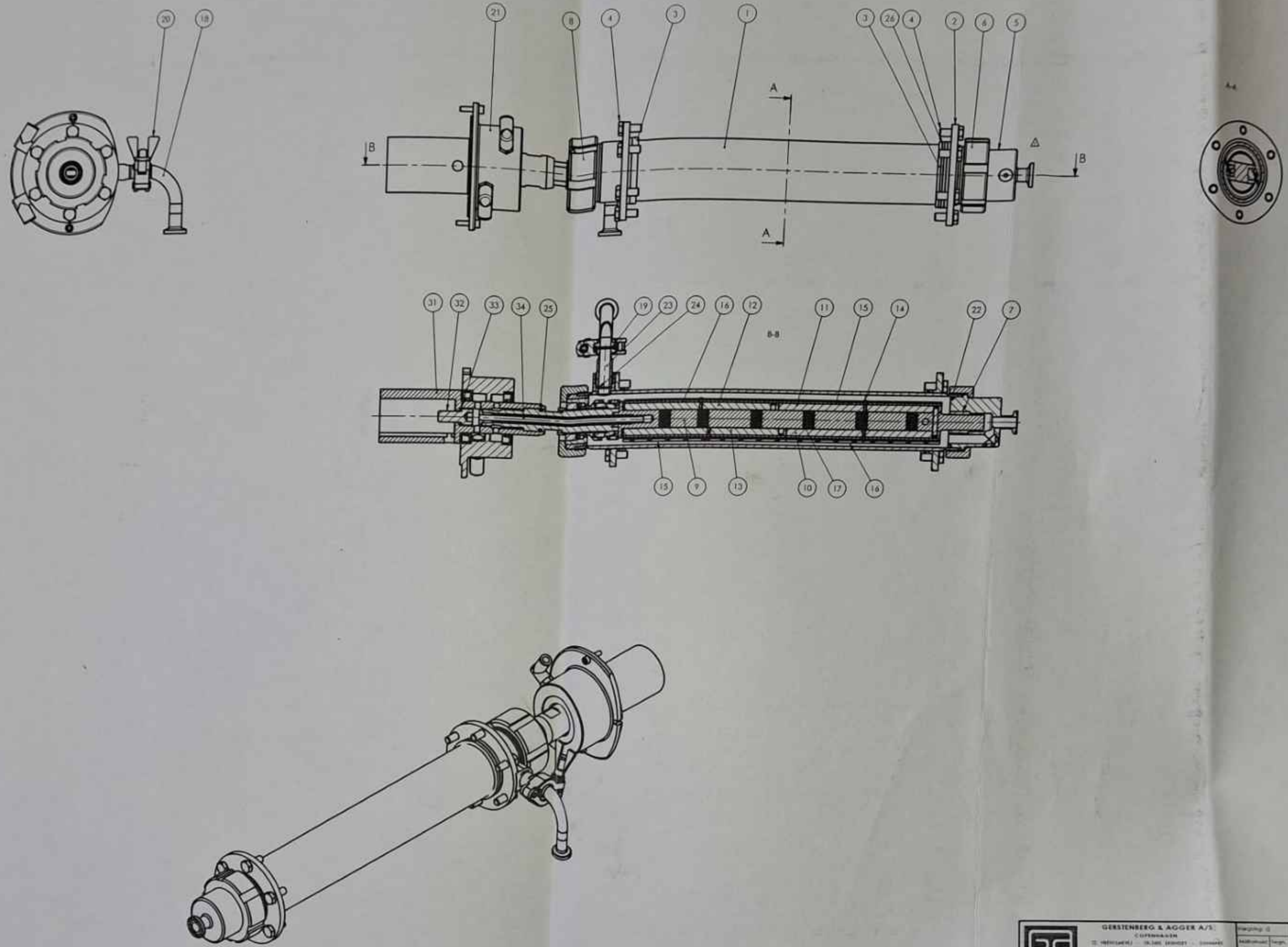
Instruction for the Replacement of Packings* in HERL-valves

The required tool is a HERL packing extractor (ill. 1). The following steps are necessary:

1. If present, remove the cap. In this process, the hole in the side of the cap must not be clogged so that the refrigerating agent which might be under pressure can escape from the cap following the initial rotations. The person performing this work must avoid coming into direct contact with the escaping refrigerating agent.
2. Mount the handwheel.
3. Open the valve completely, and close it again by 90°. Then open it with a jerk against the backseating (to ensure that the backseating tightens adequately).
4. Remove the handwheel, the stuffing box nut and the stuffing box case. (ill. 2).
5. Place the packing extractor close to the outer edge of the packing as possible in order to prevent the spindle surface from being damaged.
6. Screw the packing extractor into the packing by turning it to the right (ill. 3)
7. Pull up the upper packing rings by lifting the packing extractor and simultaneously holding the valve (ill. 4+5).
8. Remove all remaining rings in the same manner.
9. Fit in the new rings (observe the number of rings for each packing unit!). Bear in mind that the opening of the stacked rings is always assembled at a displacement angle of 90°.
10. Mount the stuffing box case, the stuffing box nut and the handwheel, respectively the cap.

* (also applicable for O-Rings)

HERL



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#	Date	Revision	Name

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DuPont™ Suva®
refrigerants

AS-1

Safety of DuPont™ Suva® Refrigerants

DuPont Answers Your Questions about the Safe Handling and Use of DuPont™ Suva® Refrigerants

DuPont™ Suva® Refrigerants

DuPont™ Suva® refrigerants, which are composed of hydrochlorofluorocarbon (HCFC) and hydrofluorocarbon (HFC) compounds, were developed as safe, effective alternatives to existing chlorofluorocarbon (CFC) refrigerants.

Suva® 123 (R-123) is the DuPont brand name for HCFC-123 refrigerant, which is a replacement for CFC-11 in centrifugal chillers.

Suva® 124 (R-124) is the DuPont brand name for HCFC-124 refrigerant, which will have application in some CFC-114 systems and is also a component of Suva® MP blends.

Suva® 125 (R-125) is the DuPont brand name for HFC-125, which is a component of some Suva® blends.

Suva® 134a (R-134a) and **Suva® 134a Auto** are DuPont brand names for HFC-134a refrigerant, which is a primary replacement for CFC-12.

Suva® MP service refrigerants are ternary blends of HCFC-22, HFC-152a, and HCFC-124 that have been developed as replacements for CFC-12 and R-500 in a variety of applications.

- **Suva® MP39** (R-401A) is a replacement for CFC-12 in medium-temperature stationary positive displacement air-conditioning and refrigeration systems.
- **Suva® MP66** (R-401B) is a replacement for CFC-12 in low-temperature stationary refrigeration applications and in some transport refrigeration equipment. Suva® MP66 is also the recommended alternative for existing R-500 systems.

Suva® 409A (R-409A) is a ternary blend of HCFC-22, HCFC-124, and HCFC-142b that has been developed as a replacement for CFC-12 in stationary positive displacement air-conditioning and refrigeration equipment.

Suva® HP62 (R-404A) refrigerant is a ternary blend of HFC-125, HFC-143a, and HFC-134a that has been developed as a long-term replacement for R-502 and some R-22 refrigeration applications in high-, medium-, and low-temperature ranges. Suva® HP62 can also be used to retrofit existing R-502 equipment.

Suva® 507 (R-507) is a binary blend of HFC-125 and HFC-143a that has been developed as a long-term replacement for R-502 in commercial refrigeration equipment. It can be used in new or existing R-502 systems.

Suva® HP service refrigerants are ternary blends of HFC-125, HC-290, and HCFC-22 that have been developed as replacements for R-502 primarily for retrofitting existing systems.

- **Suva® HP80** (R-402A) is a primary service refrigerant replacement for R-502 in medium- and low-temperature refrigeration; it has discharge temperatures equivalent to R-502.
- **Suva® HP81** (R-402B) is the preferred replacement for R-502 in limited applications where a 10 to 20°F increase in compressor discharge temperature is desirable, such as some ice machines and other self-contained equipment.

The miracles of science™

Table 1
Physical Properties of DuPont™ Suva® Refrigerants

Product	Composition, wt%	Average Boiling Point °C (°F) at 1 atm	Occupational Exposure Limit* (ppm v/v)
Suva® 123	100% HCFC-123	27.8 (82)	50
Suva® 124	100% HCFC-124	-10.8 (12.2)	1,000
Suva® 125	100% HFC-125	-48.3 (-55.3)	1,000
Suva® 134a	100% HFC-134a	-26 (-15)	1,000
Suva® MP39	53% HCFC-22/13% HFC-152a/34% HCFC-124	-36.1 (-33)	1,000
Suva® MP66	61% HCFC-22/11% HFC-152a/28% HCFC-124	-34.7 (-30.4)	1,000
Suva® 409A	60% HCFC-22/25% HCFC-124/15% HCFC-142b	-34 (-30)	1,000
Suva® HP62	44% HFC-125/52% HFC-143/4% HFC-134a	-46.4 (-51.6)	1,000
Suva® 507	50% HFC-125/50% HFC-143a	-46.7 (-52.1)	1,000
Suva® HP80	60% HFC-125/2% HC-290/38% HCFC-22	-49.2 (-56.5)	1,000
Suva® HP81	38% HFC-125/2% HC-290/60% HCFC-22	-47.3 (-53.2)	1,000
Suva® 408A	7% HFC-125/46% HFC-143a/47% HCFC-22	-44 (-46.3)	1,000
Suva® 407C (9000)	23% HFC-32/25% HFC-125/52% HFC-134a	-43.6 (-46.4)	1,000
Suva® 410A (9100)	50% HFC-32/50% HFC-125	-51.5 (-60.8)	1,000
Suva® 95	46% HFC-23/54% FC-116	-88 (-126.5)	1,000

*The occupational exposure limits listed are either the DuPont Acceptable Exposure Limit (AEL) or Threshold Limit Value (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH).

Suva® 408A (R-408A) is a ternary blend of HFC-125, HFC-143a, and HCFC-22. It has been developed as a replacement for R-502 in existing low- and medium-temperature commercial refrigeration equipment. It is an option to Suva® HP80 where lower operating pressures are desired; however, it does have higher compressor discharge temperatures.

Suva® 407C (9000) is a ternary blend of HFC-32, HFC-125, and HFC-134a. It has been formulated as a similar pressure replacement for HCFC-22 in new or existing air-conditioning equipment and heat pumps.

Suva® 410A (9100) is a binary blend of HFC-32 and HFC-125. It is a high-pressure replacement for HCFC-22 for new air-conditioning applications.

Suva® 95 (R-508B) is an azeotropic mixture of HFC-23 and PFC-116, designed as a replacement for R-503, CFC-13, and HFC-23 in very low-temperature applications (below –40°F [-40°C] evaporator temperature).

Table 1 provides a quick summary of these refrigerants, including composition, boiling point, and acceptable exposure limit (AEL) information.

This technical bulletin answers common safety questions, discusses potential symptoms of overexposure, and provides first aid and medical advice for effects of overexposure that may occur from improper use or handling of Suva® refrigerants.

Users must read and understand the Material Safety Data Sheets (MSDSs) before handling or using Suva® refrigerants. Failure to follow the MSDS instructions could result in injury or death. An MSDS can be obtained for any DuPont refrigerant from the DuPont locations listed on the last page of this technical bulletin, or from any DuPont refrigerants Authorized Distributor.

Introduction

For many years, CFCs have been used successfully as refrigerants, blowing agents, cleaning solvents, and aerosol propellants. CFCs seemed an ideal choice due to their unique combination of properties; however, the exceptional stability of these compounds, coupled with their chlorine content, has linked them to the depletion of the earth's protective ozone layer.

As a result, DuPont and many other companies have developed alternative refrigerants to replace CFCs. The DuPont series of products are based on HCFC and HFC compounds. Unlike CFCs, HFCs contain no chlorine and, therefore, have zero ozone-depletion potential (ODP). HCFCs do contain chlorine, but have up to 98% less ODP than CFCs. The presence of one or more hydrogen atoms in HCFC molecules allows them to break apart faster in the lower atmosphere so that less chlorine reaches the ozone layer.

These alternative refrigerants have similar performance characteristics to CFCs, but with greatly reduced environmental impact. Suva® refrigerants are nonflammable and offer in-use stability and zero or reduced ozone-depletion and global-warming potential. Although they are not drop-in replacements, HCFC- and HFC-based refrigerants require minimal changes to existing equipment when compared with other alternative products. For detailed discussions about retrofitting equipment with DuPont Suva® refrigerants, refer to DuPont technical bulletins ART-33, ART-34, ART-36, or ART-37.

Flammability

Are Suva® refrigerants flammable?

Suva® refrigerants are nonflammable in air at temperatures up to 100°C (212°F) at atmospheric pressure, and under normal use conditions. However, DuPont Suva® refrigerants should not be mixed with any flammable gases or liquids for any reason because these mixtures can have unpredictable flammability properties and could be unsafe.

Mixtures of some Suva® refrigerants with high concentrations of air at elevated pressure and/or temperature can become combustible in the presence of an ignition source. These products can also become combustible in an oxygen enriched environment (oxygen concentrations greater than that in air). Whether a mixture containing these products and air, or these products in an oxygen enriched atmosphere become combustible depends on the inter-relationship of 1) the temperature 2) the pressure, and 3) the proportion of oxygen in the mixture. In general, these products should not be allowed to exist with air above atmospheric pressure or at high temperatures; or in an oxygen enriched environment. **These products should NOT be mixed with air under pressure for leak testing or other purposes.**

Experimental data has also been reported which indicate combustibility of HCFC-22 and HFC-134a in the presence of chlorine. These two products are used either as pure refrigerants or as components in some of the Suva® blend refrigerants.

Refrigerants should not be exposed to open flames or electrical heating elements. High temperatures and flames can cause the refrigerants to decompose, releasing toxic and irritating fumes. In addition, a torch flame can become dramatically larger or change color if used in high concentrations of many refrigerants including R-500 or R-22, as well as many alternative refrigerants. This flame enhancement can cause surprise or even injury. Always recover refrigerants, evacuate equipment, and ventilate work areas properly before using any open flames.

Decomposition

What causes decomposition?

Refrigerants will decompose when exposed to high temperatures from flames or electric resistance heaters. Decomposition may produce toxic and irritating compounds, such as hydrogen chloride and hydrogen fluoride.

How can I tell if a refrigerant has decomposed?

The strong odors released from the decomposed refrigerant will irritate your nose and throat. The irritating nature of these fumes released from decomposition will usually force you to evacuate the area. Follow all DuPont recommendations for refrigerant handling to prevent refrigerant decomposition and other hazards.

Are decomposition products hazardous?

Yes. The acidic vapors produced are dangerous and the area should be evacuated immediately and ventilated to prevent exposure to personnel. Anyone exposed to the decomposition products should be taken to fresh air and given medical treatment immediately. **Do not attempt to continue working in these fumes, they can injure you.**

Inhalation Toxicity

Are Suva® refrigerants toxic?

Suva® refrigerants pose no acute or chronic hazard when they are handled in accordance with DuPont recommendations and when exposures are maintained at or below recommended exposure limits, such as the DuPont Acceptable Exposure Limit (AEL).

What is an AEL?

An AEL is an acceptable exposure limit established by DuPont. AELs specify a time-weighted average (TWA) airborne concentration for which nearly all workers may be repeatedly exposed without adverse effects during an 8- or 12-hour day or 40-hour work week. In practice, short-term exposures should not exceed three times the established exposure limit (AEL, PEL, TLV, or other index) published by the manufacturer, or 1,250 ppm, **whichever is lower**. Repeated exposure to refrigerant vapors at levels above manufacturers' recommended limits may cause adverse health effects, and must be avoided.

Repair all leaks promptly and control leakage from refrigeration equipment to keep workplace refrigerant concentrations as low as possible.

What is a STEL or EEL?

A short-term exposure limit (STEL) is a 15-minute TWA exposure which should not be exceeded at any time during the work day. Emergency exposure limits (EEL) specify airborne concentrations for brief periods which should not result in permanent adverse health effects during emergencies. EELs are established by DuPont for a time period of up to one hour with a not-to-exceed ceiling limit. These limits should be considered an aid in planning for emergencies or spills, but should not be considered a substitute for proper engineering controls. For the Suva® refrigerants, an EEL has been set only for Suva® 123. The EEL is 1,000 ppm with a ceiling limit of 2,500 ppm.

What are common symptoms of overexposure?

Inhaling high concentrations of Suva® refrigerant vapors may cause temporary central nervous system depression with narcosis (sleepiness), lethargy, and weakness. Other effects that may occur include dizziness, a feeling of well-being or intoxication, and a loss of coordination. Continued inhalation of refrigerant vapors may produce heartbeat irregularities (cardiac sensitization), unconsciousness and, with gross overexposure, even death.

A person experiencing **any** of the initial symptoms should be moved to fresh air immediately and kept calm and quiet. If not breathing, give artificial respiration. If breathing is difficult, use oxygen. Call a physician immediately. People will exhibit these effects at very different concentrations; therefore, leave a work area immediately if you notice any of these symptoms, even if others with you do not.

Mechanical Equipment Room Requirements

- Install an air monitor capable of detecting the refrigerant(s) used in concentrations up to the EEL or STEL.
- Install suitable alarms that activate at or below the refrigerant's AEL, and that will alert persons outside of the equipment room that a leak condition exists.
- Route relief valve discharge headers and purge units outdoors, away from all air intakes to building.
- Install local exhaust to ventilate the work area in the event that the air monitor alarm point is exceeded.
- Follow minimum standards for refrigerants as required and specified by ASHRAE Standard 15–1994 (or the most recent revision).

Refer to DuPont technical bulletin AS-5 for more detailed guidelines for using HCFC-123 in refrigeration and air-conditioning applications.

What is cardiac sensitization?

As with many other halocarbons or hydrocarbons, inhalation of high concentrations of Suva® refrigerants in the presence of high blood levels of the body's adrenaline may result in serious heart irregularities and possible death, an effect known as cardiac sensitization.

In experimental screening studies, test animals were exposed to various levels of refrigerant vapor followed by injection of epinephrine to simulate human stress reactions. Cardiac sensitization with Suva® refrigerant components ranges from 20,000 to 150,000 ppm or higher, well above expected exposures in the workplace. By comparison, a cardiac sensitization response is observed with CFC-11 and CFC-12 at approximately 5,000 and 50,000 ppm and higher, respectively.

Because of possible disturbances of cardiac rhythm, catecholamine drugs such as epinephrine should be considered only as a last resort in life-threatening emergencies.

Can inhaling Suva® refrigerant vapors cause suffocation?

If a large release of refrigerant occurs, vapors can concentrate near the floor or in low areas and displace available oxygen, causing suffocation. In the event of a large spill or leak, always wear proper respiratory and other personal protective equipment. Use self-contained breathing apparatus or an air-line respirator when entering confined areas such as tanks or basement areas where vapors may have accumulated. Test all work areas for available oxygen using appropriate monitoring equipment before entering. Place a second employee outside the work area when you enter, and use a lifeline to that employee.

How can I work safely on systems in enclosed areas?

1. Make sure all relief and purge vent piping is routed outdoors, and away from all air intakes to the building.
2. Make certain the area is well ventilated. Use auxiliary ventilation such as blowers or fans, if necessary, to disperse refrigerant vapors.
3. Test the work area for available oxygen before entering enclosed areas. **Do not use a leak monitor to test for oxygen.** A refrigerant leak detector will not tell you if adequate oxygen is present to sustain life.
4. Install refrigerant leakage detection and oxygen monitoring equipment in the work areas. For a discussion of leak detection equipment, see DuPont technical bulletin ARTD-27A. Also, refer to ASHRAE Standard 15-1994, "Safety Code for Mechanical Ventilation," for ventilation and air monitoring requirements for equipment rooms.

What should I do if a large refrigerant leak or spill occurs?

Do not attempt to enter the area to repair equipment until the vapors are dispersed, OR until you are equipped with proper breathing apparatus. Evacuate **everyone** until the area has been ventilated. Use blowers or fans to circulate air at the floor level and in any basement or low areas.

Is the deliberate inhalation of Suva® refrigerant dangerous?

Intentional misuse or deliberate inhalation of Suva® refrigerants **may cause death without warning**. This practice is extremely dangerous.

Can I smell Suva® refrigerants?

Most refrigerants have such a faint odor that they can be difficult to detect even at dangerous levels. Do not use smell as a test for safe levels of refrigerants in a work area. Frequent leak checks and air monitoring are the only adequate ways to determine that areas are safe for entry and work.

Skin and Eye Contact

Is skin or eye contact with Suva® refrigerants hazardous?

At room temperature, Suva® refrigerant *vapors* have little effect on skin or eyes.

Always wear protective clothing, including long-sleeved clothing and gloves, when there is a risk of exposure to liquid refrigerants. Protection should include goggles and face shield to protect the eyes. If liquid refrigerant enters your eyes, flush them with plenty or water, then seek medical attention.

Is frostbite a possible hazard?

In liquid form, Suva® refrigerants can freeze skin or eyes on contact, causing frostbite. If you are splashed with liquid, immediately remove all clothing that contains refrigerant to prevent additional freezing. Soak the exposed area in *lukewarm* water, not cold or hot. Do not use dressings or ointments. Then seek medical attention immediately.

Pressure and Cylinder Safety

Can pressurized refrigerants ever cause a hazard?

Yes. Some of the potential hazards may include:

- In an overfilled container, vessel, or pipeline where temperature increases may become "liquid full" and immediately cause a dangerous increase in hydrostatic pressure, which can cause high-pressure leaks or even rupture of the vessel.
- A correctly filled returnable or disposable cylinder that is heated above the recommended maximum temperature of 52°C (125°F) could result in dangerously high pressures, possibly in excess of the cylinder design pressures.
- A returnable or disposable refrigerant cylinder connected to the discharge side of refrigeration or air-conditioning equipment may be exposed to pressures that can exceed the capacity of the cylinder relief devices, causing the cylinder to rupture or shatter.

DuPont owns returnable refrigerant cylinders and ton tanks. No returnable container may be refilled by a user without DuPont consent. United States Department of Transportation regulations forbid transportation of returnable cylinders refilled without DuPont authorization.

What are the proper procedures for safely handling disposable and returnable cylinders?

- Remove liquid from the cylinder when charging any Suva® blend. Once removed from the cylinder it can be flashed to vapor for charging.
- Verify proper hookup of charging hoses. Do not charge to the discharge side of the compressor.
- Open valves slowly.
- Protect cylinders from moisture and rusting during storage.
- Verify that the refrigerant label matches any color code or labeling used on the equipement.
- Do not tamper with any relief devices on cylinders or refrigerant equipment.
- Do not drop, dent, or mechanically abuse containers.
- Do not recharge disposable or refillable cylinders with used refrigerants.
- Do not use disposable cylinders as compressed air tanks.
- Do not force connections.
- Do not use flame on cylinders to heat them. Never expose cylinders to temperatures above 52°C (125°F).

General Precautions for Handling Suva® Refrigerants

- **Never** pressurize systems or vessels containing Suva® refrigerants with air for leak testing or any other purpose.
- **Never** heat cylinders above 52°C (125°F). Do not place cylinders near flames or heat sources, or discard into fires.
- **Never** use torches or open flames to heat cylinders during refrigerant charging operations.
- **Never** tamper with valves or pressure relief devices.
- **Never** refill disposable cylinders with ***anything***. Any refrigerant heels should be used or transferred to recovery containers, and the empty cylinder should be properly disposed of.
- **Never** refill disposable or returnable cylinders with reclaimed refrigerants or lubricants. Use only proper recovery cylinders for this purpose. It is illegal to ship original cylinders with used refrigerants.
- **Never use disposable refrigerant cylinders as compressed air tanks**. Refrigerant cylinders are not coated properly on the inside, and moisture from compressed air will cause corrosion. This can weaken the cylinder and cause a violent rupture. There may be NO evidence of cylinder weakening until it fails.
- **Always** store refrigerant cylinders in a dry area. Storage in damp areas may permit corrosion, which will weaken the cylinders over time. Also do not store in direct sunlight where cylinder temperatures can exceed 52°C (125°F).

How should I correctly braze or weld piping on refrigeration or air-conditioning equipment?

- Make certain there is adequate ventilation in the work area, and that you have tested the air space for safe levels of refrigerant vapor and oxygen.
- Evacuate the Suva® refrigerant from the equipment you will be repairing. Recover the refrigerant into a proper recovery cylinder. **Do not vent refrigerant**.
- Purge system with nitrogen if available. If not, open the system and ensure no residual pressure is present. Drain all lubricant possible from the area to be welded to prevent fires.
- Leave system open during repair to prevent pressure buildup.
- Use auxiliary ventilation to disperse any fumes or decomposing refrigerant that may have remained in the piping or equipment during the repair process.
- If you notice an increase in the size or shape of the open flame, or the flame changes color, stop work immediately and reventilate the equipment. This flame enhancement effect should be a warning that too much refrigerant vapor is still present around the equipment.

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The MSDS format adheres to the standards and regulatory requirements of the United States and may not meet regulatory requirements in other countries.

"SUVA" 507
6123FR Revised 30-AUG-2001

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification

"SUVA" is a registered trademark of DuPont.

Corporate MSDS Number : DU007297

Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont Chemical Solutions Enterprise
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS
Product Information : 1-800-441-7515
Transport Emergency : CHEMTREC 1-800-424-9300
Medical Emergency : 1-800-441-3637

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
HFC-125	354-33-6	50
HFC-143a	420-46-2	50

HAZARDS IDENTIFICATION

Potential Health Effects

Potential Health Effects

SKIN CONTACT

Immediate effects of overexposure may include: Frostbite, if liquid or escaping vapor contacts the skin. Significant skin permeation, and systemic toxicity, after contact appears unlikely.

INHALATION

Gross overexposure may cause: Central nervous system depression with dizziness, headache, confusion, incoordination, drowsiness or unconsciousness. Suffocation, if air is displaced by vapors. Based on animal data, this material may cause: Irregular heart beat with a strange sensation in the chest, "heart thumping", cardiac

(HAZARDS IDENTIFICATION - Continued)

arrhythmias, apprehension, lightheadedness, feeling of fainting, dizziness, inadequate circulation, weakness, sometimes progressing to loss of consciousness and death.

At flame temperatures, this material can decompose to hydrogen fluoride which can be lethal at much lower concentrations.

ADDITIONAL HEALTH EFFECTS

Increased susceptibility to the effects of this material may be observed in persons with pre-existing disease of the: cardiovascular system.

Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

FIRST AID MEASURES

First Aid

INHALATION

If inhaled, immediately remove to fresh air. Keep person calm. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash contaminated clothing before reuse. Treat for frostbite if necessary by gently warming affected area.

EYE CONTACT

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION

Ingestion is not considered a potential route of exposure.

Notes to Physicians

Because of possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, should only be used with special caution in situations of emergency life support.

FIRE FIGHTING MEASURES

\# Flammable Properties

Flash Point : No flash point

Flammable Limits in Air, % by Volume:
LEL : None per ASTM E681
UEL : None per ASTM E681
Autoignition: Not determined

Fire and Explosion Hazards:

Cylinders may rupture under fire conditions. Decomposition may occur.

Contact of welding or soldering torch flame with high concentrations of refrigerant can result in visible changes in the size and color of torch flames. This flame effect will only occur in concentrations of product well above the recommended exposure limit, therefore stop all work and ventilate to disperse refrigerant vapors from the work area before using any open flames.

R-507 is not flammable in air at temperatures up to 100 deg C (212 deg F) at atmospheric pressure. However, mixtures of R-507 with high concentrations of air at elevated pressure and/or temperature can become combustible in the presence of an ignition source. R-507 can also become combustible in an oxygen enriched environment (oxygen concentrations greater than that in air). Whether a mixture containing R-507 and air, or R-507 in an oxygen enriched atmosphere becomes combustible depends on the inter-relationship of 1) the temperature 2) the pressure, and 3) the proportion of oxygen in the mixture. In general, R-507 should not be allowed to exist with air above atmospheric pressure or at high temperatures; or in an oxygen enriched environment. For example: R-507 should NOT be mixed with air under pressure for leak testing or other purposes.

Extinguishing Media

As appropriate for combustibles in area.

Fire Fighting Instructions

Cool cylinder with water spray or fog. Self-contained breathing apparatus (SCBA) is required if cylinders rupture and contents are released under fire conditions. Water runoff should be contained and neutralized prior to release.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Accidental Release Measures

Ventilate area (using forced ventilation), especially low or enclosed places where heavy vapors might collect. Remove open flames. Use self-contained breathing apparatus (SCBA) for large spills or releases.

HANDLING AND STORAGE

Handling (Personnel)

Avoid breathing high concentrations of vapor. Avoid contact of liquid with eyes and prolonged skin exposure. Use with sufficient ventilation to keep employee exposure below recommended limits.

Contact with chlorine or other strong oxidizing agents should also be avoided. See Fire and Explosion Data section.

Storage

Do not heat above 52 C (126 F). Store in a clean, dry place.

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Refrigerant concentration monitors may be necessary to determine vapor concentrations in work areas prior to use of torches or other open flames, or if employees are entering enclosed areas.

Exposure Guidelines

Applicable Exposure Limits

HFC-125

PEL	(OSHA)	: None Established
TLV	(ACGIH)	: None Established
AEL *	(DuPont)	: 1000 ppm, 8 & 12 Hr. TWA
WEEL	(AIHA)	: 1000 ppm, 4900 mg/m3, 8 Hr. TWA

HFC-143a

(Applicable Exposure Limits - Continued)

PEL	(OSHA)	: None Established
TLV	(ACGIH)	: None Established
AEL *	(DuPont)	: 1000 ppm, 8 & 12 Hr. TWA
WEEL	(AIHA)	: 1000 ppm, 8 Hr. TWA

* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

PHYSICAL AND CHEMICAL PROPERTIES

Physical Data

% Volatiles	: 100 %
Evaporation Rate	: >1
Solubility in Water	: Not Determined
Odor	: Ethereal (slight).
Form	: Liquified Gas.
Color	: Clear, Colorless.
Boiling Point	: -46.9 C (-52.4 F) @ 1 atm
Vapor Pressure	: 184.9 psia @ 25 C (77 F)
Specific Gravity	: 1.079 @ 25 C (77 F)

STABILITY AND REACTIVITY

Chemical Stability

Stable at normal temperatures and storage conditions.

However, avoid open flames and high temperatures.

Incompatibility with Other Materials

Incompatible with active metals, alkali or alkaline earth metals--powdered Al, Zn, Be, etc.

Decomposition

Decomposition products are hazardous. This material can be decomposed by high temperatures (open flames, glowing metal surfaces, etc.) forming hydrofluoric acid and possibly carbonyl fluoride. These materials are toxic and irritating. Contact should be avoided.

Polymerization

Polymerization will not occur.

TOXICOLOGICAL INFORMATION

Animal Data

HFC-125

INHALATION:

4 hour, ALC, rat: > 709,000 ppm (Very low toxicity).

Single exposure to high doses caused: Lethargy. Labored breathing. Weak cardiac sensitization, a potentially fatal disturbance of heart rhythm caused by a heightened sensitivity to the action of epinephrine. Repeated exposure caused: No significant toxicological effects.
No-Observed-Adverse-Effect-Level (NOAEL): 50,000 ppm

ADDITIONAL TOXICOLOGICAL EFFECTS:

No animal data are available to define the following effects of this material: carcinogenicity, reproductive toxicity. In animal testing this material has not caused developmental toxicity. Tests have shown that this material does not cause genetic damage in bacterial or mammalian cell cultures, or in animals. This material has not been tested for its ability to cause permanent genetic damage in reproductive cells of mammals (not tested for heritable genetic damage).

HFC-143a

Inhalation 4 hour LC50: > 540,000 ppm in rats (Very low toxicity by inhalation)

INHALATION: Single exposure to 500,000 ppm caused anaesthesia, but no mortality at 540,000 ppm. Cardiac sensitization occurred in dogs at 300,000 ppm from the action of exogenous epinephrine. Two, 4-week inhalation studies have been conducted. In the first study, pathological changes in the testes were observed at all exposures concentrations; no effects were observed in females. The testicular effect was considered related to the method used to expose the rats to HFC-143a. In the second study using the same exposure concentrations, no effects were noted in males at any concentration. Data from a 90-day study revealed no effects in male or female rats at exposures up to 40,000 ppm.

INGESTION: Long-term exposure caused significantly decreased body weights in male rats fed 300 mg/kg for 52 weeks, but there was no effect on mortality. During this long-term exposure study, tests in rats demonstrated no carcinogenic activity when HFC-143a was administered orally in corn oil at 300 mg/kg/day, five days a week, for 52 weeks and observed for an additional 73 weeks. Tests in animals demonstrate no developmental toxicity. No animal test

(TOXICOLOGICAL INFORMATION - Continued)

reports are available to define reproductive hazards. Tests in bacterial cell cultures demonstrate mutagenic activity, but the compound did not induce oncogenic transformation of mammalian cells in culture. HFC-143a was not mutagenic in animals.

ECOLOGICAL INFORMATION

Ecotoxicological Information

AQUATIC TOXICITY:

HFC-143a

The compound is very low to slightly toxic.
96 hr. LC50, rainbow trout: > 40 mg/L.

DISPOSAL CONSIDERATIONS

Waste Disposal

Comply with Federal, State, and local regulations. Reclaim by distillation or remove to a permitted waste disposal facility.

TRANSPORTATION INFORMATION

Shipping Information

DOT/IMO/IATA

Proper Shipping Name	: LIQUEFIED GAS, N.O.S. (PENTAFLUOROETHANE AND TRIFLUOROETHANE)
Hazard Class	: 2.2
UN No.	: 3163
DOT/IMO Label	: NONFLAMMABLE GAS

Shipping Containers

Tank Trucks.
Cylinders.

REGULATORY INFORMATION

U.S. Federal Regulations

TSCA Inventory Status : Listed.

TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312

Acute : No

(REGULATORY INFORMATION - Continued)

Chronic : No
Fire : No
Reactivity : No
Pressure : Yes

HAZARDOUS CHEMICAL LISTS

SARA Extremely
Hazardous Substance - No
CERCLA Hazardous Substance - No
SARA Toxic Chemical - No

OTHER INFORMATION

NFPA, NPCA-HMIS

NPCA-HMIS Rating
Health : 1
Flammability : 0
Reactivity : 1

Personal Protection rating to be supplied by user depending on use conditions.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS : MSDS Coordinator
> : DuPont Fluoroproducts
Address : Wilmington, DE 19898
Telephone : (800) 441-7515

# Indicates updated section.

This information is based upon technical information believed to be reliable. It is subject to revision as additional knowledge and experience is gained.

End of MSDS

INSTRUCTIONS
FOR
PILOT PIN WORKER 1, 2 AND 3 LITRES

WARNING

The Pilot Pinworker is a pressure vessel consisting of rotating parts, hot surfaces and electrical equipment.

This instruction contains several safety warnings.

All plant personnel must be familiar with the contents of these instructions, especially the safety warnings. Gerstenberg & Agger A/S will not assume any responsibility for personal injury or equipment damage caused by faulty operation.

30.08.2004

NOTICE

The information contained in this instruction is subject to change without notice.

Gerstenberg & Agger A/S makes no warranty of any kind with regard to this material and shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing performance, or use of this material.

IF PROBLEMS OCCUR

If you suspect a problem with this **Pilot Pin Worker**, first check with the contents of this instruction and find the indicated problem before rectification.

If you are unable to solve the problem despite all efforts using this instruction, refer to Gerstenberg & Agger A/S.

THIS INSTRUCTION

In order to allow and promote the correct use of the unit, the description under different sections shall be strictly followed. This will secure the user's safety, reduce the risk of damage to the **Pilot Pin Worker** and consequent malfunction or inefficient operation.

USERS GUIDELINES

This instruction is divided into ten sections. Sections 1 to 9 primarily deal with the essential information to the user of this unit. Each section comprises sub-sections; refer to the table of contents.

A list of spare parts and the figures conclude this instruction in section 10.

INSTRUCTIONS FOR PILOT PIN WORKER

TABLE OF CONTENTS

7. SERVICE AND MAINTENANCE

8. CLEANING AND DISINFECTING

9. DISMANTLING, ASSEMBLING AND REPLACEMENT OF MAIN PARTS AND COMPONENTS

10. LIST OF SPARE PARTS

1. GENERAL

1.1 Scope

The objective of this instruction is to assist the plant personnel engaged in the installation, maintenance and daily operation of the **PILOT PIN WORKER**. This instruction specifies the general requirements pertaining to the installation, operation, maintenance, inspection and service. It is therefore extremely important that all plant personnel are familiar with these instructions.

1.2 Application

The Gerstenberg & Agger A/S **PILOT PIN WORKER** is designed for solidification / plasticizing of margarine and similar products.

1.3 Markings

Nameplate

The information provided on the nameplate should be used as reference when contacting Gerstenberg & Agger A/S.

Health and Safety Warning Signs
In order to incorporate the health and safety aspects, the following warning signs are provided on the **PILOT PIN WORKER**

High system pressure
The unit operates under high pressure. No part of the system must be dismantled unless it is established that the system is de-pressurised and thoroughly vented.

1.4 Protection of the **PILOT PIN WORKER**

Storage and Handling

1) Store the machine in original packing until installation.
2) When unpacking do it on the place where the **PILOT PIN WORKER** is to be installed. Lifting is best done with a crane or forklift using straps under the base of the machine, taking into consideration the high gravity point.

1.5 Maintenance Tools

For this machine only std. tools are needed.

1.6 Safety Warnings

1.6.1 General

This **PILOT PIN WORKER** is a rotating machine. When in operation, do not perform service or maintenance.

Always ensure that the **PILOT PIN WORKER** rotates as the direction arrow shows.

The **PILOT PIN WORKER** must not be used for heating/cooling the chlorine containing liquids and is not compatible for heating / cooling any other product than specified.

Unless specifically stated in the contract, the unit must not be installed in an explosive environment.

1.6.2 Operation

Never operate the **PILOT PIN WORKER** at speeds higher than those specified or recommended by Gerstenberg & Agger A/S.

Never apply pressures and temperatures higher than the designed figures.

The operation of this unit is limited to solidification/plasticizing / cooling of specific liquid feeds. Never operate the unit without the product or water in the cylinder.

1.6.3 Service and Maintenance

Service and maintenance of this unit shall only be performed by personnel skilled in the maintenance of industrial machinery, and who are familiar with the contents of this instruction.

For safe operation, use only genuine spares and replacement parts supplied by Gerstenberg & Agger A/S.

Use only the approved cleaning liquids for cleaning the **PILOT PIN WORKER** parts i.e., water, dilute organic acids and CIP liquids recommended for stainless steel surfaces. When in doubt, contact Gerstenberg & Agger A/S. Do not use liquids containing chlorine under any circumstances.

2. DESIGN AND FUNCTIONAL DESCRIPTION

Drawing no. 42.098-000

2.1 Design Description

The G&A **PILOT PIN WORKER** incorporates special design features ensuring ideal solidification / plasticizing / cooling of products with effective heat transfer. The product enters at the product inlet connection of the **PILOT PIN WORKER** and flows through the cylinder while being worked up.
The high shear between rotor and stator pins incorporates the energy to the product which is necessary for making the right texture.

2.2 Functional Description

The G&A **PILOT PIN WORKER** comprises a cylindrical part mounted on the Perfector cabinet above the Perfector unit and with the motor inside the cabinet.

The cylinder/stator is a pressure vessel fitted with a row of pins. The rotor inside the stator is fitted with four rows of pins.

The product enters at the inlet connection at the front cover and is discharged through the outlet situated on top of the stator opposite the inlet.

The stator is equipped with a jacket for heating/cooling medium with inlet at the lower side and outlet at the upper side opposite the inlet.

3. TECHNICAL DATA

3.1 Design Data

	PILOT PIN WORKER
Cooling Medium	Water/Glycol
Heat Transmission Surface, m2	1l: 0.08, 2l: 0.16, 3l: 0.24
Product Viscosity Range, cP	5,000 – 1,000,000
Design Pressure, Bar g. Product/Medium side	100.0/6.0
Test Pressure, Bar g. Product/Medium side	130/9.8
Design Temperature, °C Product/Medium side	90/90
Min. Allowed Temperature, °C	-10
Volume, litre Product/Medium side	1.0 / 0.25
Geared Motor data Installed Power, kW Horizontal Flanged Motor, RPM Frequency converter, variable sp.	4.4 900
Agitator/Rotor max recommended RPM	900
Volume litre	1, 2 and 3
Shaft diameter	Ø 25
Pin Length on shaft	25 mm, in cylinder 26 mm
Tip to tip	75 mm
Barrel cylinder inner diameter	Ø 80 mm
Barrel length, mm	1l: 235, 2l: 477, 3l: 719
Weight added to the Perfector unit	90

3.2 Dimensions

According to the enclosed drawing and the above table.

3.3 Material of Construction

All parts of the **PILOT PIN WORKER** exposed to product are made of AISI 316. However, all other exposed external parts of the unit are made of AISI 304.

3.4 Noise Level, Vibrations and Emissions

At normal operating conditions the SPL at a distance of 1 meter from the unit is measured to less than 60-dB (A). This figure however shall be taken as guidelines. A deviation up to 5-dB (A) or more may be expected depending on conditions mentioned below:

The RPM and load factor
Motor size and type
Surroundings of the unit

With a properly mounted **PILOT PIN WORKER** in accordance with the instructions, there will be no vibrations transferred to the surroundings.

4. AUXILIARY EQUIPMENT AND SYSTEM

None!

5. SETTING UP

5.1 Unpacking

It is the best to bring in the crate and open it on the place where it is to be installed.

5.2 Installing the **PILOT PIN WORKER**

The following procedure must be followed in connection with the installation of a new machine.

Check that motor voltage and frequency correspond to the actual.
The rotor rotation is anti clockwise seen from the front end. Control of the rotation direction to be made without the rotor mounted. The machine must not run dry.

Connect product inlet and outlet. Make certain that pipes are supported; the **PILOT PIN WORKER** must not act as pipe supports.

Ensure that the **PILOT PIN WORKER** has been installed in accordance with local regulations.

6. INITIAL START-UP AND OPERATION

Before the initial start-up, it is mandatory that the procedures and activities outlined in section 5 are completed and verified by the plant supervisor.

Refer to safety warnings stated in section 1.6.

During initial start-up, the unit must be filled with water.

6.1 Checklist for Connections and Settings

Before the initial start-up of the unit, the following checks are essential for safety:

- Check that the unit is mounted in accordance with the instructions.
- Check that the motor rotates in the correct direction as marked.
- Product inlet connection(s) to the unit are properly tightened.

The electrical cables for the unit are connected.

6.2 Safety Instructions

Finally check and inspect:

- Motor direction of rotation.
- Level of noise and vibration

6.3 Normal Start-up and Shutdown

During the normal start-up, the unit shall be operated without product, but with water for few minutes. The same is valid during the shutdown of the unit. This will ensure a clean interior with no residual product.

6.4 Emergency Shutdown or Power Failure

An emergency shutdown of the plant is normally activated due to critical and unacceptable deviation in the operation of the plant. When activated, the complete plant will stop functioning due to interlocks. Before any restart of the plant, the unit must be cleaned.

Prior to restarting the unit, ensure that the cause(s) for emergency stop has been investigated and the necessary action has been taken. The above mentioned activity should be repeated in case of power failure.

7. SERVICE AND MAINTENANCE

7.1 Spare Parts

All parts of the **PILOT PIN WORKER** unit are manufactured with great precision. Only genuine G&A spare parts must be used. Subsequent to commissioning of the unit, a spare parts quotation is submitted by Gerstenberg & Agger A/S, Spare Parts Department. Always maintain a complete set of recommended spare (especially wear) parts on hand.

When ordering spare parts, please state the plant order number, type and size of **PILOT PIN WORKER** unit (see nameplate), and the pos. number of the parts required. Refer to the list of parts, especially the recommended parts stated in section 10.

7.2 Regular Maintenance

7.2.1 Inspection of Key Components

Shaft seal wear rings
Rubber parts

7.2.2 Inspection of Auxiliary Equipment and System

7.3 Preventive Maintenance

7.3.1 General Instructions

The rotor requires special attention as regards the eccentricity. For dismantling and assembling, refer to section 9.2.

Monitoring the shaft seal with regard to leakage and a proper heat transfer is the most appropriate way to secure the proper function of the unit.

In order to avoid damage to the shaft seal, care shall be taken during dismantling and reassembling.

NOTE
The service and maintenance of the transmission and electrical motor is not a part of this instruction. It is strongly recommended that the user must consult the separate instructions of the supplier.

7.3.2 Time Table – Maintenance Program

The following time intervals for maintenance programme are recommended for the preventive maintenance of the product distributor unit.

After X hours of operation	To be carried out	Refer to
Each shutdown of the plant.	Visual inspection and cleaning.	Section 8
The user must determine the time interval.	Dismantle the **PILOT PIN WORKER.** Inspect and clean all components. Replace all gaskets, O-rings, seals, bearing and worn parts.	Sections 9.2

NOTE
The above time intervals for the preventive maintenance of the parts and components are based on ideal conditions of operation. The user shall determine these intervals and extent through frequent inspection during the first year of operation.

7.4 Operational Disturbances and Trouble Shooting

7.4.1 General Instructions

The causes of the operational disturbances around the **PILOT PIN WORKER** apart from other factors may be related to the rotating parts, shaft seal or heat transfer efficiency. Other causes can be related to the vibration or higher power consumption on motors due to following reasons:

- Presence of deposits in the cylinder.
- Rotor partially clogged and requires dismantling and cleaning.

7.4.2 Malfunction – Probable Causes and Remedy

Symptom: Motor tripping. Insufficient, poor or no work/ heat transfer.

CAUSES	REMEDY
Product outlet pipe partially clogged.	Clean the pipe.
Shaft or rotor deformed.	Check and replace.
Unit partially clogged with product.	Clean the unit internals.

NOTE
For each listed symptom and causes mentioned above, more than one solution is usually possible. The first solution stated is the most probable correction action for the symptom. However, if that solution does not solve the problem, perform the solutions in the order they appear until the problem is solved.

8. CLEANING AND DISINFECTING

8.1 Frequency

Equipment used for handling food products in which water or protein is a continuous phase should be cleaned and disinfected after each period of use, and at least daily.

8.2 Wet Cleaning

The basic steps of cleaning the **PILOT PIN WORKER** comprise:

- Rinsing with water to remove gross deposit. Considering the requirements, a water temperature of 40°C-70°C is recommended.
- A cleaning treatment with detergent/acid solution at an appropriate velocity and temperature so that the surface is freed from deposit.
- One or more rinses with clean potable water of adequate duration on the cleaned surfaces to remove contaminants and detergent solution.

It is extremely important that when hot solutions are used for cleaning (or disinfecting) there should be adequate and suitable air venting of the **PILOT PIN WORKER**, which might be subject to collapse if the internal pressure were reduced on subsequent cooling. The medium jacket must not be isolated with stop valves; there should always be a possibility for thermal expansion.

8.3 Common Practice and Selection

CIP (Clean-In-Place)
An automatic CIP system performs the cleaning without any manual interference. Manual cleaning of certain components and equipment can reduce the cost.

Only an automatic system can be validated due to its performance each and every time. The most appropriate way is to handle the products in completely closed cycle systems during processing and cleaning.

A CIP system will always represent additional initial investment, but the operation cost in most cases will be reduced. The application of CIP is equally important in cases when different products are processed from the unit.

The **PILOT PIN WORKER** is cleaned by supplying clean water into the cylinder immediately after the interruption of product flow through the unit. Shut-off the medium supply to the unit and let the rotor be moving. Continue the washing through the unit until the water leaving the unit is clean. The unit is now ready for connecting to the CIP system. The rotor must be jogged during the whole cleaning process.

8.4 Cleaning System without CIP-Facilities

In case of no available CIP-facilities, a separate piping system should be established to ensure re-circulation of cleaning fluid across the unit. This cleaning system can also include the plant connecting pipelines.

Step 1
Establish a re-circulation system with pump that draws the cleaning fluid from a balance tank and recirculates it through the **PILOT PIN WORKER**. The pump capacity must be sufficient to ensure a fluid flow of 2,000 litre/h. In order to prevent fouling a velocity of 2 m/sec shall be maintained in the piping.

Step 2
Open the hot water valve or steam valve and raise the temperature of the circulating water to 80°C.

NOTE
When adding the chemicals, it is important to ensure that they are thoroughly distributed in the circulating fluid.

Step 3
Alkaline Cleaning

Dissolve NaOH (Sodium hydroxide) to achieve a concentration of the circulating water to 2-2.5%. Circulate the fluid through the unit at 80°C for 20 minutes. Thereafter wash the unit with clean water at 65°C to remove any residuals of NaOH.

Step 4
Acid Cleaning

Dissolve HNO_3 (Nitric acid) to achieve a concentration of the circulating water to max. 2.5%. Circulate the fluid through the unit at 65°C for 20 minutes. Thereafter wash the unit with clean water at 65°C to remove any residuals of HNO_3.

Step 5
If the unit is not restarted immediately after cleaning, it must be drained and disinfected prior to restart. Fill the unit with hot water and raise the temperature to 90°C. Circulate the water for 10 minutes and finish with a cold flush.

NOTE
In order to establish a thorough cleaning of the unit, it is recommended to frequently inspect the interior during the first year of operation. The time intervals can be varied to suit the requirements. However, prior to changing the concentration of the chemicals, please contact Gerstenberg & Agger A/S.

9. DISMANTLING, ASSEMBLING AND REPLACEMENT OF MAIN PARTS AND COMPONENTS

9.1 General Instructions

All parts, components and accessories must be treated with extreme care during dismantling or assembling. Always place the components on clean cloth, plastic foil, corrugated cardboard or similar. Do not clean components with cotton waste. Instead use non-fluffing cloth.

When tapping on a component is required, use only a wooden or plastic hammer. Never apply diametrical force to ball bearing housings in a vice or similar holding tools.

Always apply clean oil to sealing and O-rings prior to assembly. All O-rings, seals and gaskets involved during dismantling should be replaced. For proper dismantling and assembling, use only the genuine tools.

CAUTION
Subsequent to restarting the unit, always ensure that the rotor shaft rotates freely.

9.2 Dismantling and Re-assembling of the PILOT PIN WORKER

Prior to any dismantling ensure that:

- The unit is in cold condition, empty and clean.
- The cable to the electric motor is disconnected.
- The media supply is shut-off.
- The product inlet/outlet pipes are disconnected

Dismantling Procedure

End Cover
Drawing no. 42.098-000 item 4

Unscrew the screws item 5 and remove the end cover.

- Rotor. The rotor can now be removed.

- Cylinder/Jacket Unit.

Drawing no. 42.098-000

Unscrew the 6 screws item 5 holding the cylinder front cover.

Dismantle the following items in the order mentioned:

- Rotor
- Rotor drive shaft with sealbox
- Motor console with flange
- Connection flange

9.2.2 **Assembling Procedure**

All bolts and screws must be greased with anti-seize compound before assembling.

All rubber gaskets must be greased with an approved grease to prevent damage during assembly.

Assembling procedure is carried out by doing the above described in reverse order.

- Utility and pipe connections

All product and utility can now be reconnected.

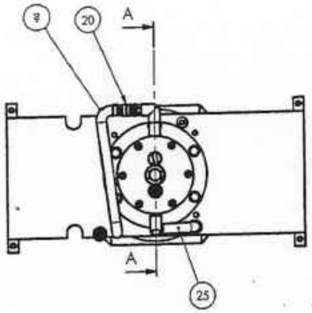
Before restart of the **PILOT PIN WORKER** we recommend to carry out the procedures described in section 6, Initial start up, and Cleaning section 8.

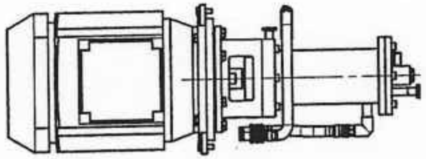
9.3 Replacement of Key Components.

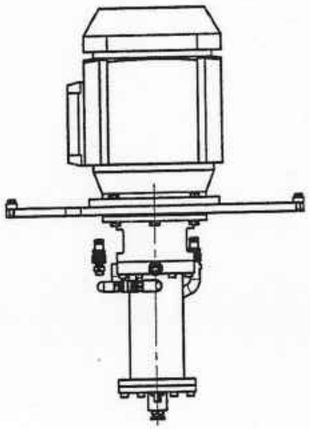
If any main part of the **PILOT PIN WORKER** is found damaged please contact **Gerstenberg & Agger A/S.**

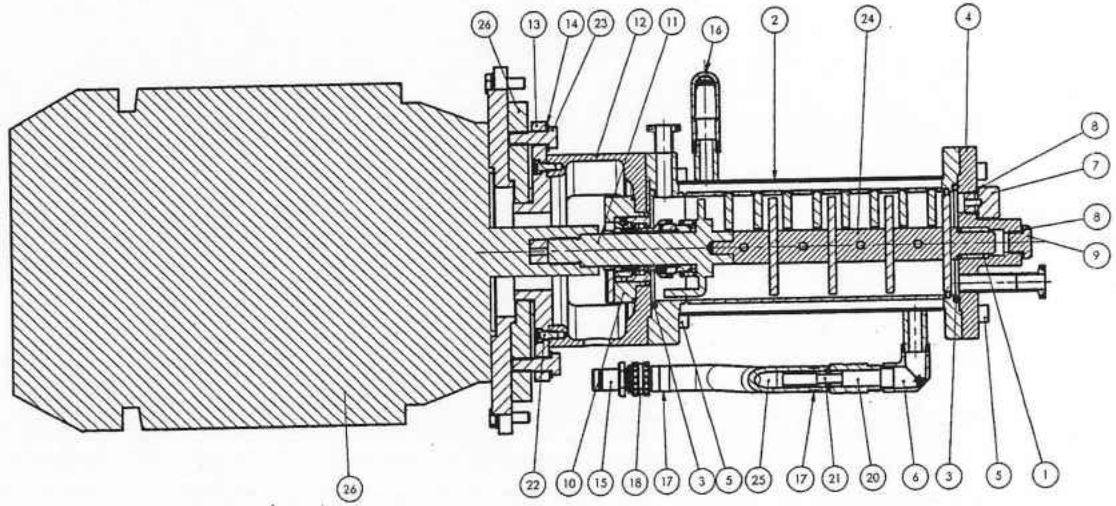
10. LIST OF SPARE PARTS

Refer to Assembling Drawing no. 42.098-000 and parts list.



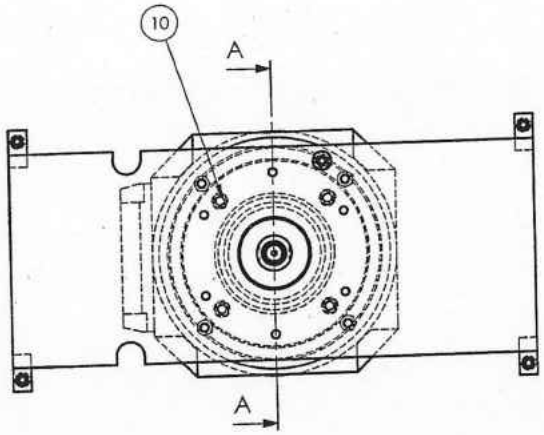


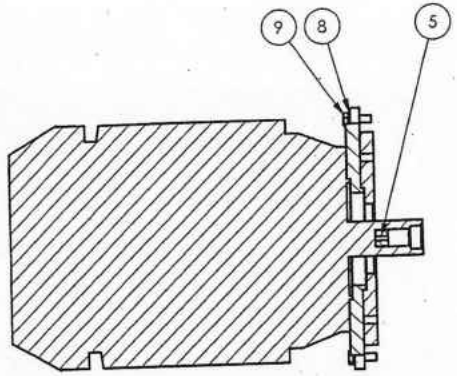




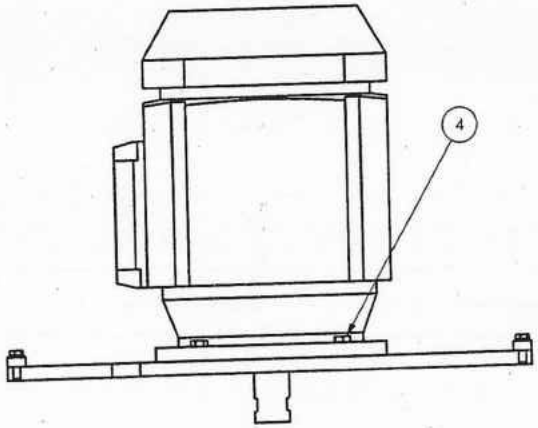
A-A (1 : 2)

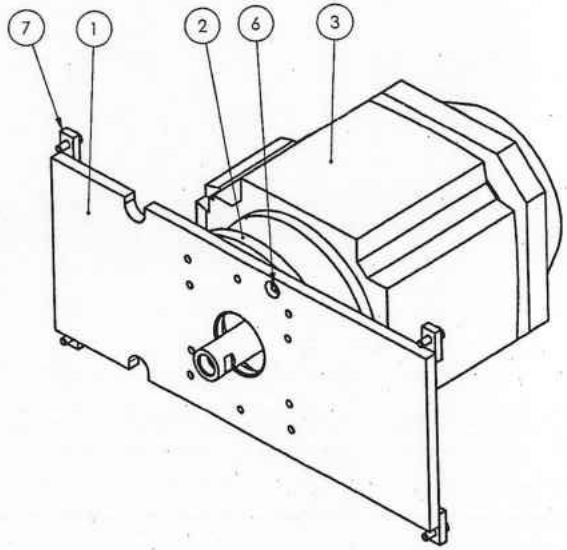
GERSTENBERG & AGGER A/S COPENHAGEN	Vægt/kg: 56.326		Date	Tegn.
	Målforhold 1:5	Tegn.	21-01-2004	am
		Kont.		
Modul Pilot Perfector Labo Pindemaskine 1 ltr Pilot Pin worker 1 ltr	42.098-000			Rev.
				A1





A-A





GERSTENBERG & AGGER A/S
COPENHAGEN
22, VIBEHOLMSVEJ - DK-2605 BRØNDBY - DANMARK
TELEFON: 43277000 - TELEFAX: 43277003
E-mail: headoffice@gerstenbergs.com

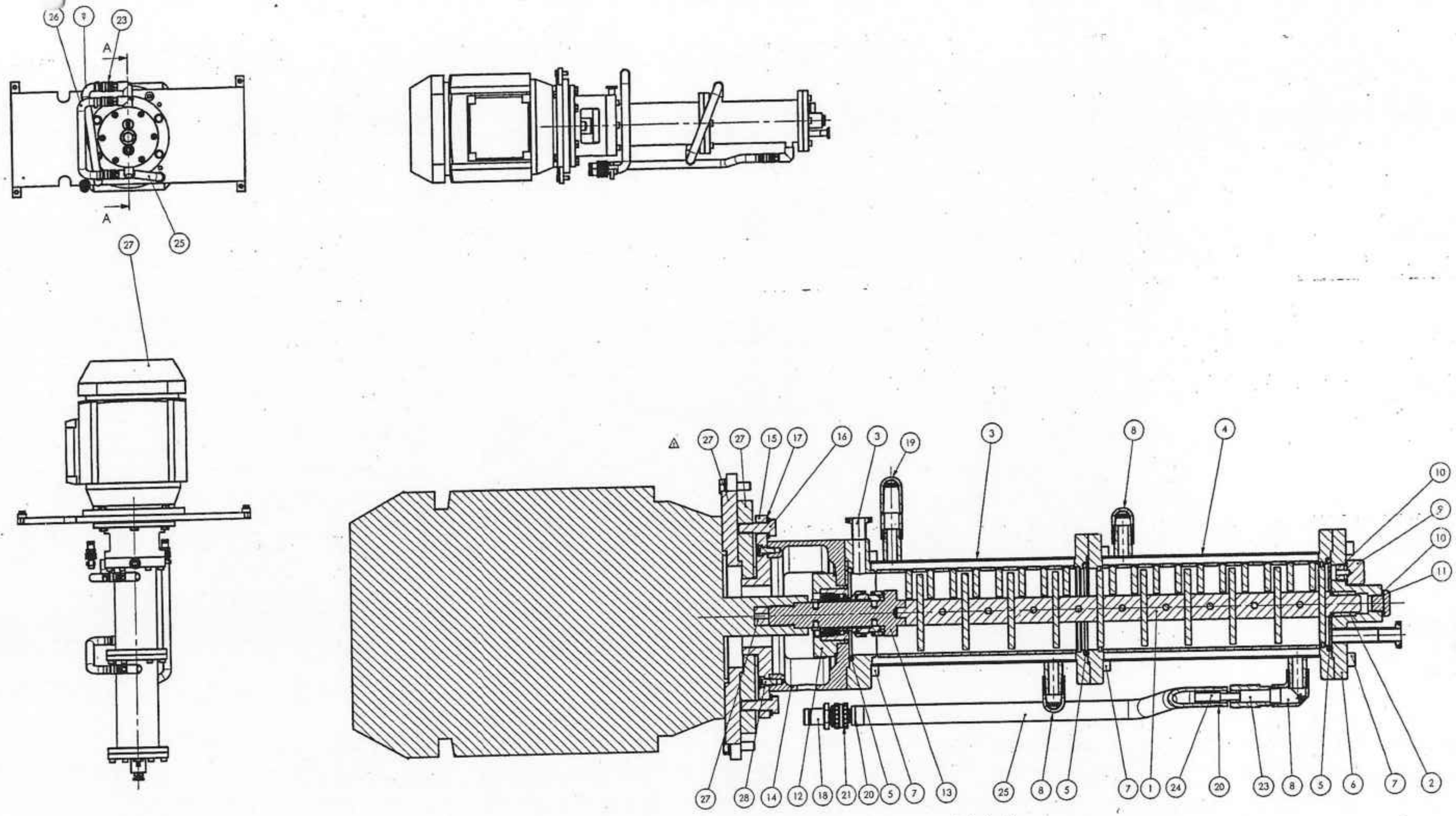
Vægt/kg: 40,058	Dato	Sign.
Målforhold 1:4	Tegn. 05-02-04	cm
	Kont. 25/2-2004	llb

Denne tegning er kun gyldig i underskrevet stand.
This drawing is only valid when handsigned.
Any amendment must be confirmed by GERSTENBERG & AGGER A/S

Modul Pilot Perfector 57
Motor transmission
Pindemaskine / Pin rotor

42.179-000 Rev.

A2



A-A (1 : 2)

#	Date	Revision	Name
2	06-02-2004	pl41.300 gearsat udgår til pl42.179 motor	CM
1	28-08-2003	slange og fittings for vand aendr., ekstr.view	CM

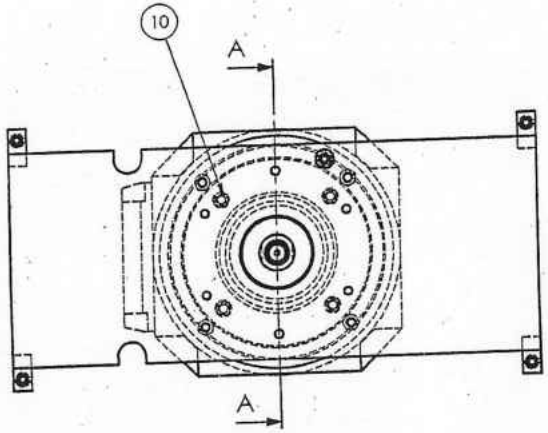
GERSTENBERG & AGGER A/S
COPENHAGEN

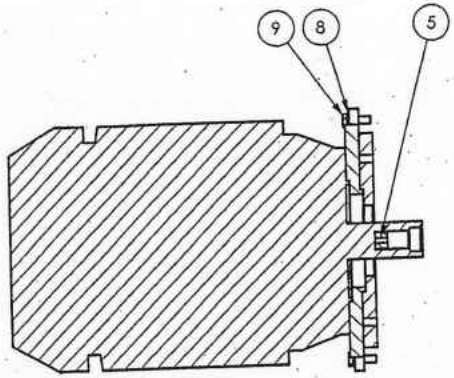
Modul Pilot Perfector
Labo Pindemaskine 2ltr
Pilot Pin worker 2ltr

		Date	Sign.
1:5	Tegn.	01-07-03	sp
	Konf.	12/2-2004	lb

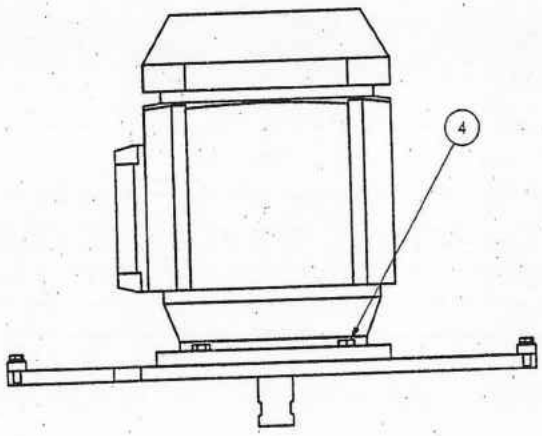
40.145-000

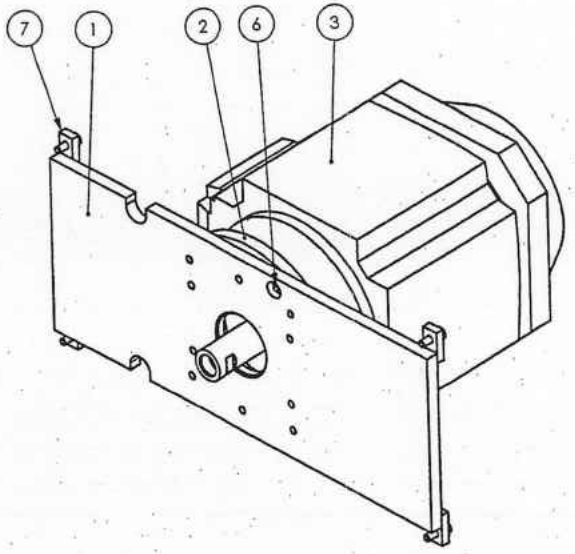
A1





A-A





GERSTENBERG & AGGER A/S
COPENHAGEN
22, VIBEHOLMSVEJ - DK-2605 BRØNDBY - DANMARK
TELEFON: 43277003 - TELEFAX: 43277003
E-mail: headoffice@gerstenbergs.com

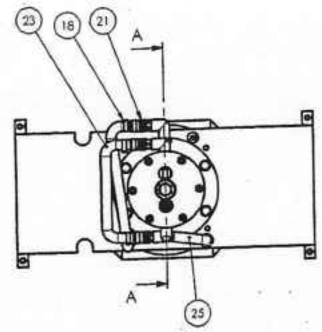
Vægt/kg: 40,058		Dato	Sign.
Målforhold	Tegn.	05-02-04	cm
1:4	Kont.	25/2-2004	IIb

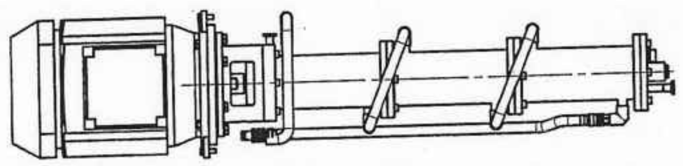
Denne tegning er kun gyldig i underskrevet stand.
This drawing is only valid when handsigned.
Any amendment must be confirmed by GERSTENBERG & AGGER A/S

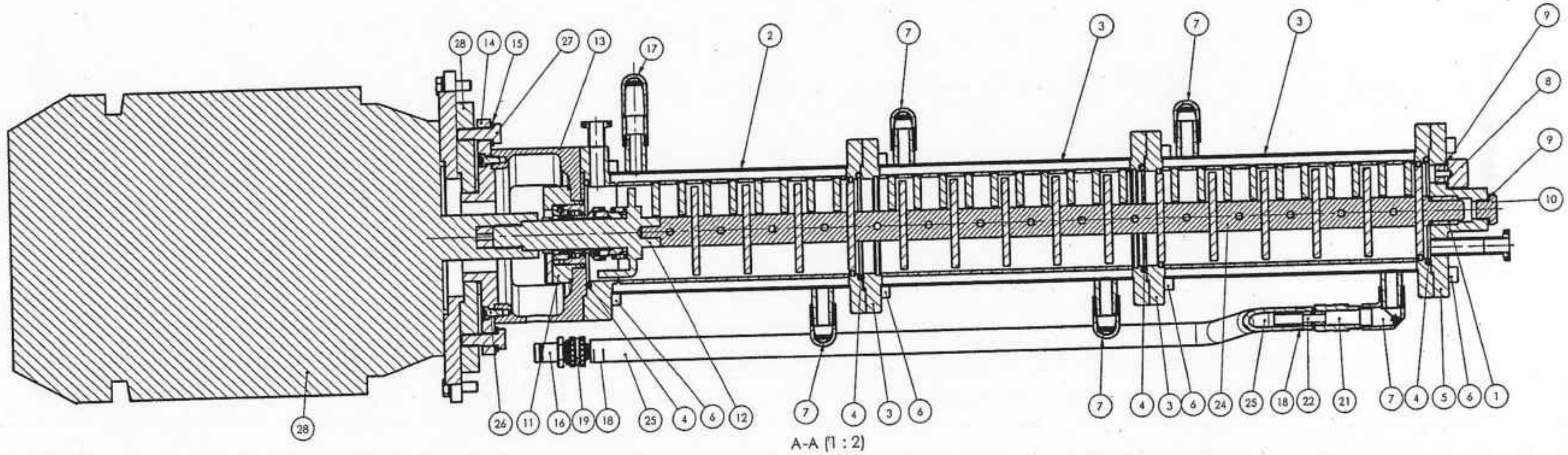
Modul Pilot Perfector 57
Motor transmission
Pindemaskine / Pin rotor

42.179-000 Rev.

A2

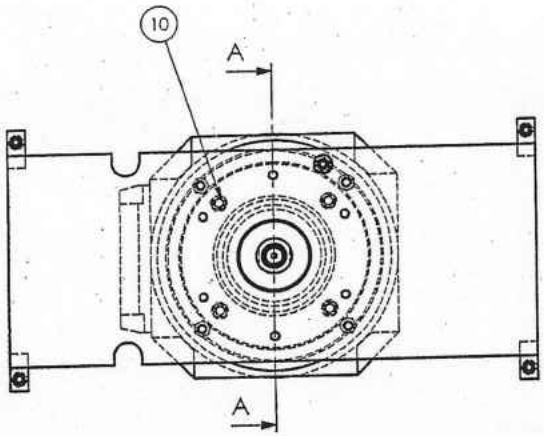


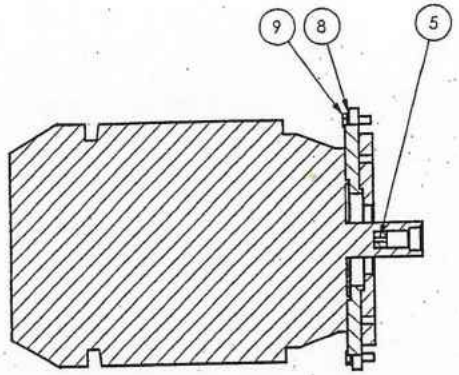




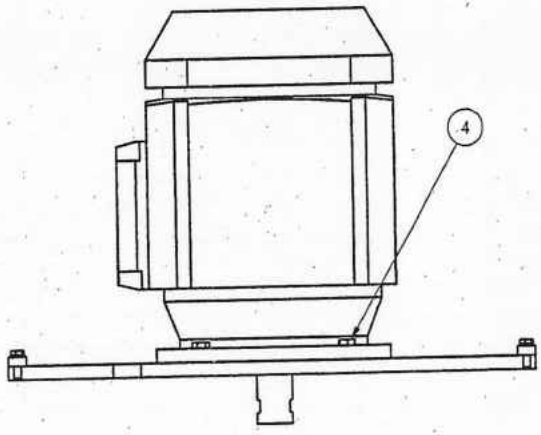
A-A (1 : 2)

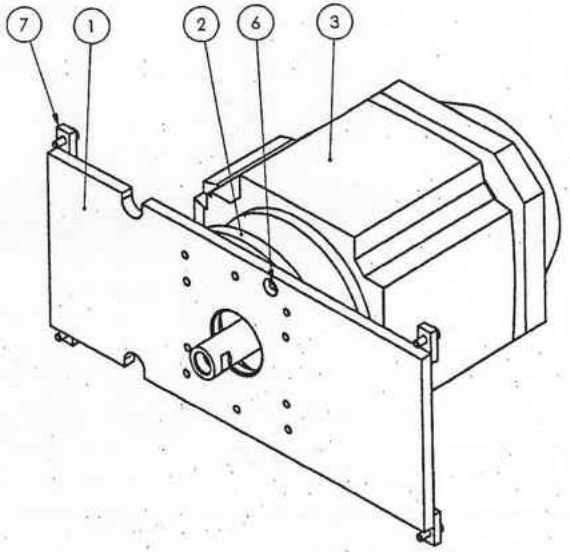
GERSTENBERG & AGGER A/S COPENHAGEN	Vægt/kg: 68,578	Date	Sign.
	Målforhold 1:5	Tegn. 20-01-04	cm
		Kont.	
Modul Pilot Perfector Labo Pindemaskine 3ltr Pilot Pin worker 3ltr	42.099-000	Rev.	
			A1





A-A





GERSTENBERG & AGGER A/S
COPENHAGEN
22. VISEHOLMSVEJ · DK-2605 BRØNDBY · DANMARK
TELEFON: 43277000 · TELEFAX: 43277003
E-mail: headoffice@gerstenberg.com

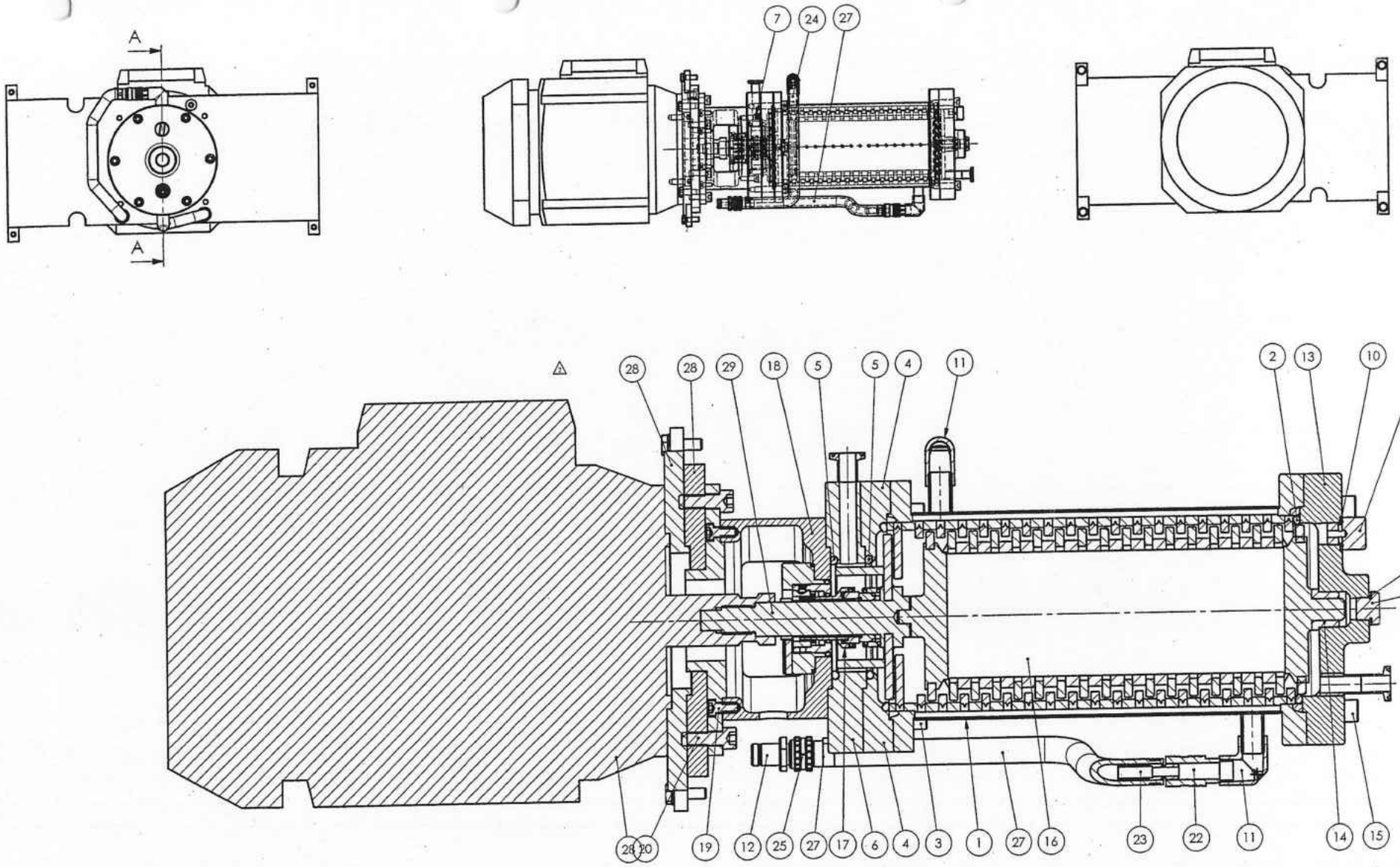
Vægt/kg: 40,058		Dato	Sign.
Målforhold	Tegn.	05-02-04	cm
1:4	Kont.	25/2-2004	llb

Denne tegning er kun gyldig i underskrevet stand.
This drawing is only valid when handsigned.
Any amendment must be confirmed by GERSTENBERG & AGGER A/S

Modul Pilot Perfector 57
Motor transmission
Pindemaskine / Pin rotor

42.179-000 Rev.

A2



SECTION A-A
SCALE 1 : 2

#	Date	Revision	Name
2	17-02-2004	pl41.300+27.336-001 ud pl42.184+40.144-004 ind	CM
1	08-09-2003	slange og fittings for vand ændret	Cm

GERSTENBERG & AGGER A/S
COPENHAGEN
22. VIBEHOLMSVEJ · DK-2605 BRØNDBY · DANMARK
TELEFON: 43277000 · TELEFAX: 43277003
E-mail: headoffice@gerstenbergs.com

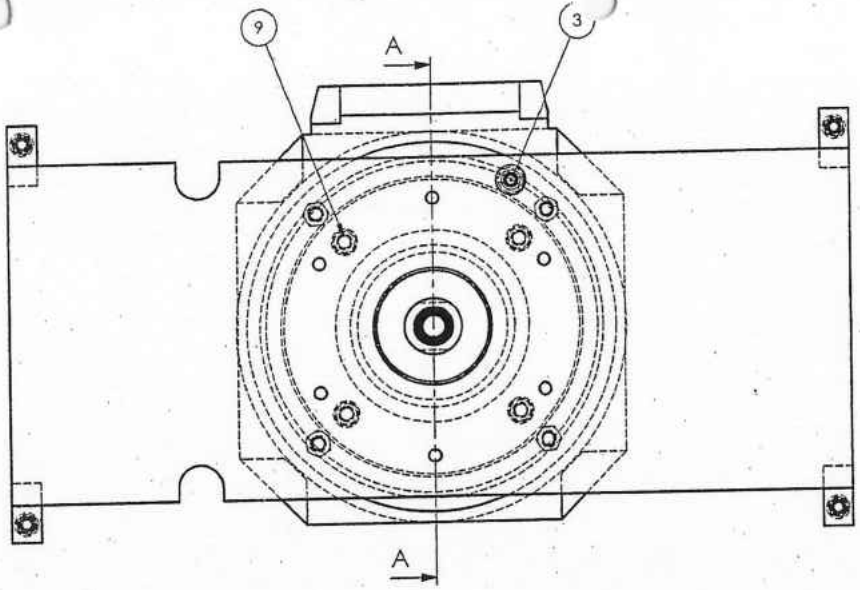
Vægt/kg: 65,455	Dato	Sign.
Målforhold	Tegn. 17-02-04	cm
1:5	Kont. 25/2-2004	llb

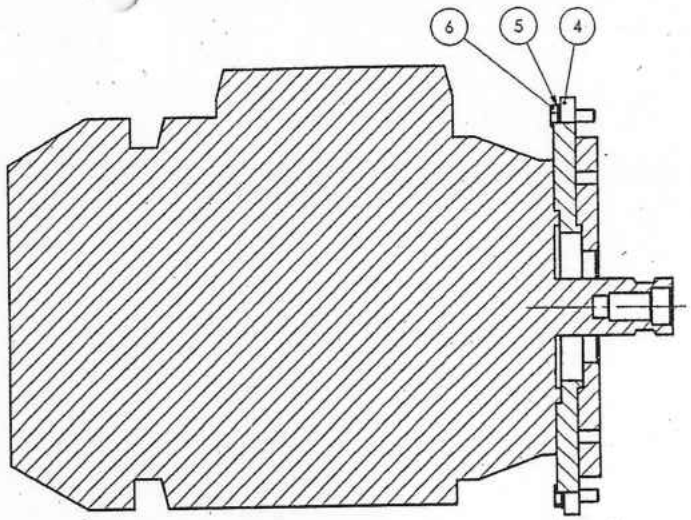
Denne tegning er kun gyldig i underskrevet stand.
This drawing is only valid when handsigned.
Any amendment must be confirmed by GERSTENBERG & AGGER A/S

Module Pilot Perfector 57
Labo fasevender, 1L
Pilot inverter, 1L

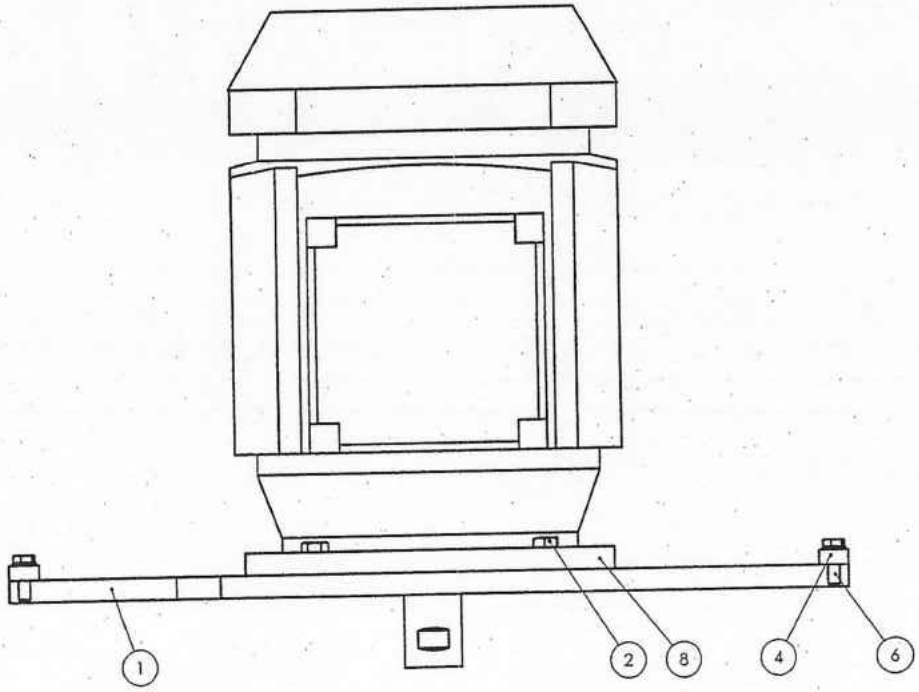
Rev.
40.144-000

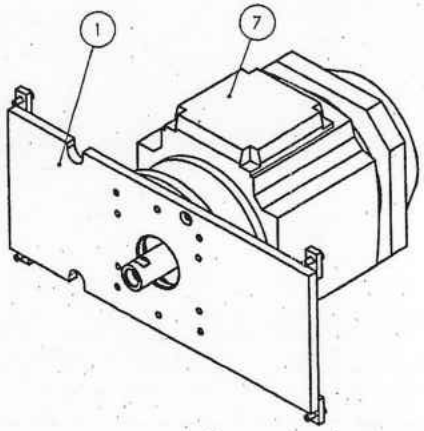
A2





A-A





GERSTENBERG & AGGER A/S
COPENHAGEN
22, VIBENHUSVEJ · DK-2605 BRØNDBY · DANMARK
TELEFON: 43277000 · TELEFAX: 43277003
E-mail: headoffice@gerstenbergs.com

Vægt/kg: 39.875	Dato	Sign.
Målforhold 1:2.5	Tegn. 09-02-04	cm
	Kont. 12/2-2004	llb

Denne tegning er kun gyldig i underskrevet stand.
This drawing is only valid when handsigned.
Any amendment must be confirmed by GERSTENBERG & AGGER A/S

Modul Pilot Perfector 57
Motor transmission
Fasevender / Inverter

42.184-000 Rev.

A2

Gerstenberg & Agger A/S

Draw.date:

Spare parts list pl42.098
Pin rotor 1L for Pilot Perfector

Position	Item number	Quantity	Description	Description
000	42.098-000	1,00	Assembly, Pin worker 1Ltr	
001	18.036b-737	1,00	Bushing 24/17x22 P/450G	
002	40.145-001	1,00	Cylinder 1ltr. for pilot pin worker	
003	140-0041	2,00	O-ring 082.00*5.00 NBR 70	
004	40.145-002	1,00	End cap for pilot pin worker	
005	160-0411	12,00	Screw M8x35, DIN 912, A2	
006	100-0078	1,00	Angle 3/8""	
007	14.986-052	1,00	Air screw 3/8"	
008	140-0536	2,00	Usit ring 24/17.4x2, A2	
009	100-0361	1,00	Plug, F1HPP, DN3/8"	
010	s28.906	1,00	Sanitary shaft seal Labo 0.7L	
011	40.144-005	1,00	Gudgeon for Pilot Percector 57	
012	40.146-002	1,00	Console body for gearmotor top	
013	40.146-001	1,00	Flange for gearmotor top	
014	160-0235	6,00	Washer ø10, DIN125A, A2	
015	310-1164	2,00	Plug-in Nipple 1/2" Theme 18220	
016	40.145-003	1,00	Angle 1/2"U-3/8"i speciel L	
017	290-0004	4,00	Hose band	
018	120-0106	2,00	Hose connection 1/2"	
019	290-0002	0,50	Hose 12.5*19.0 (1/2)	
020	310-0111	2,00	Coupling 3/8""	
021	310-0112	2,00	Nipple	
022	160-2091	6,00	SCREW-DIN7984-M06*012----------	
023	160-0102	6,00	Screw M10x30, DIN933, A2	
024	25.152-001a	1,00	Pin rotor 1 ltr.	
025	290-0002	1,00	Hose 12.5*19.0 (1/2)	
026	pl42.179	1,00	Motor transmission for Pilot Perf. 057	

Gerstenberg & Agger A/S

Draw.date:

Spare parts list pl42.179
Motor transmission for Pilot Perf. 057

Position	Item number	Quantity	Description	Description
000	42.179-000	1,00	Assembly, motor transmission for Pilot	
001	42.142-002	1,00	Plate for motor 57 BGS	
002	42.142-004	1,00	Flange for motor size 132, for MPP BC	
003	661-0005-21	1,00	MOTOR-3,8KW-B14-8P-3x380-420V/	
004	160-0101	4,00	Screw M10x25, DIN 933, A2	
005	41.300-002	1,00	Spacer for shaft	
006	160-1021	1,00	Set screw M8*12 DIN 933	
007	40.061-018	4,00	Bracket w.M8	
008	160-0234	4,00	Washer M8, DIN 125A, A2	
009	160-0098	4,00	Screw M8x25, DIN933, A2	
010	160-0343	4,00	Screw M10x25, DIN 912, A2	

Gerstenberg & Agger A/S

Draw.date:

Spare parts list pl40.145-01
Pin rotor 2L. for Pilot Perf.

Position	Item number	Quantity	Description	Description
000	40.145-000		Angle piece for water 1/2-3/8"	
001	25.152-002a	1,00	Pin rotor 2 ltr.	
002	18.036b-737	1,00	Bushing 24/17x22 P/450G	
003	40.145-001	1,00	Cylinder 1ltr. for pilot pin worker	
004	25.132-002b	1,00	Cylinder	
005	140-0041	3,00	O-ring 082.00*5.00 NBR 70	
006	40.145-002	1,00	End cap for pilot pin worker	
007	160-0411	18,00	Screw M8x35, DIN 912, A2	
008	100-0078	3,00	Angle 3/8""	
009	14.986-052	1,00	Air screw 3/8"	
010	140-0536	2,00	Usit ring 24/17.4x2, A2	
011	100-0361	1,00	Plug, F1HPP, DN3/8"	
012	s28.906	1,00	Sanitary shaft seal Labo 0.7L	
013	40.144-005	1,00	Gudgeon for Pilot Percector 57	
014	40.146-002	1,00	Console body for gearmotor top	
015	40.146-001	1,00	Flange for gearmotor top	
016	160-0102	6,00	Screw M10x30, DIN933, A2	
017	160-0235	6,00	Washer ø10, DIN125A, A2	
018	310-1164	2,00	Plug-in Nipple 1/2" Theme 18220	
019	40.145-003	1,00	Angle 1/2"U-3/8"i speciel L	
020	290-0004	6,00	Hose band	
021	120-0106	2,00	Hose connection 1/2"	
022	290-0002	0,50	Hose 12.5*19.0 (1/2)	
023	310-0111	4,00	Coupling 3/8""	
024	310-0112	4,00	Nipple	
025	290-0002	0,70	Hose 12.5*19.0 (1/2)	
026	290-0002	1,00	Hose 12.5*19.0 (1/2)	
027	pl42.179	1,00	Motor transmission for Pilot Perf. 057	
028	160-2091	6,00	SCREW-DIN7984-M06*012----------	

Gerstenberg & Agger A/S

Draw.date:

Spare parts list pl42.179

Motor transmission for Pilot Perf. 057

Position	Item number	Quantity	Description	Description
000	42.179-000	1,00	Assembly, motor transmission for Pilot	
001	42.142-002	1,00	Plate for motor 57 BGS	
002	42.142-004	1,00	Flange for motor size 132, for MPP BG	
003	661-0005-21	1,00	MOTOR-3,8KW-B14-8P-3x380-420V/5	
004	160-0101	4,00	Screw M10x25, DIN 933, A2	
005	41.300-002	1,00	Spacer for shaft	
006	160-1021	1,00	Set screw M8*12 DIN 933	
007	40.061-018	4,00	Bracket w.M8	
008	160-0234	4,00	Washer M8, DIN 125A, A2	
009	160-0098	4,00	Screw M8x25, DIN933, A2	
010	160-0343	4,00	Screw M10x25, DIN 912, A2	

Gerstenberg & Agger A/S

Draw.date:

Spare parts list pl42.099
Pin rotor 3L. for Pilot Perf.

Position	Item number	Quantity	Description	Description
000	42.099-000	1,00	Assembly, Pin worker 3L.	
001	18.036b-737	1,00	Bushing 24/17x22 P/450G	
002	40.145-001	1,00	Cylinder 1ltr. for pilot pin worker	
003	25.132-002b	2,00	Cylinder	
004	140-0041	4,00	O-ring 082.00*5.00 NBR 70	
005	40.145-002	1,00	End cap for pilot pin worker	
006	160-0411	24,00	Screw M8x35, DIN 912, A2	
007	100-0078	5,00	Angle 3/8""	
008	14.986-052	1,00	Air screw 3/8"	
009	140-0536	2,00	Usit ring 24/17.4x2, A2	
010	100-0361	1,00	Plug, F1HPP, DN3/8"	
011	s28.906	1,00	Sanitary shaft seal Labo 0.7L	
012	40.144-005	1,00	Gudgeon for Pilot Percector 57	
013	40.146-002	1,00	Console body for gearmotor top	
014	40.146-001	1,00	Flange for gearmotor top	
015	160-0235	6,00	Washer ø10, DIN125A, A2	
016	310-1164	2,00	Plug-in Nipple 1/2" Theme 18220	
017	40.145-003	1,00	Angle 1/2"U-3/8"i speciel L	
018	120-0106	2,00	Hose connection 1/2"	
019	290-0004	8,00	Hose band	
020	290-0002	1,00	Hose 12.5*19.0 (1/2)	
021	310-0111	6,00	Coupling 3/8""	
022	310-0112	6,00	Nipple	
023	290-0002	0,50	Hose 12.5*19.0 (1/2)	
024	25.152-003a	1,00	Pin rotor 3 ltr.	
025	290-0002	1,50	Hose 12.5*19.0 (1/2)	
026	160-2091	6,00	SCREW-DIN7984-M06*012----------	
027	160-0102	6,00	Screw M10x30, DIN933, A2	
028	pl42.179	1,00	Motor transmission for Pilot Perf. 057	

Gerstenberg & Agger A/S

Draw.date:

Spare parts list pl42.179
Motor transmission for Pilot Perf. 057

Position	Item number	Quantity	Description	Description
000	42.179-000	1,00	Assembly, motor transmission for Pilot	
001	42.142-002	1,00	Plate for motor 57 BGS	
002	42.142-004	1,00	Flange for motor size 132, for MPP BC	
003	661-0005-21	1,00	MOTOR-3,8KW-B14-8P-3x380-420V/	
004	160-0101	4,00	Screw M10x25, DIN 933, A2	
005	41.300-002	1,00	Spacer for shaft	
006	160-1021	1,00	Set screw M8*12 DIN 933	
007	40.061-018	4,00	Bracket w.M8	
008	160-0234	4,00	Washer M8, DIN 125A, A2	
009	160-0098	4,00	Screw M8x25, DIN933, A2	
010	160-0343	4,00	Screw M10x25, DIN 912, A2	

Gerstenberg & Agger A/S

Draw.date:

Spare parts list pl40.144-01
Inverter 1 ltr. for pilot perf.

Position	Item number	Quantity	Description	Description
000	40.144-000	1,00	Assembly, Inverter for Pilot Perfector 5	
001	29.236-001	1,00	Cylinder 1.1 ltr	
002	140-0517	2,00	O-ring 129.30x5.70, NBR 70	
003	160-0349	6,00	Screw M10x50, DIN 912, A4	
004	27.338-001	1,00	Intermediate ring	
005	140-0531	2,00	O-ring 79.30 x 5.70, NBR 70	
006	40.144-001	1,00	Intermediate flange ø200	
007	160-0350	6,00	Screw M8x25, DIN912, A4	
008	14.986-052	1,00	Air screw 3/8"	
009	100-0093	1,00	Plug 3/8"	
010	140-0536	2,00	Usit ring 24/17.4x2, A2	
011	100-0078	2,00	Angle 3/8""	
012	310-1164	2,00	Plug-in Nipple 1/2" Theme 18220	
013	40.144-002	1,00	End cover for outlet	
014	17.100-766	1,00	Bushing 30x16x20, P/450G	
015	160-0752	6,00	Screw M10*040 DIN912 A2	
016	29.237-001	1,00	Pin rotor 1.1 ltr	
017	s28.906	1,00	Sanitary shaft seal Labo 0.7L	
018	40.146-002	1,00	Console body for gearmotor top	
019	160-2091	6,00	SCREW-DIN7984-M06*012----------	
020	160-0751	6,00	Screw M10x30, DIN 912, A2	
021	40.146-001	1,00	Flange for gearmotor top	
022	310-0111	2,00	Coupling 3/8""	
023	310-0112	2,00	Nipple	
024	290-0002	0,50	Hose 12.5*19.0 (1/2)	
025	120-0106	2,00	Hose connection 1/2"	
026	290-0004	4,00	Hose band	
027	290-0002	1,00	Hose 12.5*19.0 (1/2)	
028	pl42.184	1,00	Motor transmission for Pilot Perf. 057	
029	40.144-004	1,00	Gudgeon for Pilot Percector 57	

Gerstenberg & Agger A/S

Draw.date:

Spare parts list pl42.184
Motor transmission for Pilot Perf. 057

Position	Item number	Quantity	Description	Description
000	42.184-000	1,00	Motor transmission for Pilot Inverter	
001	42.142-002	1,00	Plate for motor 57 BGS	
002	160-0101	4,00	Screw M10x25, DIN 933, A2	
003	160-1021	1,00	Set screw M8*12 DIN 933	
004	40.061-018	4,00	Bracket w.M8	
005	160-0234	4,00	Washer M8, DIN 125A, A2	
006	160-0098	4,00	Screw M8x25, DIN933, A2	
007	661-0007-20	1,00	MOTOR-5,5KW-B14-4P-3x380-420V/	
008	42.142-004	1,00	Flange for motor size 132, for MPP BC	
009	160-0343	4,00	Screw M10x25, DIN 912, A2	

INSTRUCTIONS
FOR
PILOT MICROTATOR (INVERTER)

WARNING

The Microtator is a pressure vessel consisting of rotating parts, hot surfaces and electrical equipment.

This instruction contains several safety warnings.

All plant personnel must be familiar with the contents of these instructions, especially the safety warnings. Gerstenberg & Agger A/S will not assume any responsibility for personal injury or equipment damage caused by faulty operation.

30.08.2004

NOTICE

The information contained in this instruction is subject to change without notice.

Gerstenberg & Agger A/S makes no warranty of any kind with regard to this material and shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing performance, or use of this material.

IF PROBLEMS OCCUR

If you suspect a problem with this **Microtator**, first check with the contents of this instruction and find the indicated problem before rectification.

If you are unable to solve the problem despite all efforts using this instruction, refer to Gerstenberg & Agger A/S.

THIS INSTRUCTION

In order to allow and promote the correct use of the unit, the description under different sections shall be strictly followed. This will secure the user's safety, reduce the risk of damage to the **Microtator** and consequent malfunction or inefficient operation.

USERS GUIDELINES

This instruction is divided into eleven sections. Sections 1 to 9 primarily deal with the essential information to the user of this unit. Each section comprises sub-sections, refer to the table of contents.

A list of spare parts and the figures concludes this instruction in section 10.

INSTRUCTIONS FOR MICROTATOR

TABLE OF CONTENTS

1. GENERAL

1.1 Scope

The objective of this instruction is to assist the plant personnel engaged in the installation, maintenance and daily operation of the **Microtator**. This instruction specifies the general requirements pertaining to the installation, operation, maintenance, inspection and service. It is therefore extremely important that all plant personnel are familiar with these instructions.

1.2 Application

The Gerstenberg & Agger A/S **Microtator** is designed for emulsification / cooling of mayonnaise, margarine and similar products.

1.3 Markings

Nameplate

The information provided on the nameplate should be used as reference when contacting Gerstenberg & Agger A/S.

Health and Safety Warning Signs
In order to incorporate the health and safety aspects, the following warning signs are provided on the **Microtator**.

High system pressure
The unit operates under high pressure. No part of the system must be dismantled unless it is established that the system is de-pressurised and thoroughly vented.

1.4 Protection of the **Microtator**

Storage and Handling

1) Store the machine in original packing until installation.
2) When unpacking do it on the place where the **Microtator** is to be installed. Lifting is best done with a crane or forklift using straps underneath the base of the machine, taking in consideration the high gravity point.

1.5 Maintenance Tools

For this machine only std. tools are needed.

1.6 Safety Warnings

1.6.1 General

This **Microtator** is a rotating machine. When in operation, do not touch, perform service or maintenance.

Always ensure that the **Microtator** rotates as the direction arrow shows.

The **Microtator** must not be used for heating/cooling chlorine containing liquids and is not compatible for heating/cooling any other product than specified.

Unless specifically stated in the contract, the unit must not be installed in an explosive environment.

1.6.2 Operation

Never operate the **Microtator** at speeds higher than those specified or recommended by Gerstenberg & Agger A/S.

Never apply pressures and temperatures higher than the designed figures.

The operation of this unit is limited to emulsification / cooling of specific liquid feeds. Never operate the unit without the product or water in the cylinder.

1.6.3 Service and Maintenance

Service and maintenance of this unit shall only be performed by personnel skilled in the maintenance of industrial machinery, and who are familiar with the contents of this instruction.

For safe operation, use only genuine spares and replacement parts supplied by Gerstenberg & Agger A/S.

Use only the approved cleaning liquids for cleaning the **Microtator** parts i.e., water, diluted organic acids and CIP liquids recommended for stainless steel surfaces. When in doubt, contact Gerstenberg & Agger A/S. Do not use liquids containing chlorine under any circumstances.

2. DESIGN AND FUNCTIONAL DESCRIPTION

Drawing no. 41.743-000

2.1 Design Description

The G&A **Microtator** incorporates special design features ensuring ideal mixing-emulsification / cooling of products with effective heat transfer. The product enters at the product inlet connection along the cylinder of the **Microtator** and flows through the cylinder while being emulsified. A uniform temperature distribution is ensured by the rotor mixers that continuously and gently blends the product.

The high shear between rotor and stator pins incorporates the energy to the product which is necessary for making a stable product.

2.2 Functional Description

The G&A **Microtator** comprises a cylindrical part mounted on the Perfector base frame, above the Perfector.

The cylinder/stator is a cylindrical pressure vessel. The cylinder is equipped with 2 rows of pins and contains a rotor that carries 4 rows of the pins.

The base unit comprises the electric motor, mounted in the base frame. The rotor shaft is directly mounted on the motor at the front cover.

The product enters at the product inlet connection at the front cover and flows along the cylinder and discharged through the outlet. The cooling medium enters from the lower side of the jacket with outlet at the upper side of the jacket situated on the upper side of the stator apposite the inlet.

3. TECHNICAL DATA

3.1 Design Data

	Microtator
Cooling Medium	**Water/Glycol**
Heat Transmission Surface, m2	0.004
Product Viscosity Range, cP	5,000 – 1,000,000
Design Pressure, Bar g. Product/Medium side	100/10
Test Pressure, Bar g. Product/Medium side	130/14
Design Temperature, °C Product/Medium side	90/90
Min. Allowed Temperature, °C	-10
Volume, litre Product/Medium side	1,0
Geared Motor data	
Installed Power, kW	5,5
Horizontal Flanged Motor, RPM	900
Gear Ratio Variable, Max	Frequency converter
Agitator/Rotor RPM, max recommended	1500
Added to the Weight, kg	100
Floor Space, m2	
Stator diameter mm	125
Stator length mm	304
Rows of pins	2
Diameter pins mm	6
Spacing mm	16
Rotor diameter mm	108
Rotor length mm	282
Rows of pins	4
Pin diameter mm	6
Spacing mm	16

3.2 Dimensions

According to the enclosed drawing and the above table.

3.3 Material of Construction

All parts of the **Microtator** exposed to product are made of AISI 316.
However, all other exposed external parts of the unit are made of AISI 304.

3.4 Noise Level, Vibrations and Emissions

At normal operating conditions the SPL at a distance of 1 meter from the unit is measured to less than 60-dB (A). This figure however shall be taken as

guidelines. A deviation up to 5-dB (A) or more may be expected depending on conditions mentioned below:

The RPM and load factor
Motor size and type
Surroundings of the unit

With a properly mounted **Microtator** in accordance with the instructions, there will be no vibrations transferred to the surroundings.

4. AUXILIARY EQUIPMENT AND SYSTEM

None!

5. SETTING UP

5.1 Unpacking

It is the best to bring in the crate and open it on the place where it is to be installed.

5.2 Installing the **Microtator**

The following procedure must be followed in connection with the installation of a new machine.

Check that motor voltage and frequency correspond to the actual.
The rotor rotation is anti clockwise seen from the front end with the rotor removed. The machine must not run dry.

Connect product inlet and outlet. Make certain that pipes are supported; the **Microtator** must not act as pipe supports.

5.3 Installation of Auxiliary Equipment and System.

For cooling with water or glycol the system can be designed by the user, to comply with the actual installation.

Ensure that the Microtator has been installed in accordance with local regulations.

6. INITIAL START-UP AND OPERATION

Before the initial start-up, it is mandatory that the procedures and activities outlined in section 5 are completed and verified by the plant supervisor.

Refer to safety warnings stated in section 1.6.

During initial start-up, the unit must be filled with water.

6.1 Checklist for Connections and Settings

Before the initial start-up of the unit, the following checks are essential for safety:

- Check that the unit is mounted in accordance with the instructions.
- Check that the motor rotates in the correct direction as marked.
- Product inlet connection(s) to the unit are properly tightened.

The electrical cables for the unit are connected.

6.2 Safety Instructions

Finally check and inspect:

- Motor direction of rotation.
- Level of noise and vibration

After a predetermined initial operational time, the unit is ready for continuous operation with product.

6.3 Normal Start-up and Shutdown

The normal start-up, operation and shutdown of the unit are integrated with the production-line/or manual. Furthermore, for enhancing the operational performance of the unit, inspection, service and maintenance shall be performed as stated in this instruction.

During the normal start-up, the unit shall be operated without product, but with water for few minutes. The same is valid during the shutdown of the unit. This will ensure a clean internals with no residual product.

6.4 Emergency Shutdown or Power Failure

An emergency shutdown of the plant is normally activated due to critical and unacceptable deviation in the operation of the plant. When activated, the complete plant will stop functioning due to interlocks. Before any restart of the plant, the unit must be cleaned.

Prior to restarting the unit, ensure that the cause(s) for emergency stop has been investigated and the necessary action has been taken. The above mentioned activity should be repeated in case of power failure.

NOTE
In case of voltage drop-out

In case of motor failure, the product inlet to the Microtator must stop immediately.

7. SERVICE AND MAINTENANCE

7.1 Spare Parts

All parts of the **Microtator** unit are manufactured with great precision. Only genuine G&A spare parts must be used. Subsequent to commissioning of the unit, a spare parts quotation is submitted by Gerstenberg & Agger A/S Spare parts department. Always maintain a complete set of recommended spare (especially wear) parts on hand.

When ordering spare parts, please state the plant order number, type and size of the **Microtator** unit (see name plate), and the Pos. number of the parts required. Refer to the list of parts.

7.2 Regular Maintenance

7.2.1 Inspection of Key Components

Shaft seal wear rings
Rubber parts

7.2.2 Inspection of Auxiliary Equipment and System

7.3 Preventive Maintenance

7.3.1 General Instructions

The rotor requires special attention with regards to the eccentricity. For dismantling and assembling, refer to section 9.2.

Monitoring the shaft seal with regard to leakage and a proper heat transfer is the most appropriate way to secure the proper function of the unit.

In order to avoid damage to the shaft seal, care shall be taken during dismantling and reassembling.

7.3.2 Time Table – Maintenance Program

The following time intervals for maintenance programme are recommended for the preventive maintenance of the product distributor unit.

After X hours of operation	To be carried out	Refer to
Each shutdown of the plant	Visual inspection and cleaning.	Section 8
The user must determine the time interval.	Dismantle the **Microtator.** Inspect and clean all components. Replace all gaskets, O-rings, seals, bearing and worn parts.	Sections 9.2

NOTE
The above time intervals for the preventive maintenance of the parts and components are based on ideal conditions of operation. The user shall determine these intervals and extent through frequent inspection during the first year of operation.

7.4 Operational Disturbances and Trouble Shooting

7.4.1 General Instructions

The causes of the operational disturbances around the **Microtator** unit apart from other factors may be related to the rotating parts, shaft seal or heat transfer efficiency. Other causes can be related to the vibration or higher power consumption on motors due to following reasons:

- Presence of deposits in the cylinder.
- Rotor partially clogged and requires dismantling and cleaning.

7.4.2 Malfunction – Probable Causes and Remedy

Symptom: Motor tripping. Insufficient, poor or no emulsification/ heat transfer

CAUSES	REMEDY
Product outlet pipe partially clogged.	Clean the pipe.
Shaft or rotor deformed.	Check and replace.
Unit partially clogged with product.	Clean the unit internals.

NOTE
For each listed symptom and causes mentioned above, more than one solution is usually possible. The first solution stated is the most probable correction action for the symptom. However, if that solution does not solve the problem, perform the solutions in the order they appear until the problem is solved.

8. CLEANING AND DISINFECTING

8.1 Frequency

Equipment used for handling food products in which water or egg is a continuous phase should be cleaned and disinfected after each period of use, and at least daily.

As it is impracticable to dismantle and clean manually all contact surfaces, cleaning-in-place is carried out by circulating suitable solutions. Nevertheless, equipment should be inspected periodically and manually cleaned using suitable brushes when appropriate. Where possible, the **Microtator**, pumps, valves, and pipelines should be dismantled for inspection and for manual cleaning at frequent intervals.

8.2 Wet Cleaning

The basic steps of cleaning the **Microtator** comprise:

- Rinsing with water to remove gross deposit. Considering the requirements, a water temperature of 40°C-70°C is recommended.
- A cleaning treatment with detergent/acid solution at an appropriate velocity and temperature so that the surface is freed from deposit.
- One or more rinses with clean potable water of adequate duration on the cleaned surfaces to remove contaminants and detergent solution.

It is extremely important that when hot solutions are used for cleaning (or disinfecting) there should be adequate and suitable air venting of the **Microtator**, which might be subject to collapse if the internal pressure were reduced on subsequent cooling. The medium jacket must not be isolated with stop valves; there should always be a possibility for thermal expansion.

8.3 Common Practice and Selection

CIP (Clean-In-Place)
An automatic CIP system performs the cleaning without any manual interference. Manual cleaning of certain components and equipment can reduce the cost.

Only an automatic system can be validated due to its performance each and every time. The most appropriate way is to handle the products in completely closed cycle systems during processing and cleaning.

A CIP system will always represent additional initial investment, but the operation cost in most cases will be reduced. The application of CIP is equally important in cases when different products are processed from the unit.

The **Microtator** is cleaned by supplying clean water into the cylinder immediately after the interruption of product flow through the unit. Shut-off the medium supply to the unit and let the rotor moving. Continue the washing through the unit until the water leaving the unit is clean. The unit is now ready for connecting to the CIP system. The rotor must be jogged during the whole cleaning process. Each ingredient nozzle should be flushed during the CIP-sequence, at least once for each cleaning agent.

8.4 Cleaning System without CIP-Facilities

In case of no available CIP-facilities, a separate piping system should be established to ensure re-circulation of cleaning fluid across the unit. This cleaning system can also include the plant connecting pipelines.

Step 1
Establish a re-circulation system with pump that draws the cleaning fluid from a balance tank and recirculate it through the **Microtator**. The pump capacity must be sufficient to ensure a fluid flow of 2,000 litre/h. In order to prevent fouling a velocity of 2 m/sec shall be maintained in the piping. During the CIP the inlet flow is divided over all inlet nozzles in use.

Step 2
Open the hot water valve or steam valve and raise the temperature of the circulating water to 80°C.

NOTE
When adding the chemicals, it is important to ensure that they are thoroughly distributed in the circulating fluid.

Step 3
Alkaline Cleaning

Dissolve NaOH (Sodium hydroxide) to achieve a concentration of the circulating water to 2-2.5%. Circulate the fluid through the unit at 80°C for 20 minutes. Thereafter wash the unit with clean water at 65°C to remove any residuals of NaOH.

Step 4
Acid Cleaning

Dissolve HNO_3 (Nitric acid) to achieve a concentration of the circulating water to max. 2.5%. Circulate the fluid through the unit at 65°C for 20 minutes. Thereafter wash the unit with clean water at 65°C to remove any residuals of HNO_3.

Step 5
If the unit is not restarted immediately after cleaning, it must be drained and disinfected prior to restart. Fill the unit with hot water and raise the temperature to 90°C. Circulate the water for 10 minutes and finish with a cold flush.

NOTE
In order to establish a thorough cleaning of the unit, it is recommended to frequently inspect the interior during the first year of operation. The time intervals can be varied to suit the requirements. However, prior to changing the concentration of the chemicals, please contact Gerstenberg & Agger A/S.

9. DISMANTLING, ASSEMBLING AND REPLACEMENT OF MAIN PARTS AND COMPONENTS

9.1 General Instructions

All part, components and accessories must be treated with extreme care during dismantling or assembling. Always place the components on clean cloth, plastic foil, corrugated cardboard or similar. Do not clean components with cotton waste. Instead use non-fluffing cloth.

When tapping on a component is required, use only a wooden or plastic hammer. Never apply diametrical force to ball bearing housings in a vice or similar holding tools.

Always apply clean oil to sealing and O-rings prior to assembly. For proper dismantling and assembling, use only the genuine tools.

CAUTION
Subsequent to restarting the unit, always ensure that the rotor shaft rotates freely.

9.2 Dismantling and Re-assembling of the **Microtator**

Prior to any dismantling ensure that:

- The unit is in cold condition, empty and clean.
- The cable to the electric motor is disconnected.
- The media supply is shut-off.
- The product inlet/outlet pipes are disconnected

Dismantling Procedure

End Cover
Drawing no. 40.144-000, Item no. 13

Unscrew the bolts item 15 and remove the top cover.

Rotor Unit
Drawing no. 40.144-000, Item no. 16

Carefully draw out the pin rotor.

Stator Unit
Drawing no. 40.111-000, Item no. 1

Unscrew the bolts item 3, and remove the stator.

Intermediate flange
Drawing no. 40.144-000, Item no. 4

Unscrew the bolts and remove the flange.

Connection flange

Drawing no. 40.144-000, Item no. 6

Unscrew the bolts and remove the flange.

Shaft with shaft seal
Drawing no. 40.144-000, Item no. 29

Block the motor shaft by inserting the key across the motor shaft, now unscrew the rotor shaft.
The shaft seal can now be dismounted.

Motor console
Drawing no. 40.144-000, Item no. 18

Unscrew the bolts item 20 and remove the console.

Motor
Drawing no. 42.184-000, Item no. 7
Unscrew the bolts item 2 and remove the motor.

9.2.2 Assembling Procedure

All bolts and screws must be greased with anti-seize compound before assembling.

All rubber gaskets must be greased with an approved grease to prevent damage during assembly.

Assembling procedure is carried out by doing the above described in reverse order.

- Utility and pipe connections

All product and utility can now be reconnected.

Before restart of the **Microtator** we recommend to carry out the procedures described in section 6, Initial start up, and Cleaning section 8.

9.3 Replacement of key Components

If any main part of the **Microtator** is found damaged please contact **Gerstenberg & Agger A/S.**

10 LIST OF SPARE PARTS

Please see the enclosed Spare parts Master List **pl 40.144-01 / pl 42.184.**

The master list gives a complete listing of the spare parts for the **Microtator.**