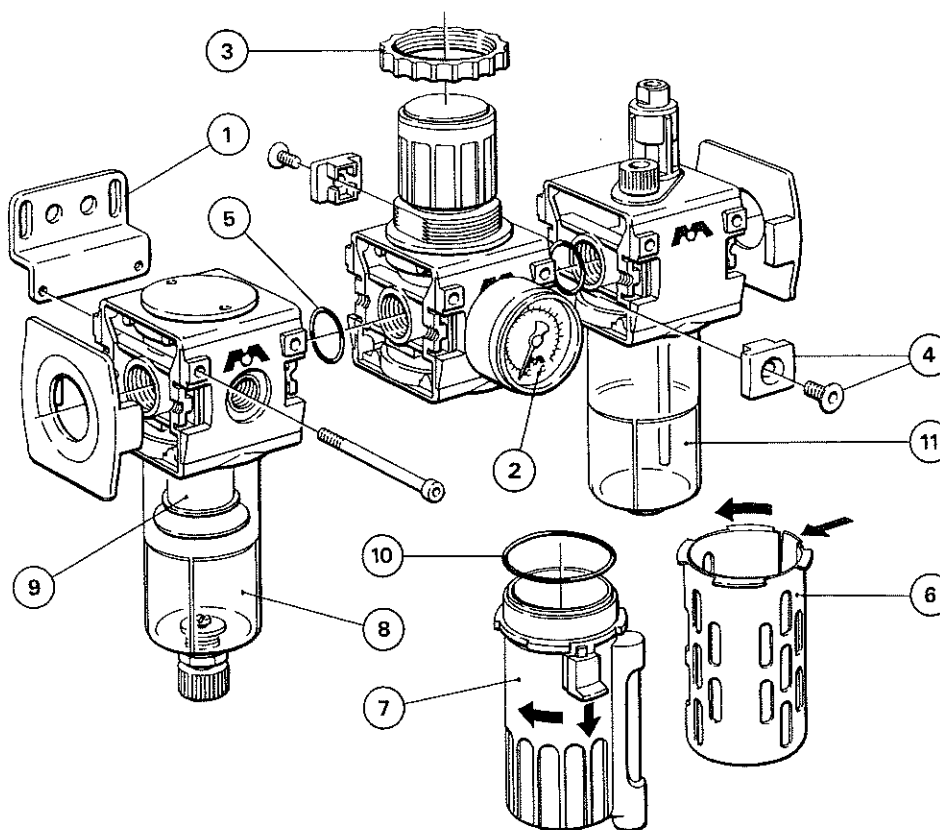


Accessories and spare parts for the modular components



General accessories

- 1 Bracket + screws
- 2 Pressure gauge Ø 40 G 1/8 0 -16 bar
- 2 Pressure gauge Ø 50 G 1/4 0-16 bar
- 3 Panel mounting ring
- 4 Clamp + screw
- 5 O-ring

G 1/4

915-111 810
915-111 820
915-111 830
915-111 840
04938 240 07
04938 242 01

G 1/2

915-331 810
915-331 820
915-331 830
915-331 840
04938 241 04
04938 243 09

Spare parts and filter/regulator

- 6 Bowl guard
- 7 Metal bowl, man. drain
- 7 Metal bowl, auto. drain
- 8 Polycarbonate bowl, man. drain
- 8 Polycarbonate bowl, auto. drain
- 9 Filter element 40 µm
- 10 O-ring

915-111 890
915-111 901
915-111 902
04938 228 02
04938 244 06
04938 224 03
04938 226 08

04938 219 03
—
—
04938 229 18
04938 245 03
04938 225 00
04938 227 05

Spare parts lubricator

- 6 Bowl guard
- 7 Metal bowl
- 11 Polycarbonate bowl
- 10 O-ring

915-111 890
915-111 910
04938 238 09
04938 226 08

04938 219 03
04938 239 06
04938 227 05

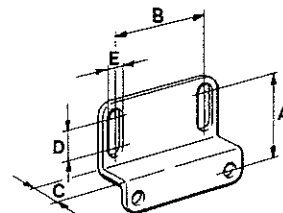
Spare parts regulator

- Diaphragm
- Valve poppet
- Spring 0,5-10 bar
- Spring 0,5-3 bar

04938 230 00
04938 236 04
04938 231 08
04938 234 18

04938 231 08
04938 237 01
04938 232 05
04938 235 07

Bracket

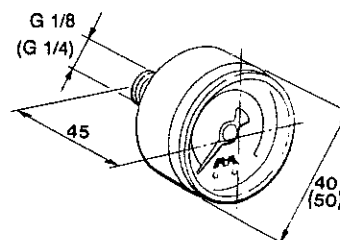


Dimensions

	A	B	C	D	E
G 1/4	27,5	38	20	8	5,4
G 1/2	33	50	20	13	6,4

Pressure gauge

G 1/8, (G 1/4)



SECURITE

Instructions générales de sécurité

- a) Une installation se décompose en plusieurs types d'éléments : machines tournantes, appareils électriques, tuyauteries (sous vide ou sous pression) transportant des fluides à diverses températures. Chacun d'eux doit être envisagé du point de vue de son bon fonctionnement dans l'installation d'une part, et de la sécurité des personnes d'autre part. Dans tous les cas, il est impératif de respecter les consignes données par la signalisation sur le site.
- b) A l'intérieur des locaux de l'installation, le personnel devra porter les vêtements de travail et protections nécessaires (lunettes, bouchons d'oreilles, chaussures et casques de sécurité, harnais, ...). Les vêtements amples et les bijoux susceptibles d'offrir une prise aux machines sont interdits. Ceci d'autant plus que les bijoux peuvent être la cause d'électrocutions.
- c) Les composants situés en extérieur devront faire l'objet de précautions particulières en cas de pluie ou de gel : les surfaces d'appui peuvent alors devenir très glissantes.
- d) Avant de pénétrer à l'intérieur d'un appareil, il est impératif d'identifier les risques possibles et de vérifier qu'il a été correctement ventilé de manière à faire disparaître toute trace de gaz nocifs (gaz de combustion, gaz inertes, émanations de solutions de lavage) susceptibles de causer des troubles respiratoires, voire des blessures graves. Ne jamais y pénétrer tant que l'on n'est pas sûr que les conditions atmosphériques normales y sont rétablies, qu'il est isolé du réseau électrique et que le signal indiquant que des travaux sont en cours est placé sur l'appareil.
- e) Il est impératif de respecter les asservissements de sécurité. Ils ont pour objet de protéger l'installation et d'assurer la sécurité des personnes. Ne jamais modifier ou supprimer un asservissement de sécurité sans avoir consulté NIRO au préalable et avoir obtenu une confirmation écrite.
- f) Ne jamais faire fonctionner une installation au-delà de sa capacité nominale sans avoir consulté au préalable la société du groupe NIRO qui l'a conçue. Ceci s'applique à tous les composants, notamment aux pompes, aux filtres de ventilateurs, aux vannes et aux appareils de chauffage.

SECURITE

Sécurité électrique

Généralités

Les armoires de puissance, armoires de contrôle et certains appareils fonctionnent sous des tensions élevées, qui peuvent s'avérer mortelles. Des méthodes de travail et d'entretien appropriées réduisent les risques d'accident de manière significative.

La pratique de contrôles de routine permet de détecter les indices de mauvais fonctionnements: odeur de brûlé, échauffement anormaux... On s'attachera à en éliminer rapidement les causes.

Fonctionnement

Une utilisation incorrecte de l'équipement électrique peut créer une situation dangereuse. L'accès à cet équipement doit être limité au personnel qualifié, formé à son fonctionnement et à sa maintenance ainsi qu'aux aspects de sécurité.

1 Haute tension

Les armoires électriques sous haute tension doivent rester fermées en fonctionnement. De nombreuses armoires sont raccordées à plusieurs sources. Il est nécessaire de comprendre comment chaque appareil est raccordé de sorte qu'il puisse être complètement isolé du réseau avant toute intervention.

2 Réglages

Un appareil mal réglé peut devenir une source de problèmes, voire de danger. Avant tout réglage il est impératif d'évaluer les conséquences de celui-ci en termes de fonctionnement de l'appareil et de sécurité du personnel. Les modes d'emploi correspondant à certains composants spécifiques devront être consultés avant de procéder aux réglages de mise au point.

3 Pannes

Un fusible qui fond, un disjoncteur qui se déclenche, indiquent la présence d'un risque potentiel. Il est impératif de remonter jusqu'à la cause de la surcharge avant de rétablir le circuit. Ne pas supprimer la cause de cette surcharge pourrait porter atteinte au fonctionnement de l'installation et à la sécurité des personnes.

SECURITE

Températures élevées

Tout appareil dont les parois externes sont susceptibles d'atteindre des températures élevées présente un risque pour le personnel. On aura donc recours à une barrière ou à une isolation thermique pour le protéger. Parmi les matériaux d'isolation performants, on trouve la laine minérale et les plaques de fibre de verre lorsqu'elles supportent la température prévue.

Protection du personnel

1. Afin d'éviter tout accident lors de l'exploitation d'appareils fonctionnant sous vide ou à des pressions ou températures élevées, le personnel concerné recevra une formation et un encadrement adéquat. La formation a pour but d'apprendre au personnel à réagir correctement face au danger.
2. Les appareils fonctionnant sous vide ou à des pressions ou températures élevées, feront l'objet d'une signalisation permanente.
3. Dans cet environnement particulier, une tenue spéciale comportant, entre autres, un casque, des gants, des lunettes et des chaussures de sécurité, peut être exigée.

NIRO



INSTRUCTION MANUAL

for

SPRAY DRYING PLANT

SOLVAY S.A., BRUXELLES

YOUR ORDER NO. 41911552

P-6.3 SPRAY DRYER

OUR ORDER NO. 094-0191-00

Contents

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Flow-Sheet	3
Safety Aspects	4
Erection	5
Feed Pump / Feed Line	6
Rotary Atomizer FS-11	7
Electric Air Heater / Pressure Switch	8
Damper, Butterfly Type	9
Pre-Filter and Hepa Filter	10
Supply-, Exhaust- and Cooling Fans	11
Spray Drying Chamber Bracket for the Atomizer Pneumatic Hammer System	12
Cyclone Collector Pressure Difference Transmitter	13
Double Flap Valve	14
Wet Scrubber / Liquid Recirculation System	15
Compressed Air System	16
Instrument Panel Lay-Out	17
Instruments	18
Circuit and Interconnection Diagrams	19
Cleaning of the Plant	20

**All plant personnel must be familiar with these instructions.
NIRO will not assume any responsibility for personal injury or
equipment damage caused by faulty operation.**

INTRODUCTION

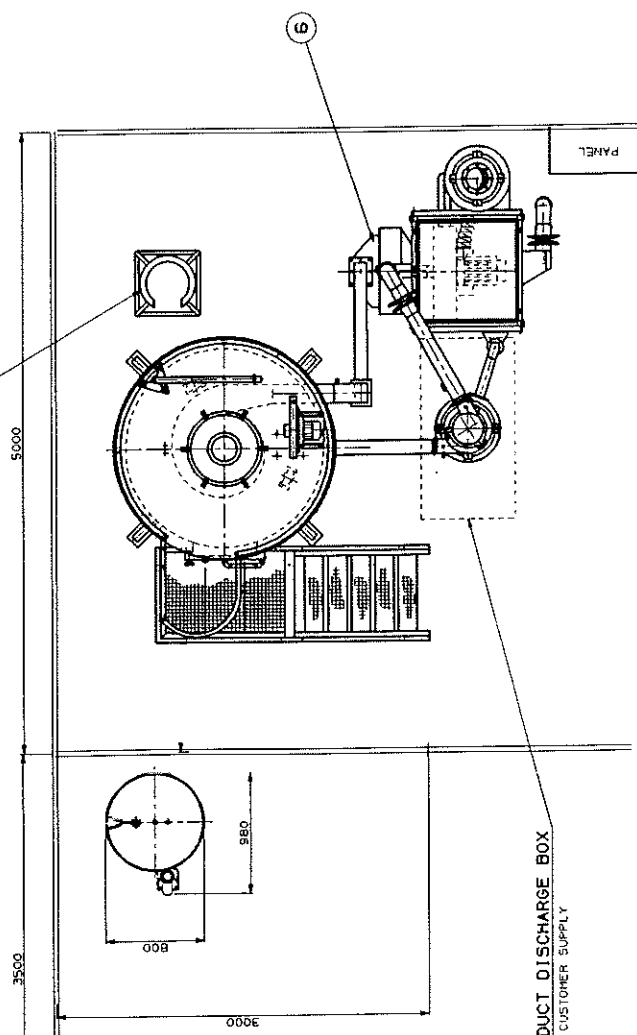
The NIRO ATOMIZER SPRAY DRYER is a flexible spray dryer for small production and research/development projects.

Ability to meet a wide range of product/operation requirements by selection of rotary, pressure or two-fluid nozzle atomization, single or two-point dried product discharge and use of airbroom.

The spray dryer is supplied as a package plant ready-to-use by connections to services as specified hereinafter.

A number of alternative equipment and accessories may not be dealt with in this manual if not relevant to this delivery, but can be studied in the attached leaflet.

When ordering SPARE PARTS, please state the serial-no. of the spray drying plant as appearing on the equipment name plate on the panel front.

[illegible]

Pos.	Qty	NIRO drawing or parts list	Description	Material	Dimension		
		104829	ASSEMBLY DRAWING				
1	1		FEED PUMP, PERISTALTIC TYPE				
2	1		ROTARY ATOMAIZER, FS-11				
3	1		PRE-FILTER				
4	1		SUPPLY FAN				
5	1		AIR HEATER				
6	1		AIR FILTER, HEPA				
7	1		P-6.3 DRYING CHAMBER				
8	1		CYCLONE COLLECTOR				
9	1		DOUBLE FLAP VALVE				
10	1		EXHAUST FAN				
11	2		NOISE ATTENUATOR				
12	1		WET SCRUBBER				
13	1		LIQUID RECIRCULATION SYSTEM				
14	1		COOLING FAN FORE ATOMAIZER				
P-6.3 SPRY DRYER, ASEPATIC ARRANGEMENT				Revision			
ORDER NO. : 094-0191-00							
				Rev.by Appr.by Date			
				Sheet 1 of 2			
*** CHANGE BY CAD-SYSTEM ONLY ***				Cate- gory 2	104829-0001		
TSP	920316	TSP	920316			BJ	920316
Made by	Date	Check.by	Date			Appr.by	Date
This parts list is the property of NIRO. It must not be used, copied or handed to any third party, or otherwise disposed of, without NIRO's permission in writing.							
NIRO A/S				GLADSAXEVEJ 305 DK-2860 SOEBORG DENMARK TEL. +4539691011 FAX +4539691414			
PARTS LIST							

	Pos.	Qty	NIRO drawing or parts list	Description	Material	Dimension
	15	1		LADDER AND RAILING ARRANGEMENT		
	16	1		LIFTING BRACKET FOR THE ATOMAIZER		
2	17	1		STAND FOR THE ATOMAIZER		
3	18	1		INSTRUMENT PANEL		
4	19	1		TURNING SUPPORTING BRACKET FOR THE CYCLONE		
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

P-6.3 SPRY DRYER, ASEPTIC ARRANGEMENT

Revision		
Rev.by	Appr.by	Date
Sheet 2 of 2		

ORDER NO. : 094-0191-00

*** CHANGE BY CAD-SYSTEM ONLY ***						Cate-gory	<div style="font-size: 2em; font-weight: bold;">104829-0001</div>	Rev.
TSP	920316	TSP	920316	BJ	920316	2		
Made by	Date	Check.by	Date	Appr.by	Date			
This parts list is the property of NIRO. It must not be used, copied or handed to any third party, or otherwise disposed of, without NIRO's permission in writing.								

NIRO A/S

GLADSAXEVEJ 305
DK-2860 SOEBORG DENMARK
TEL. +4539691011 FAX +4539691414

PARTS LIST

2-035 (09-91)

.....

1. *Journal of the American Medical Association*, 1997; 278: 1021-1025.

[illegible]

Journal of Interpersonal Violence

Journal of Interpersonal Violence 28(1)

1

J. L. J. van der Wal

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2007

^a $\text{Na}_2\text{S}_2\text{O}_8/\text{Na}_2\text{SO}_4$

^a *Neurospora crassa* ATCC 6258.

1. INSTRUMENT SYMBOLS

	LOCAL
	IN MAIN PANEL
	IN AUXILIARY PANEL NAME: PANEL NAME
	IN LOCAL PANEL NAME: PANEL NAME
	COMPUTER-BASED OPERATOR INTERFACE IN/NEAR MAIN PANEL
	SHARED DISPLAY/CONTROL IN MAIN PANEL
	LIMIT VALUE H: HIGH OR OPEN L: LOW OR CLOSED
	POINT OF MEASUREMENT WITHOUT INSTRUMENTATION

5. ACTUATING ELEMENTS

	AUTOMATIC ACTUATOR FOR REMOTE CONTROL, GENFRAI
	MANUAL ACTUATOR NOT FOR REMOTE CONTROL
	AUTOMATIC ACTUATOR WITH INTEGRATED MANUAL CONTROL FACILITY
	DIAPHRAGM ACTUATOR
	SOLENOID ACTUATOR
	PISTON ACTUATOR
	ROTARY MOTOR ACTUATOR
	ADJUSTABLE SPEED CONTROL
	ADJUSTABLE ELECTRIC POWER CONTROL

ACTUATING ELEMENT RESPONSE
TO FAILURE OF THE ACTUATING ENERGY
MAY BE INDICATED AS FOLLOWS:

	VALVE CLOSES (FC)
	VALVE OPENS (FO)
	VALVE RETAINS POSITION
	FAIL-OPEN INDICATION FOR A 3-WAY VALVE

2. PROCESS LINES

	PRIMARY FLOW LINE, GENERAL
	SECONDARY FLOW LINE, GENERAL
	MECHANICAL CONNECTION
	SUPPLY LIMIT MARKER

3. INSTRUMENT SIGNAL LINES

	GENERAL
	ELECTRICAL
	PNEUMATIC
	HYDRAULIC
	CAPILLARY

4. FLOW LINE ABBREVIATIONS

AS	AIR SUPPLY
CIP	CLEANING IN PLACE
CS	CONDENSATE SUPPLY
CWS	CHILLED WATER SUPPLY
ES	ELECTRIC SUPPLY
GS	GAS SUPPLY
NS	NITROGEN SUPPLY
OS	OIL SUPPLY
SS	STEAM SUPPLY
WS	WATER SUPPLY
.R	RETURN

6. LETTER CODE FOR IDENTIFICATION OF INSTRUMENT FUNCTIONS

FIRST LETTER		SUCCEEDING LETTER (1)
MEASURED OR INITIATING VARIABLE	MODIFIER	DISPLAY OR OUTPUT FUNCTION
A		ALARM
B		DISPLAY OF STATE (2)
C		CONTROLLING (4)
D	DENSITY	DIFFERENCE
E	ALL ELECTRICAL VARIABLES (5)	SENSING ELEMENT
F	FLOW RATE	RATIO
G	Gauging, position or length	
H	HAND (MANUALLY INITIATED) OPERATED	
I		INDICATING (3)
J		SCAN
K	TIME OR TIME PROGRAMME	
L	LEVEL	
M	MOISTURE OR HUMIDITY	
N	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE	
P	PRESSURE OR VACUUM	TEST-POINT CONNECTION
Q	QUALITY (5)	INTEGRATE OR TOTALIZE
R	NUCLEAR RADIATION	RECORDING
S	SPEED OR FREQUENCY	SWITCHING (2)
T	TEMPERATURE	TRANSMITTING
U	MULTIVARIABLE	MULTIFUNCTION UNIT
V	VISCOSITY	VALVE, DAMPER, ACTU. ELEMENT
W	WEIGHT OR FORCE	
X	UNSPECIFIED (5)	UNCLASSIFIED FUNCTIONS
Y	VIBRATION	COMPUTING RELAY, RELAY
Z		EMERG. / SAFETY ACTING (2)

EXAMPLE DIFFERENTIAL PRESSURE INDICATION, RECORDING AND CONTROL
FIRST LETTER P, MODIFIER D, SUCCEEDING LETTERS I, R, C

- (1) NORMAL SEQUENCE OF SUCCEEDING LETTERS: B, I, R, C, T, Q, S, Z, A
(2) SIGNAL TYPE: ON-OFF
(3) SIGNAL TYPE: CONTINUOUS
(4) SIGNAL TYPE: NORMALLY CONTINUOUS. IF ON-OFF, 'J' IS ADDED
(5) A NOTE SPECIFIES THE MEASURED PROPERTY. E.g. FOR LETTER E: I, U, P OR F

B	SUPPLY LIMIT MARKER	JP	JP	911007
A	Y=VIBRATION & LIMIT-VALUE SYMBOL ADDED	KTO	GAH	880901
Rev.	Revision	Rev.	Appr.	Date
NIRO A/S GLADSAXEVEJ 305 DK-2860 SØBORG DENMARK Tel. (01) 691011 Telex 15603				
This drawing is the property of N.A. It must not be used, copied or handed to any third party or otherwise disposed of without our express permission in writing.				
LEGEND TO INSTRUMENTATION ON FLOW SHEETS.		SCALE Drawn SRH 880601 Check MA 880601 Appr. GAH 880601		
BASED ON ISO 3511.		5 81600 B		
** CHANGE BY CAD-SYSTEM ONLY **				

SECURITE

Instructions générales de sécurité

- a) Une installation se décompose en plusieurs types d'éléments : machines tournantes, appareils électriques, tuyauteries (sous vide ou sous pression) transportant des fluides à diverses températures. Chacun d'eux doit être envisagé du point de vue de son bon fonctionnement dans l'installation d'une part, et de la sécurité des personnes d'autre part. Dans tous les cas, il est impératif de respecter les consignes données par la signalisation sur le site.
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- f) Ne jamais faire fonctionner une installation au-delà de sa capacité nominale sans avoir consulté au préalable la société du groupe NIRO qui l'a conçue. Ceci s'applique à tous les composants, notamment aux pompes, aux filtres de ventilateurs, aux vannes et aux appareils de chauffage.

SECURITE

Sécurité électrique

Généralités

Les armoires de puissance, armoires de contrôle et certains appareils fonctionnent sous des tensions élevées, qui peuvent s'avérer mortelles. Des méthodes de travail et d'entretien appropriées réduisent les risques d'accident de manière significative.

La pratique de contrôles de routine permet de détecter les indices de mauvais fonctionnements: odeur de brûlé, échauffement anormaux... On s'attachera à en éliminer rapidement les causes.

Fonctionnement

Une utilisation incorrecte de l'équipement électrique peut créer une situation dangereuse. L'accès à cet équipement doit être limité au personnel qualifié, formé à son fonctionnement et à sa maintenance ainsi qu'aux aspects de sécurité.

1 Haute tension

Les armoires électriques sous haute tension doivent rester fermées en fonctionnement. De nombreuses armoires sont raccordées à plusieurs sources. Il est nécessaire de comprendre comment chaque appareil est raccordé de sorte qu'il puisse être complètement isolé du réseau avant toute intervention.

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Un appareil mal réglé peut devenir une source de problèmes, voire de danger. Avant tout réglage il est impératif d'évaluer les conséquences de celui-ci en termes de fonctionnement de l'appareil et de sécurité du personnel. Les modes d'emploi correspondant à certains composants spécifiques devront être consultés avant de procéder aux réglages de mise au point.

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Un fusible qui fond, un disjoncteur qui se déclenche, indiquent la présence d'un risque potentiel. Il est impératif de remonter jusqu'à la cause de la surcharge avant de rétablir le circuit. Ne pas supprimer la cause de cette surcharge pourrait porter atteinte au fonctionnement de l'installation et à la sécurité des personnes.

SECURITE

Températures élevées

Tout appareil dont les parois externes sont susceptibles d'atteindre des températures élevées présente un risque pour le personnel. On aura donc recours à une barrière ou à une isolation thermique pour le protéger. Parmi les matériaux d'isolation performants, on trouve la laine minérale et les plaques de fibre de verre lorsqu'elles supportent la température prévue.

Protection du personnel

1. Afin d'éviter tout accident lors de l'exploitation d'appareils fonctionnant sous vide ou à des pressions ou températures élevées, le personnel concerné recevra une formation et un encadrement adéquat. La formation a pour but d'apprendre au personnel à réagir correctement face au danger.
2. Les appareils fonctionnant sous vide ou à des pressions ou températures élevées, feront l'objet d'une signalisation permanente.
3. Dans cet environnement particulier, une tenue spéciale comportant, entre autres, un casque, des gants, des lunettes et des chaussures de sécurité, peut être exigée.

SAFETY ASPECTS

General Safety Procedures

- a) Process plants incorporate a combination of components, for example: rotating machinery, various electrical devices, ductwork transporting gas under low and high temperature vacuum and pressure, as well as various liquid piping. Each of these areas must be treated with respect to avoid damage to the equipment as well as personal injury. Always read and heed warning signs and labels.
- b) When entering equipment, always wear appropriate clothing, ear- and eye-protection, footwear, hard-hats, and safety belts/ harnesses. Loose clothing, which may become caught in equipment, is not permitted. Jewelry can also get caught or provide a conductive path and is not permitted.
- c) When entering the plant components located outdoor, take particular care during rainy or icy conditions as grating, checker plate, and platforms can be quite slippery.
- d) Before entering a vessel, identify possible hazards and be certain it has been thoroughly vented to remove traces of unburned combustion gases, inert atmospheres or cleaning products, which could result in severe respiratory problems and subsequent injury or death. Do not enter until satisfied that normal atmospheric conditions exist in the vessel, any interconnection electrical equipment is isolated, and warning sign is placed on vessel indicating work-in-progress.
- e) Respect plant interlocks. They are built into the system to protect equipment and prevent personnel injury. Do not alter, jumper, or bypass any interlock without first consulting NIRO and obtaining written confirmation.
- f) Never operate the system beyond the design capacities without first consulting with the NIRO Group company, who supplied the equipment. This applies to all components including pumps, fans filters, valves, heaters, etc.
- g) Never disable an alarm because it is a nuisance or for any reason. Correct the problem instead.
- h) Never touch any component unless absolutely certain of its temperature. Even though insulated and clad, some surfaces may still be hot enough to result in personal injury.
- i) Before operating any component, such as a fan, valve, heater, pump or the like, thoroughly review and understand the vendor's instructions available in the plant manual.
- j) Always operate and maintain equipment in accordance with the equipment manufacturer's instructions, particularly with regard to lubrication and replacement parts.

SAFETY ASPECTS

Rotating Mechanical Equipment

To avoid serious personal injury, death, or property damage, it is extremely important that you follow the safety instructions listed below. If you do not understand any of these instructions, **DO NOT PROCEED** any further until you have obtained clarification which clearly answers your questions.

- a) All persons who will install, operate or maintain the equipment should read and thoroughly understand the operating, installation and maintenance manual supplied with the system first.
- b) Do not start the equipment until all guards and covers are mounted in their proper location and all doors are closed. If the equipment is not supplied with a warning sign, a suitable sign must be placed on the equipment without delay (as shown below, or an equivalent).

!!! WARNING !!!

**GUARDS, ACCESS DOORS AND COVERS
MUST BE SECURED IN PLACE
BEFORE OPERATING THIS EQUIPMENT**

**LOCK OUT POWER
BEFORE SERVICING OR REMOVING
GUARDS, ACCESS DOORS AND COVERS**

**Failure to follow these instructions
may result in personal injury or property damage**

- c) Do not open any doors or remove any covers while the equipment is in operation, unless these openings are properly protected by grates or screens to prevent entry and discharge of solid objects.
- d) Do not insert hands, feet, tools, or other foreign objects into any equipment while it is in operation. Any of these actions could result in bodily harm or death.
- e) **Lockout Provisions**

Before performing any work or inspection in proximity to moving parts, it is absolutely imperative that associated motor disconnects and/or circuit breakers be locked in the open (off) position. Individuals involved with this work should personally place keystone padlocks on the disconnect in a manner to guarantee a de-energized condition; keys should be securely attached in a conspicuous place on or near the lock. The padlock should **never** be removed by anyone other than the person who placed it on the disconnect.

SAFETY ASPECTS

Electrical Safety

General

All power distribution equipment, control panels, and instruments contain hazardous voltage which can kill or maim personnel. The degree of hazard is significantly reduced by proper operation and maintenance.

Routine observations should be used to look for signs of electrical problems. Unusually hot surfaces or burnt smells should be investigated promptly and the cause corrected.

Operation

Improper operation of electrical equipment can create an unsafe situation. The access to such equipment must be limited to personnel who are qualified and familiar with not only the equipment being operated but also associated pieces of equipment and all hazards involved with such equipment.

1. Hazardous Voltage

Electrical enclosures contain hazardous voltages and must remain closed when in operation. Many enclosures have multiple sources of voltage. A complete understanding of the connections of each piece of equipment is necessary so all sources of power to the equipment can be disconnected and locked off before access to the equipment is permitted.

2. Adjustments

It is possible to misadjust equipment, causing an unsafe or unsatisfactory situation. Prior to making any adjustments, the result of that change must be evaluated to ensure equipment operation and personnel safety are maintained. Instructions furnished for specific pieces of equipment should be consulted for functional adjustments.

3. Failures

Blown fuses, tripped breakers, or tripped overloads are indication that a potentially hazardous situation exists and the cause of the overload must be determined before equipment is returned to service. Failure to determine and correct the cause of the overload may result in equipment damage and a personnel risk.

If a fuse has blown or breaker tripped, excessive currents may have caused damage to electrical equipment. The equipment involved should be checked for damage and repaired, if necessary, before being returned to service.

SAFETY ASPECTS

High Temperature Equipment

Equipment operating in a working or personnel access area with a high surface temperature poses a safety risk. Personnel protection can be provided by guarding or insulation. Satisfactory insulation materials include mineral wool blanket or rigid fiber glass board able to withstand the anticipated temperature of the hot face (high temperature surfaces).

Personnel Protection

1. Proper training and supervision are necessary to avoid injury or death of personnel working in any capacity around equipment which is operating at high pressure, temperature, or vacuum. Training of personnel is required to ensure that all personnel react correctly to a hazardous situation.
2. Adequate warning signs and identification labels must be posted and maintained to make personnel aware of the presence of the high temperature, pressure, or vacuum.
3. Attire appropriate to the particular environment including, but not limited to good quality helmets, gloves, goggles, and safety shoes must be required.

SAFETY ASPECTS

Guidelines for Good Hygienic Practice **for** **Design and Operation of NIRO Plant**

These guidelines are advisory and recommended hygienic principles for the safe manufacture of dairy and food products. These guidelines are not replacing any requirements from the regulatory agencies.

Whilst the requirements of the regulatory agencies are observed, these guidelines additionally describe optimum achievable principles.

These guidelines are to be included in the Operational and Maintenance (O and M) Manual of plant designed and supplied for dairy and food products. It is for the customer to evaluate and adopt where appropriate.

1.1 General Considerations for Personnel at a Food Plant

- 1.1.1 The maintenance of hygiene standards is a fundamental responsibility of all personnel on a site.

Standards should be defined by the manager's responsible for plant hygiene in consultation with other site managers, and in accordance with the requirements of official agencies having jurisdiction.

Standards should be encompassed in a code of practice particular to the site.

- 1.1.2 Contamination of clean areas by inappropriate behavior of personnel must be prevented and where complete conformity is impossible, special care should be taken to prevent contamination of dry areas.

- 1.1.3 Movement of personnel throughout the site must be controlled. Areas should be designated according to the activity carried out within them; i.e. raw material, processing, finished goods; and access to these areas must be restricted to those personnel who work within a respective area.

Labels on clothing can be used to indicate authority to enter a particular area. However, the use of color coded clothing and footwear in correspondingly color coded areas will give greater control of the movement of personnel.

- 1.1.4 The necessary movement from one area to another must be accompanied by a change of protective clothing, including footwear.

- 1.1.5 A major factor in cross-contamination is footwear. The use of disinfectant footbaths/hygiene pads at the entrance to each designated area can reduce risk, but these also can be a source of contamination if not managed properly, as they are a source of moisture within the building.

- 1.1.6 Limiting the points of access to each area will reduce the risk of contamination, and personnel should be restricted to using only designated entrances/exits according to the needs of their job.

1.2 Hygiene Training

- 1.2.1 Managers of plant should arrange for adequate and continuing training of all personnel, in hygienic handling of food and in personal hygiene, so that they understand the precautions necessary to prevent the contamination of dairy and food products.

- 1.5.3 Cleanable protective clothing should be changed regularly and immediately after soiling has occurred.
- 1.5.4 Protective clothing should be stored on the premises and not used for purposes off the premises, eg. visiting other sites, travelling to and from work.
- 1.5.5 Where there is a risk of contaminating product, hair not completely covered by a hat should be enclosed by a fine mesh hair net.
- 1.5.6 Where there is a risk of contaminating product, beards and moustaches also should be completely covered by suitably designed head wear.
- 1.5.7 Protective clothing should be frequently laundered.
- 1.5.8 Jewelry and watches should not be worn in production areas, except for plain rings.
- 1.5.9 Coins and small personal effects should not be taken into the production area.
- 1.5.10 Gloves used in the handling of raw materials and dairy and food products should be maintained in good and sanitary condition. The wearing of gloves should not exempt a person from adhering to hand cleaning requirements.

1.6 Personal Behaviour

- 1.6.1 The use of tobacco should be strictly forbidden in all production areas. If permitted on the premises, it should be restricted to special areas designated for this purpose.
- 1.6.2 Personnel using designated smoking areas should remove protective clothing before entering such areas and must wash their hands thoroughly before donning protective clothing and re-entering production areas.
- 1.6.3 The carrying of smoking equipment into production areas should be prohibited.
- 1.6.4 Signs displaying "No Smoking Beyond This Point" should be clearly displayed to reinforce areas of smoking prohibition.
- 1.6.5 The eating of food and the chewing of gum, betel nuts, tobacco, etc. should be prohibited in production areas, as must unhygienic practices such as spitting.

- 2.1.5 The use of compressed air is not recommended for cleaning. Brushes may be used if vacuum equipment is unavailable.
- 2.1.6 All non-food waste must be removed in suitably marked, covered receptacles. These must be removed on a routine basis, at least daily. All re-usable receptacles should be cleaned before being brought into the building.
- 2.1.7 All discarded product must be removed in covered containers that are colour-coded to identify them from acceptable product. On no account must downgraded product be placed in the same packaging or containers as acceptable product.
- 2.1.8 The hopper for waste dusts from the central vacuum system should be sited outside the plant building and well away from air inlets.

2.2 Process Plant

- 2.2.1 All product-containing surfaces should be cleaned immediately after use, or as often as is necessary.
- 2.2.2 All wet equipment should be cleaned, according to the section on cleaning, after each production run with intermediate cleans as specified.
- 2.2.3 Dry cleaning of other areas should take place according to the schedule appropriate for the particular plant and process. A log should be kept of all dry cleans.

2.3 Utensils

- 2.3.1 Equipment and utensils should be disinfected immediately before use and whenever there has been the possibility of contamination.
- 2.3.2 After cleaning, all liquid product contact equipment and utensils should be stored in a bath of effective sterilant until used.
- 2.3.3 If disposable utensils are unavailable, all dry cleaning equipment used inside the process plant, such as brushes, should be washed, soaked in sterilant, dried and stored in plastic bag until ready for use. This equipment should be colour-coded to distinguish it from general floor sweeping equipment, etc.

2.4 Fabrics

Where fabrics are used, they should be washed, disinfected, and dried after each period of use, except where used in collector systems of powder products, in which case they should be removed and exchanged at specified, recorded intervals.

3.0 Cleaning and Disinfection of Plant and Equipment

3.1 Frequency of Cleaning and Disinfection

- 3.1.1 Equipment used for handling food in which water is a continuous phase should be cleaned and disinfected after each period of use, and at least daily.
- 3.1.2 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, equipment such as pumps, valves, plate heat exchangers, and pipelines should be dismantled for inspection and for manual cleaning at frequent intervals.
- 3.1.3 Where, after pasteurization, intermediate products are held at temperatures and time which will support bacterial growth (10 °C to 63 °C), regular samples should be tested and cleaning frequency adjusted appropriately. In the case of balance tanks used to store concentrated product between evaporation and finishing, cleaning should take place at intervals of not more than 4 hours.
- 3.1.4 Equipment in contact with dry products should be dry cleaned when necessary. Wet cleaning should be carried out when there has been an accumulation of solid materials, or if the equipment is implicated in a bacteriological deterioration of the product, or where there has been a lengthy shut-down.
- 3.1.5 Where twin filters are used, these should be alternated every three hours or when a pressure differential builds up, and the one which is taken off line cleaned and disinfected.
- 3.1.6 Air filters should be inspected and cleaned regularly, according to a pre-determined schedule based on the manufacturer's recommendation and/or measurement of the pressure drop across the filter.
- 3.1.7 C.I.P. spray nozzles should be examined periodically according to the hygiene schedule, to ensure the effective distribution of detergent and disinfectant.
- 3.1.8 Plant and equipment should always be wet-cleaned prior to re-use, following period of shut-down and especially following maintenance.
- 3.1.9 Plant and equipment should always be cleaned before extended periods of inactivity.
- 3.1.10 Either immediately after cessation of work for the day or at such other times as may be appropriate, floors, including gulleys,

All areas should be dried before re-use by passing hot air through the plant.

- 3.2.4 Product-contact areas of equipment which are wet cleaned should be physically isolated from those parts of the plant which operate under dry continuous conditions. If any structural deterioration is noted, this should be reported to management immediately.

3.3 Dry Cleaning

- 3.3.1 Special clean protective clothing and shoe covers should be used by persons entering the equipment for the purposes of cleaning (or maintenance).

- 3.3.2 Product recovered from the system, during dry cleaning or on re-start after dry cleaning, must be kept separate from normal production in clearly identifiable containers.

- 3.3.3 Powder deposits should be removed from the system by means of a vacuum cleaner. If brushes are used, precautions should be taken to ensure that they are well disinfected.

Compressed air is not recommended for dislodging powder because of the potential for spreading contaminant material.

- 3.3.4 The potential for contaminating sieves during dry cleaning is great, and it is preferable to carry spare sieves which are clean, disinfected and dry, to exchange for soiled sieves. If sieves are cleaned without exchange, operators must wear gloves and use disinfected brushes and utensils.

- 3.3.5 Recessed areas associated with inspection hatches, access doors and explosion vents must receive particular attention during a dry clean.

3.4 Inspection

- 3.4.1 The internal surface of the equipment must be checked regularly (at least annually) for cracks which might allow ingress of liquid containing solids into cladding walls. Particular attention should be paid to areas of stress such as welds, support structures, hammers, vibrators, etc.

- 3.4.2 Special attention should be paid to the state of repair of any cladding, which, if allowed to become wet due to leaks, water spillage external, presence of stress cracks, or any other cause, may become a breeding ground for bacteria. If the cladding is found to be wet or implicated in any contamination, it should be removed and examined bacteriologically with particular reference

- 4.2.6 Extreme care should be taken to avoid the contamination of food, clothing, and equipment when handling hazardous substances.

5.0 Pest Control

To minimize the risk of insect, rodent and bird infestation, the following points should be noted. It is recommended that a professional pest control service is contracted to assure acceptable standards.

- 5.1 Avoid creating conditions attractive to insect pests, birds, and rodents. This involves storing packing material and raw materials off the floor on clean pallets and away from walls. To facilitate inspection, it is recommended that there is room between the stacks.
- 5.2 Control measures, whether they involve treatment with chemical, physical, or biological agents must only be undertaken by suitably qualified personnel. Physical barriers are preferable to the use of chemicals.
- 5.3 Ensure that waste products, including packing material, are not allowed to lie on the floor or the ground, but collected at once and removed to the refuse storage area daily.
- 5.4 The Pest Control Contractor should be accompanied, when carrying out his duties, by the Manager or his representative. He should ensure that any recommendations made by the Contractor are carried out. The result of inspections and any remedial work should be recorded.
- 5.5 Appoint a member of the factory staff to inspect at least once a week to ensure that rodent baits are in a satisfactory condition, and that there are no signs of any pests. As soon as evidence of insects, birds, rodents, or other pests is noted or suspected, arrange an emergency visit by the Contractor.
- 5.6 Ensure the inspection of goods delivered to the factory for any signs of pests.
- 5.7 Ensure the inspection of returnable packaging materials and pallets for signs of pests and also ensure the eradication of any infestation before re-use and dispatch.
- 5.8 Ensure that any manufactured product leaving the premises is free of infestation and is not in a condition likely to attract pests.
- 5.9 Ensure that all suppliers or packaging material, including pallets, operate to similar standards.
- 5.10 Since birds have been identified as a previous source of Salmonella contamination, measures should be taken to discourage them from becoming established in and around the plant.

- 7.2 Storage areas should be periodically cleaned.
- 7.3 Product should be transported under clean hygienic conditions and not be liable to contamination, infestation, damage by heat or moisture, or physical damage.
- 7.4 Damage to powder bags during storage can be repaired provided the bag liner has not been ruptured. If the bag liner has been ruptured, the powder must be removed for use as animal feed or disposal. Powder spillage should be immediately removed by vacuum cleaner.
- 7.5 Powder bags damaged during transport should be immediately segregated. If the bag liner has not been ruptured, the package can be repaired, otherwise the powder should be condemned for animal feed or disposal.
- 7.6 The wrapping of palletized powder with a polyethylene film, or similar substance, can help protect packaging during transport and also assist load integrity.
- 7.7 One-trip layer pads between powder bags and pallet can prevent contamination/damage by the pallet, since a supply of perfectly satisfactory pallets cannot always be guaranteed.
- 7.8 The packaging material must provide appropriate physical protection and protection against contamination to the product.
- 7.9 Packaging equipment used for standard products should not be used for the packaging of sub-standard or waste products.
- 7.10 Sub-standards and waste material should be packaged in containers which are easily distinguishable from those used for standard products.
- 7.11 Packages should be closed immediately after filling or gassing, and dust on the surface of the packaging should be removed.

8.0 Plant Hygiene and Process Control Administration

- 8.1 A single member of staff, whose duties are independent of production, should be made responsible for hygiene and process control records.
- 8.2 Duties could include:
 - i Provision of written cleaning procedures for all plant, with special reference to plant normally cleaned automatically.
 - ii Drawing up permanent cleaning and disinfection schedules to ensure that all parts of the establishment are cleaned appropriately and that critical areas, equipment, and materials are designated for specific cleaning and/or disinfection at defined intervals.

9.4.1 Category "i" sampling points obviously concern any part of the process where product is in direct contact with plant or equipment. Sampling at such points allows an immediate assessment of the contamination associated with the product.

9.4.2 Category "ii" sampling points include the following:

- floors
- walls
- ceilings
- plant and equipment surfaces
- compressed air systems
- vacuum systems
- cleaning implements
- drains

9.4.3 Sampling such points enables the micro-biological condition of the environment to be monitored and the trend of contamination to be determined.

9.4.4 An increase in the level of certain bacteria, eg. coliforms, E. coli above the normal background level, can, for example, indicate a breakdown in hygiene control. Such a breakdown could lead to the presence of pathogenic bacteria with the subsequent contamination of product contact surfaces and the product itself.

9.4.5 By understanding micro-biological trends in the plant environment, timely corrective action can be taken to reduce the risk to product.

9.5 Routine sampling of product contact surfaces and the plant environment also will monitor the effectiveness of cleaning programmes and enable appropriate improvements.

10.0 Laboratory Control and Sampling Procedures

10.1 The establishment should be equipped with or have access to laboratory facilities which are sufficiently resourced to carry out all routine testing required to maintain continuous control of all operations and processes.

10.2 Quality standards must be elaborated for each product involving:

- i Sampling points
- ii Quality criteria
- iii Frequency of sampling
- iv Critical control points
- v Analytical methods

- ii Free from substances originating from micro-organisms, particularly aflotoxins, in amounts which exceed the tolerances or criteria established by the official agency having jurisdiction.

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International Dairy Federation,
Group B-39-Spray Drying of Milk, May 1990.

10.1111/j.1365-3113.2012.04773.x

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^a See also Table 1, p. 98.

“”

SPRAY DRYER. ERECTION

- 1. SPRAY DRYER GENERAL
- 1.1 PRE-INSTALLATION MEASURES
- 1.2 INSTALLATION
- 1.3 ELECTRICAL

ERECTION

1. SPRAY DRYER GENERAL

1.1 Pre-installation Measures:

The basic plant and the accessories ordered are dispatched in export cases, and can easily be unpacked and assembled without skilled assistance.

NOTE:

For the safe installation and operation of the dryer, a permanent earth connection must be established.

The space required for the spray drying plant appears from the arrangement drawing.

No foundations are required.

The spray drying plant is provided with a suction fan. The exhaust gases deriving herefrom, must be led out into the open air, either through a chimney or a wall/window.

The connection between the fan and this outlet should be made from a heat-resistant flex-flyte tube or a galvanized mild steel duct with inside dimension Ø 125 mm (minimum).

The fan is furnished with a counter-flange of a corresponding dimension. To eliminate transmission of vibrations, a canvas sleeve should be fitted into this ducting, close to the fan.

It is advantageous to have a drain in the floor close to the dryer, as water is used for cleaning.

Feed tank as well as water tank (both normally not included in the delivery), must be placed with their outlets above the suction inlet of the feed pump.

The volume of the feed tank depends upon the size of the batches to be processed; however, it should not be less than 50 l.

Water is only applied when starting and stopping the dryer, and consequently a 10 l tank is adequate.

A feed pump arrangement with continuously variable regulation of the feed pump revolutions must be installed.

The following instructions will give detailed instructions as to the erection, the provision for and installation of power, performance, cleaning and maintenance of the spray drying plant.

1.2 Installation:

The drying chamber is equipped with four ring bolts on the chamber roof

By means of shackles and wire loops, the drying chamber can be carefully raised, placed and levelled into correct position.

Lifting gear capacity: min. one ton.

The air heater can now be fitted to the spray dryer, and connected to the panel and power source, in accordance with instructions and diagrams.

1.3 Electrical:

NOTE:

For the safe installation and operation of the dryer, a permanent earth connection must be established.

Connect the air heater in accordance with the instructions and diagrams.

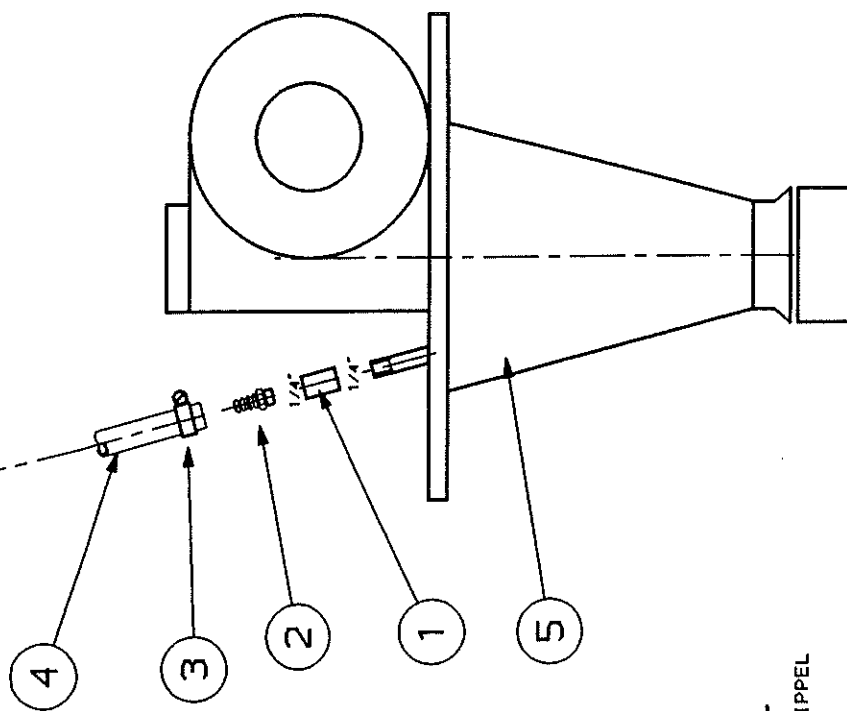
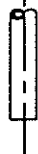
Remaining electrical work is likewise done in accordance with the circuit diagrams and the instructions relevant to the equipment concerned.

The power cable should be led through the bottom of the panel and connected to the inside terminal block.

When connecting the motors it must be checked that the direction of rotation is correct.

FØDE
FEED
SPEISE

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1	MUFFE 1/4"	1	BUSHING 1/4"	1	HØLSE 1/4"
2	SLANGENIPPEL	2	HOSE NIPPEL	2	SCHLAUCHNIPPEL
3	SPENDEBÅND	3	CLIP	3	KLAMMER
4	SLANGE	4	HOSE	4	SCHLAUCH
5	ROTERENDE FORSTØVER FU-11	5	ROTARY ATOMIZER FU-11	5	ZENTRIFUGAL ZERSTÄUBER FU-11

B		RET. STK. LISTE		JTF	JTF	911219	C	DIV.	KLN	KLN	920409
Rev. Letter	Revision			Rev.	Appr.	Date			This drawing is the property of M.A. It must not be used, copied or handed to any third party, or otherwise disposed of without our express permission in writing.		
NIRO A/S		SLAUSKÆVEJ 305 DK-2860 SØBORG DENMARK Tel. 31691011 Telex 15603		SCALE	~	SHEET		FØDESYST.: RØTERENDE FORSTØVER FEED ARR.: ROTARY ATOMIZER SPEISESYST.: ZENTRIF. ZERSTÄUBER		Category	2
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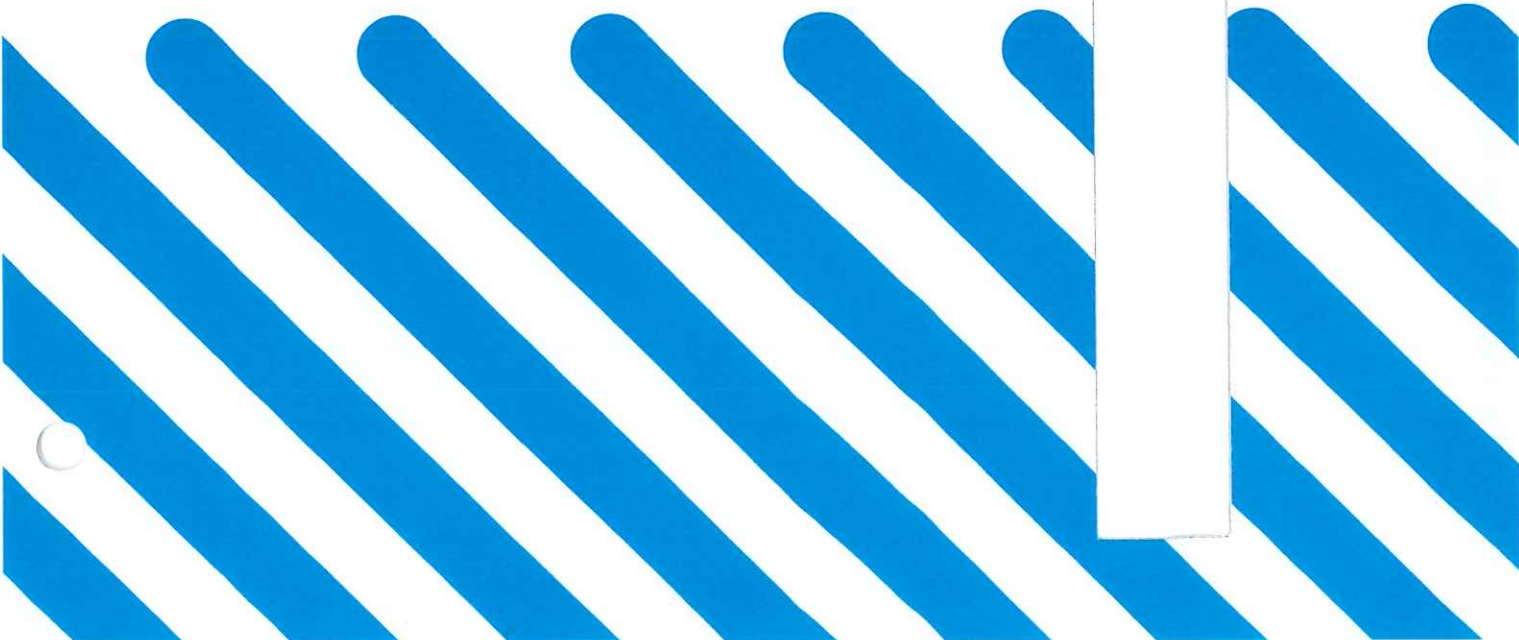
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The information contained in this document is believed to be correct but Watson-Marlow Limited accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

WARNING: These products are not designed for use in, and should not be used for, patient connected applications.

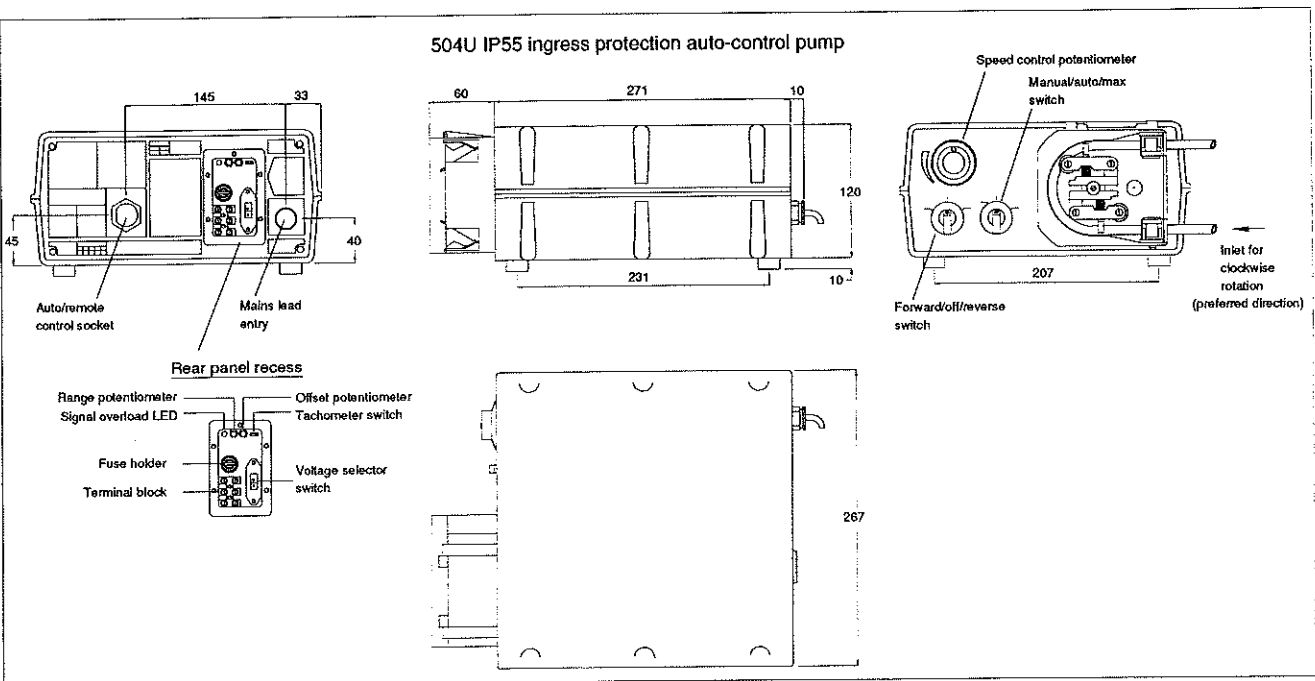
Operating
Instructions



504U/RL

IP55 ingress protection auto-control pump
Installation and operating instructions

Publication PB 0113



Thank you for choosing the Watson-Marlow 504U/RL auto-control pump. The all new 504U drive with its gasketed die-cast case is manufactured to IP55 ingress protection standards, making it particularly suitable for industrial applications. It accepts six different pumpheads for flow rates up to 2.2 litre/minute.

A sophisticated signal conditioner is built-in to the 504U/RL, which allows the pump to be automatically controlled from any analogue process signal up to 60V or 32mA. A switch on the front panel allows instant change between auto and manual control. The 504U/RL can be stopped, started and speed controlled from a remote switch or potentiometer.

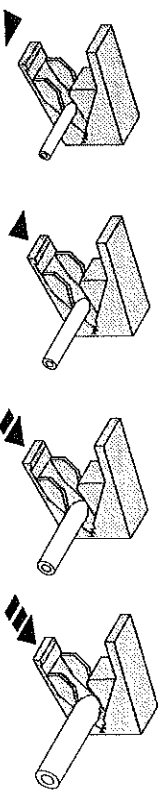
Part 1 : 504U drive	
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2 Flow rates	page 4
3 Tubing range	page 7
4 Manual operation	page 8
5 6 pin connector	page 8
6 Automatic operation	page 8
7 Calibration for auto control	page 9
8 Wiring for remote control	page 10
9 Tachometer output	page 11
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Part 2 : 501RL and 501RL2 pumpheads	
13 Description	page 13
14 Positioning the pumphead	page 13
15 Tube loading	page 13
16 Adjustment of rollers	page 14
17 Care and maintenance	page 14
18 Spares	page 14
19 Outline drawing	page 15

- 4 Fit the other end of the tubing into the second spring loaded clamp, ensuring that the tubing is not slack in the pumphead, as this can reduce tube life.

- 5 Close the crank handle and shut and lock the guard.

- 6 After the pump has been started, open the downstream clamp, for a short period, so that the tube can find its natural length.

The 501RL and 501RL2 pumpheads are fitted with four-position tube clamps which can be adjusted by pushing in or pulling out the bars at the top of the upper clamp and the bottom of the lower clamp. Set clamps so that the minimum necessary pressure is applied to the tubing.



16 Adjustment of the gap between the rollers and track

The 501RL has a factory set gap of 2.6mm between the rollers and the track and is suitable for tubing having wall thicknesses of between 1.6 and 2.0mm. For tubing with a 2.4mm wall thickness the 501RL2 has a factory set gap of 3.8mm. Adjustment of the gap will be required if tubing having a wall thickness of less than 1.6mm is to be used. There is an adjusting screw on each of the two roller arms, and each of these screws will require adjustment. The correct gap is twice the wall thickness less twenty percent. Correct adjustment is important: over occlusion will reduce tube life; under occlusion will reduce pumping efficiency.

To change the gap setting, turn each adjusting screw clockwise to increase the gap or anticlockwise to decrease the gap. A full turn changes the gap by 0.8mm.

To restore the original settings of 2.6mm or 3.8mm, turn the adjusting screws until both rollers are just touching the track, then tighten each screw by three and a quarter turns for the 501RL or four and threequarter turns for the 501RL2.

17

Care and maintenance

If aggressive liquids are spilled on to the pumphead, the head should be removed and cleaned. Remove any tubing from the pumphead, and swing out the crank handle to expose the rotor retaining screw. Turn the screw anticlockwise one turn to release the collet, and withdraw the rotor from the shaft. Unscrew the track retaining screw and detach the track from its spigot.

Check moving parts of the rotor from time to time for freedom of movement. Lubricate pivot points and rollers occasionally with a light lubricating oil.

2

Flow rates

The 504U can be fitted with any of six different pumpheads. For more information about the 501RL and 501RL2 see Part 2 of this manual. For details of other pumpheads, please refer to the relevant operating instructions.

The flow rates given below were obtained using silicone tubing (except for the 502AA where vinyl tubing was used), with the pumphead rotating clockwise, pumping water at 20C with zero suction and delivery pressures (unless otherwise stated). Where an application is critical, the flow rate should be determined under operating conditions. The important factors are suction and delivery pressures, temperature, and fluid viscosity. Tube life will be reduced when pumping against pressure. Maximum numbers of pumpheads/channels permissible are also given.

501RL and 501RL2 flow rates (ml/min)									
Tubing internal diameter									
0.5mm	0.8mm	1.6mm	3.2mm	4.8mm	6.4mm	8.0mm			
1/50"	1/32"	1/16"	1/8"	3/16"	1/4"	5/16"			
55	2.3	6.7	24	101	220	347	550		
220	9.2	27	94	410	892	1400	2200		

303 flow rates (ml/min)									
Tubing internal diameter									
0.5mm	0.8mm	1.6mm	3.2mm	4.8mm	6.4mm	8.0mm			
1/50"	1/32"	1/16"	1/8"	3/16"	1/4"	5/16"			
55	1.7	3.9	15	55	121	198	275		
220	6.6	15.4	60	220	484	792	1100		

Maximum number of 303 pumpheads									
Silicone tubing internal diameter									
0.5mm	0.8mm	1.6mm	3.2mm	4.8mm	6.4mm	8.0mm			
1/50"	1/32"	1/16"	1/8"	3/16"	1/4"	5/16"			
55	6	6	6	6	6	6	5		
220	6	6	6	6	6	6	5		
Marprene, Marvinal, Neoprene, and Viton tubing internal diameter									
0.5mm	0.8mm	1.6mm	3.2mm	4.8mm	6.4mm	8.0mm			
1/50"	1/32"	1/16"	1/8"	3/16"	1/4"	5/16"			
55	6	6	6	6	4	3	3		
220	6	6	6	6	4	3	3		

Standard operating conditions

501RL and 501RL2

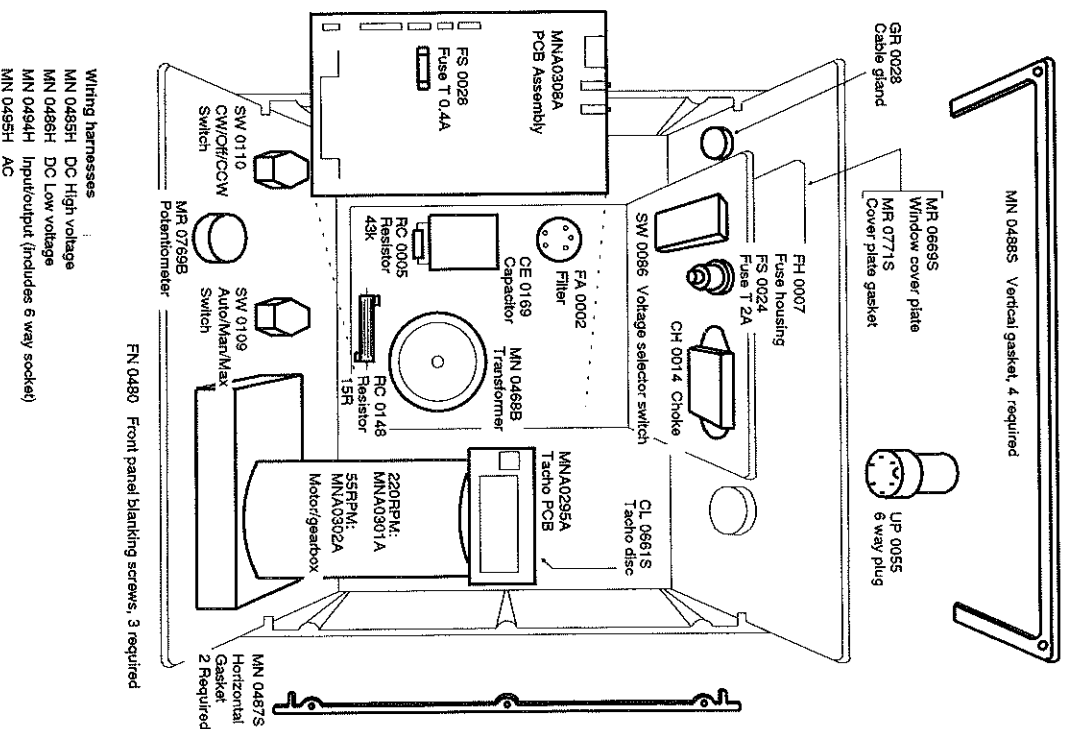
303

11 Care and maintenance

Scheduled maintenance of the 504U is not required. When the pump needs cleaning, remove the pumphead and use a mild solution of detergent in water. Do not use strong solvents. For pumphead care, refer section 16.

Warning: Disassembly of the drive unit will compromise ingress protection standard if it is not reassembled correctly using new gaskets.

12 Spares



304MC, 304MCX and 504MC2 flow rates (ml/min)												
Tubing internal diameter												
0.13mm 0.19mm 0.25mm 0.38mm 0.50mm 0.63mm 0.76mm												
rpm	0.005"	0.007"	0.01"	0.015"	0.02"	0.025"	0.03"	Channels				
55	0.04	0.15	0.26	0.46	0.83	1.50	2.30	15				
110*	0.09	0.30	0.52	0.92	1.70	3.10	4.60	15				
Tubing internal diameter												
0.88mm 1.02mm 1.14mm 1.29mm 1.42mm 1.47mm 1.52mm												
rpm	0.035"	0.04"	0.045"	0.05"	0.055"	0.058"	0.06"	Channels				
55	3.20	4.10	5.00	6.60	8.30	8.80	9.40	15				
110*	6.40	8.10	9.90	13.0	17.0	18.0	19.0	15				
Tubing internal diameter												
1.65mm 1.85mm 2.05mm 2.38mm 2.54mm 2.79mm												
rpm	0.065"	0.07"	0.08"	0.09"	0.1"	0.11"	Channels					
55	11.0	14.0	17.0	20.0	24.0	26.0	15					
110*	22.0	28.0	33.0	40.0	47.0	53.0	15					

308MC, 308MCX and 508MC2 flow rates (ml/min)												
Tubing internal diameter												
0.13mm 0.19mm 0.25mm 0.38mm 0.50mm 0.63mm 0.76mm												
rpm	0.005"	0.007"	0.01"	0.015"	0.02"	0.025"	0.03"	Channels				
55	0.04	0.14	0.23	0.41	0.70	1.30	1.90	15				
110*	0.09	0.28	0.47	0.83	1.40	2.60	3.90	15				
Tubing internal diameter												
0.88mm 1.02mm 1.14mm 1.29mm 1.42mm 1.47mm 1.52mm												
rpm	0.035"	0.04"	0.045"	0.05"	0.055"	0.058"	0.06"	Channels				
55	2.60	3.30	4.40	5.20	6.10	6.60	7.20	15				
110*	5.30	6.60	8.80	10.0	12.0	13.0	14.0	15				
Tubing internal diameter												
1.65mm 1.85mm 2.05mm 2.38mm 2.54mm 2.79mm												
rpm	0.065"	0.07"	0.08"	0.09"	0.1"	0.11"	Channels					
55	8.30	9.90	12.0	14.0	17.0	18.0	15					
110*	17.0	20.0	24.0	29.0	33.0	36.0	15					

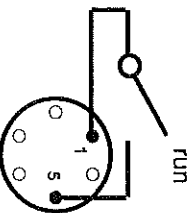
* 304MC, 504MC, 308MC, and 508MC pumpheads must not be run at speeds greater than 110rpm, half the maximum speed of the 220rpm 504U drive.

The 504U/RL can be stopped and started from a remote switch, or speed controlled from a remote potentiometer with a value between 4.7 kohm and 5 kohm. Connections for each function are shown below. Both functions may be used concurrently. The pump can also be remotely stopped and started when the pump speed is under process control.

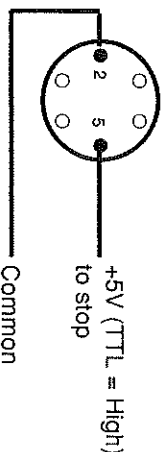
Never apply mains voltage across any pins on the 6 pin socket as permanent damage, not covered by warranty, will result. Up to 60V may be applied across pins 2 and 3, but not across other pins because permanent damage, not covered by warranty, may result.

Remote stop/start

Using internally generated voltage



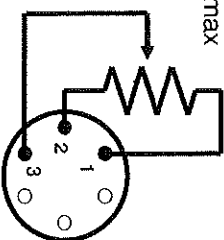
Using TTL compatible input



The remote stop/start signal may be derived from an internally generated voltage, switched through external contacts. Close contacts to stop, open to run. Alternatively a 5V, TTL compatible, input may be applied to pin 5 (pin 2, common) with 5V (High) = stop, 0V (Low) = run.

Remote potentiometer

When a remote potentiometer has been connected, the signal conditioner must be calibrated. Set the switch on the front panel to its Auto position. Remove the small panel covering the rear panel recess. Set the remote potentiometer to minimum and adjust for zero speed by turning the signal offset potentiometer until the pumphead rotor begins to rotate, and then turn back until the rotor just stops. Set the remote potentiometer to maximum and adjust for maximum speed by turning the signal range potentiometer until the red indicator in rear panel recess illuminates, and then turn back until the indicator just extinguishes. Securely replace the panel over the rear panel recess with its gasket in position.



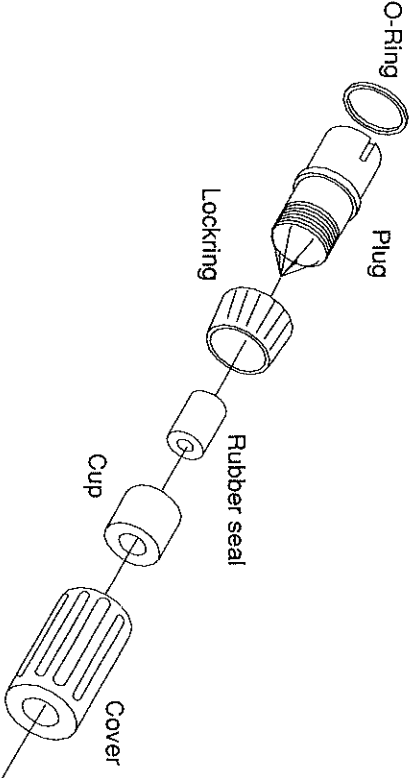
A remote potentiometer must be correctly connected. Incorrect connection may result in permanent damage, not covered by warranty.

Set the auto/manual/max switch on the front panel to its manual position. Start the pump by turning the forward/off/reverse switch on front panel to the required direction of rotation. The preferred direction of rotation is clockwise (with fluid entering at the bottom right of the pumphead and exiting at the top right of the pumphead), which will ensure the longest possible tube life. To operate against higher pressures, use anticlockwise rotation. The pump can be primed rapidly at its maximum speed by turning the auto/manual/max switch on the front panel to its max position. When released the switch will return to its manual position.

To stop the pump, turn the forward/off/reverse switch to its central off position. To change the direction of flow, turn the forward/off/reverse switch to its central off position until the pumphead rotor stops, and then turn it to the other direction of rotation.

The speed control ratio of the 504U/RL is 100:1. The speed setting dial is calibrated in percentage of maximum speed, and has a locking knob to prevent accidental speed changes. If the pump has been running under automatic control, and is now to run under manual control, it is only necessary for the auto/manual/max switch on the front panel to be moved to its manual position. It is not necessary for the process signal to be disconnected from the pump or for the calibration potentiometers to be adjusted.

For all auto and remote control operations, the drive is supplied with a 6 pin waterproof connector. Correct assembly of the connector plug is essential or the ingress protection standard will be compromised.



The diagrams in the following sections refer to the 6 pin plug viewed from the rear.



Watson-Marlow Limited

Falmouth, Cornwall TR11 4RU, England

☎ National: Falmouth 0326 73461

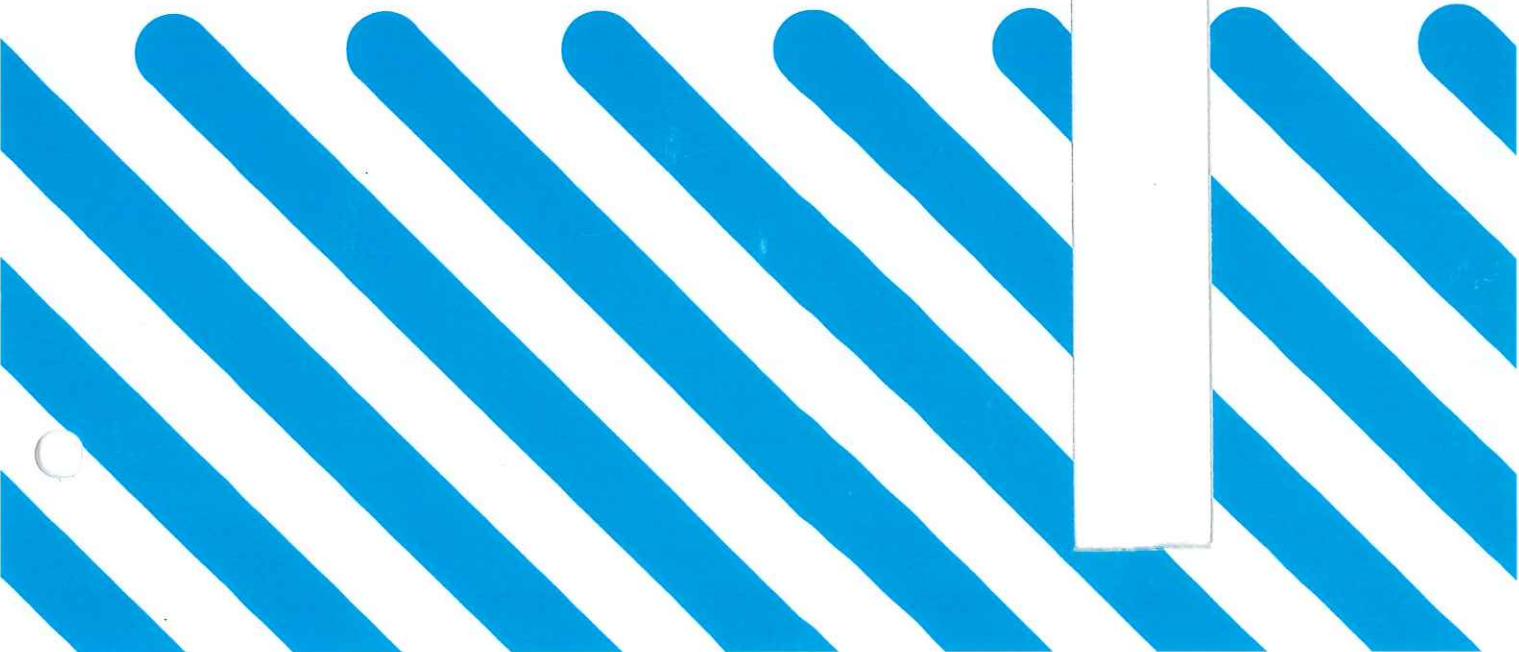
☎ International: +44 326 73461

Telex: 45594 Triflo G Fax: 0326 76009

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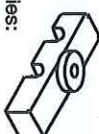
The information contained in this document is believed to be correct but Watson-Marlow Limited accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

**Operating
Instructions**



The 505L pumphead is "maintenance free" although you may check moving parts of the rotor from time to time for freedom of movement.

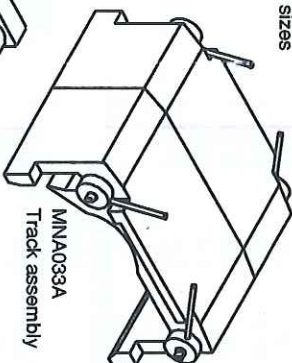
If aggressive liquids are spilled on to the pumphead, the head should be removed and cleaned. Do not use strong solvents.



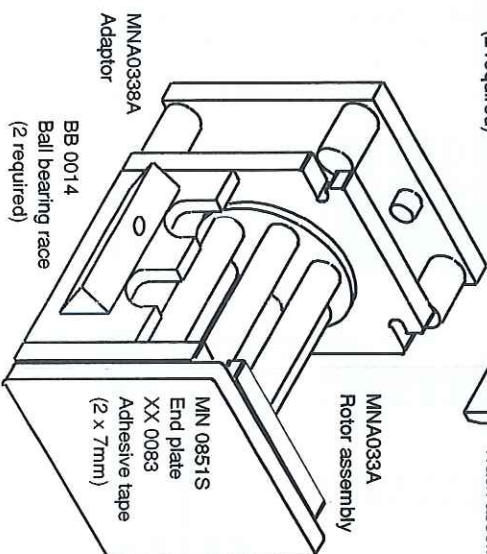
Accessories:
505L TC Tube clamp set
059.4001.000
Comprises of 2 clamps for
each of the six tube sizes



MNA0339A
Tube locating peg
(2 required)



MNA033A
Track assembly



MNA033A
Rotor assembly

BB 0014
Ball bearing race
(2 required)

MN 0851S
End plate
XX 0083
Adhesive tape
(2 x 7mm)

MNA0338A
Adaptor

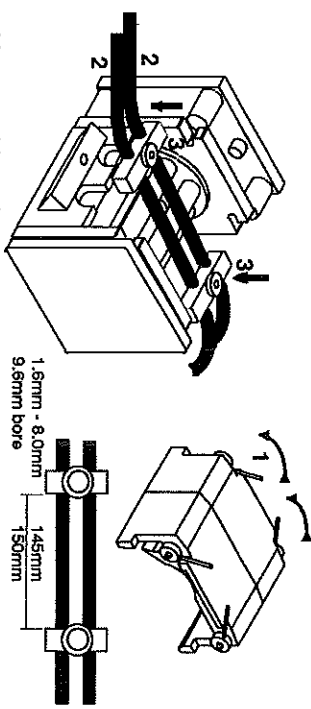
505L Pumphead

Twin track
Low pulse pumphead

Publication PB 0115

Using the 505L as a two (totally separate) channel pumphead

Lift the two bars (1) at either side of the pumphead and remove the the track, as above. Remove both locating "pegs". Take the two tube lengths (2) and insert into the "arches" of the tube clamps (3) ensuring that the nominal distance between the clamps is 145mm for bore sizes up to 8.0mm and 150mm for 9.6mm bore. All tube clamps are marked with the nominal bore for their intended tubing and only the correct size should be used.



Take this assembly and secure one tube clamp. Whilst stretching the tubing slightly, fit the second tube clamp locking it down securely.

Replace the track and pull down the securing bars.

Warning

When fitting new lengths of Marprene tubing, run for about half an hour and then retension the tubing making sure that the nominal lengths above are restored. If tubing lengths greater than those given are used, the tubing may move about within the pumphead and damage will occur.

3 Flow rates

The flow rates given below were obtained using silicone tubing, with the pumphead rotating clockwise, pumping water at 20C with zero suction and delivery pressures (unless otherwise stated). Where an application is critical, the flow rate should be determined under operating conditions. The important factors are suction and delivery pressures, temperature, and fluid viscosity. Tube life will be reduced when pumping against pressure.

They are the combined flow using the Watson-Marlow twin tube elements. Equivalent flows for two separate channels are each approximately half that given.

505L flow rates (ml/min)									
		Tubing internal diameter							
		1.6mm	3.2mm	4.8mm	6.4mm	8.0mm	9.6mm		
		1/16"	1/8"	3/16"	1/4"	5/16"	3/8"		
Drive	rpm								
505Di	55	40	125	230	385	495	605		
503U	220	155	500	925	1540	1980	2420		
504U									
503S	10	7.0	23	42	70	90	110		
504S	50	35	115	210	350	450	550		
	100	70	230	420	700	900	1100		
	170	120	390	715	1170	1530	1870		
ML/revolution		0.7	2.3	4.2	7.0	9.0	11		

ii Two year warranty

Watson-Marlow Limited warrants, subject to the conditions below, through either Watson-Marlow Limited or its authorised distributors, to repair or replace free of charge, including labour, any part of this product which fails within two years of delivery of the product to the end user. Such failure must have occurred because of defect in material or workmanship and not as a result of operation of the product other than in accordance with the instructions given in this manual.

Conditions of and specific exceptions to the above warranty are:

- 1 Consumable items such as tubing are excluded.
- 2 Products must be returned by prearrangement carriage paid to Watson-Marlow Limited or its authorised distributor.
- 3 All repairs or modifications must have been made by Watson-Marlow Limited or its authorised distributors or with the express permission of Watson-Marlow Limited or its authorised distributors.
- 4 Products which have been abused, misused, or subjected to malicious or accidental damage or electrical surge are excluded.

Warranties purporting to be on behalf of Watson-Marlow Limited made by any person, including representatives of Watson-Marlow Limited or its distributors, which do not accord with the terms of this warranty shall not be binding upon Watson-Marlow Limited unless expressly approved in writing by a Director or Manager of Watson-Marlow Limited.

iii Contents

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2	Tube loading	page 4
3	Flow rates	page 6
4	Adjustment of the track	page 7
5	Tubing range	page 7
6	Care and maintenance	page 8
7	Spares	page 8

iv Warning

When returning for servicing, in the current situation of heightened concern over the handling of hazardous materials, any equipment which has been contaminated with, or exposed to, body fluids, toxic chemicals or any other substance hazardous to health must be decontaminated. A certificate (a suitable blank form is available from Watson-Marlow), or signed statement that the equipment has been decontaminated must be attached to the shipping carton.

Conditions and exceptions

Contamination by materials hazardous to health

INSTRUCTIONS

FOR

ATOMIZER SIZE FS11

TYPE AVOG-OOS-STV

SERIAL NO. 1904

GEAR RATIO

CUSTOMER SOLVAY

BELGIUM

CONTRACT NO. 094-0191-00

NIRO



DANISCO

**INSTRUCTIONS
FOR
ATOMIZER FS 11**

**All plant personnel must be familiar with these instructions.
NIRO will not assume any responsibility for personal injury
or equipment damage caused by faulty operation.**

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1105 en**

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3. <u>OPERATION AND MAINTENANCE</u>	2
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5. <u>MOUNTING OF LIQUID DISTRIBUTOR AND ATOMIZER WHEEL</u>	3
6. <u>DISMANTLING THE SPINDLE</u>	4
7. <u>MOUNTING THE SPINDLE</u>	4
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ATOMIZER FS11

1. GENERAL DESCRIPTION

The atomizer consists of an upper and a lower part connected by the round supporting plate. The upper part comprises a motor console including a motor.

The atomizer is driven by a 2-pole high frequency motor mounted with a flange.

The lower part of the atomizer comprises the support for the spindle ball bearings, the spindle, feed pipe bracket and the conical skirt. The spindle runs in double sealed single row radial, very special high speed grease lubricated ball bearings. The guide bearing for the lower part of the spindle is made of antimony impregnated carbon, is selflubricating and supports the flexible spindle when it runs through first critical speed.

The flexible spindle design is adopted to compensate for irregularities in feed supply and minor irregular build-up in the atomizer wheel, situations that cannot be avoided during industrial operations. Such irregularities create imbalance which is immediately corrected by deflection of the flexible spindle.

The monitoring system comprises:

1. Flooding alarm (feed)
2. Spindle vibration alarm (if installed)
3. Tachometer

The monitor for the spindle vibrations activates an alarm at high spindle vibrations, caused by for instance abnormal product build-up in the atomizer wheel or imminent bearing failure. At excessive vibration conditions the atomizer motor is shut down to prevent damage to the spindle assembly.

Through a 1/4" tube the feed is led to the liquid distributor. Here the axial hole type feed distributor ensures a uniform distribution of the feed to the atomizer wheel.

Through a 1" tube connection on the supporting plate cooling air is introduced to the atomizer. All parts in contact with any product are manufactured in stainless steel according to US-3A standard for the food industry.

2. TECHNICAL DATA

Motor

2-pole 3 kW on shaft 6,000 rpm – 24,000 rpm – 400 Hz high frequency flange motor.

Power consumption

Maximum load of the atomizer inclusive of idling 3,5 kW.

Power transmission

Flexible claw coupling.

Spindle

Spindle rotation anticlockwise, seen from above.

Max. 24,000 rpm

Min. 6,000 rpm.

Cooling air for the atomizer

Cooling air 120 Nm³/h max. 35°C.

Cooling air to the motor

Cooling air 420 Nm³/h max. 35°C

Pressure 50 mm at motor (if installed).

Weight

Weight of atomizer with motor: 91 kg.

3. OPERATION AND MAINTENANCE

3.1 STARTING AND STOPPING THE ATOMIZER

Make sure,

that the protective cap on the spindle has been removed and that the guide bearing, liquid distributor, and atomizer wheel are fitted. Gap between atomizer wheel and skirt must be approx. 2 mm,

that feed pipe has been joined and properly sealed,

that the electrical connection for the atomizer alarm system has been plugged in.

The atomizer should not be clamped, but should rest loosely on the rubber gaskets in the atomizer chamber.

If the atomizer is equipped with tachometer, this ought to be controlled and adjusted. The best way to do this is to disassemble the protective casing at the motor fan, and by means of a mechanical tachometer control rpm at for instance 10,000 rpm/min. The machine can very well run without cooling the few minutes it takes.

Water or product must not be fed to the atomizer during the starting procedure.

Stopping

In order to facilitate cleaning and eliminate the risk of filling the atomizer with product, let the atomizer run for 5-10 minutes after the feed pump has been switched off.

4. INSPECTION OF GUIDE BEARING (Drwg. No. 41843)

The self-lubricating guide bearing (8) supporting the flexible spindle during start and stop, when the atomizer runs through first critical speed, is worn after some time. Consequently, it must be inspected regularly and must be exchanged when the inner diameter has been increased to 15,8 mm, i.e. when the testing rod (made of aluminium) in the tool box can go through the guide bearing.

5. MOUNTING OF LIQUID DISTRIBUTOR AND ATOMIZER WHEEL

Unscrew the protection hood for the lower part of the spindle and screw the liquid distributor on instead of using the special key 10057 in the tool box.

The protection hood should be kept in the tool box for later use during transportation of the atomizer.

Unscrew the two nuts (2 and 3 - 41845) from the spindle.

Make sure that the cone of the spindle and the conical bore of the atomizer are clean. Apply a thin layer of molybdenum disulphide (MOLYCOTE) to the cone of the spindle and wipe off again. This thin, invisible layer of MOLYCOTE should be renewed at regular intervals to facilitate removal of the wheel.

Install the wheel on the spindle and mount the disc and the two nuts - tighten well = 40 Nm.

When the atomizer is lifted, take care that nothing hits the spindle or the wheel as even a slight bending of the spindle may cause heavy vibrations during operation causing spindle breakage.

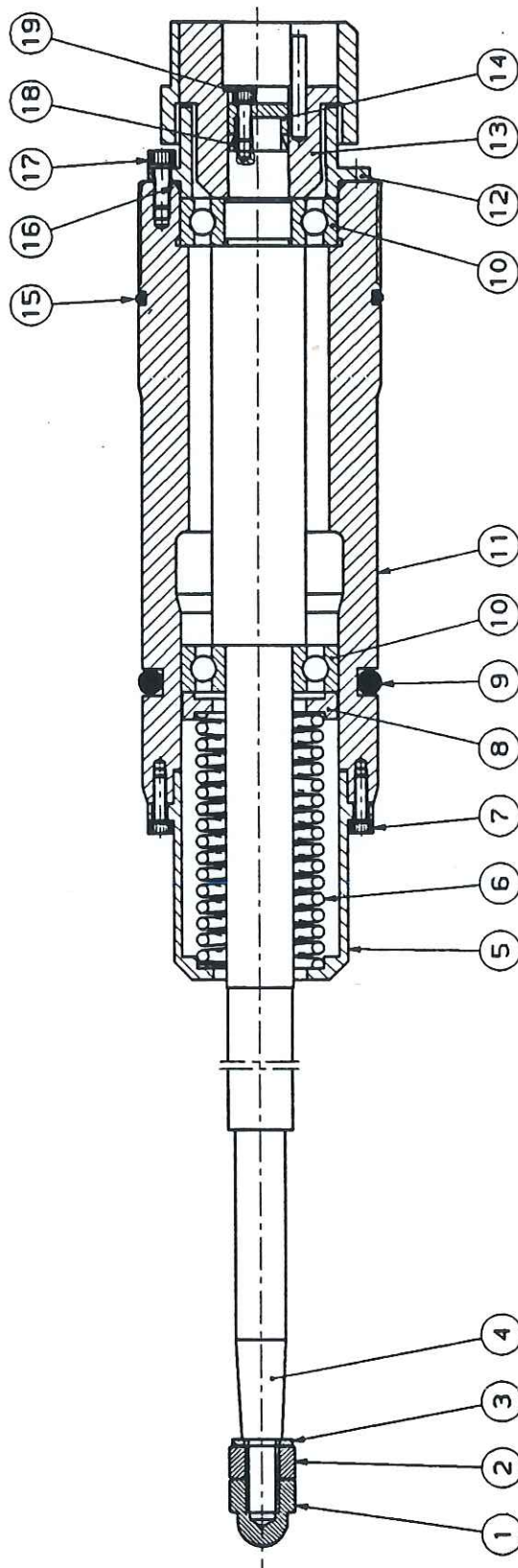
6. **DISMANTLING THE SPINDLE** (Drwg. No. 41843)

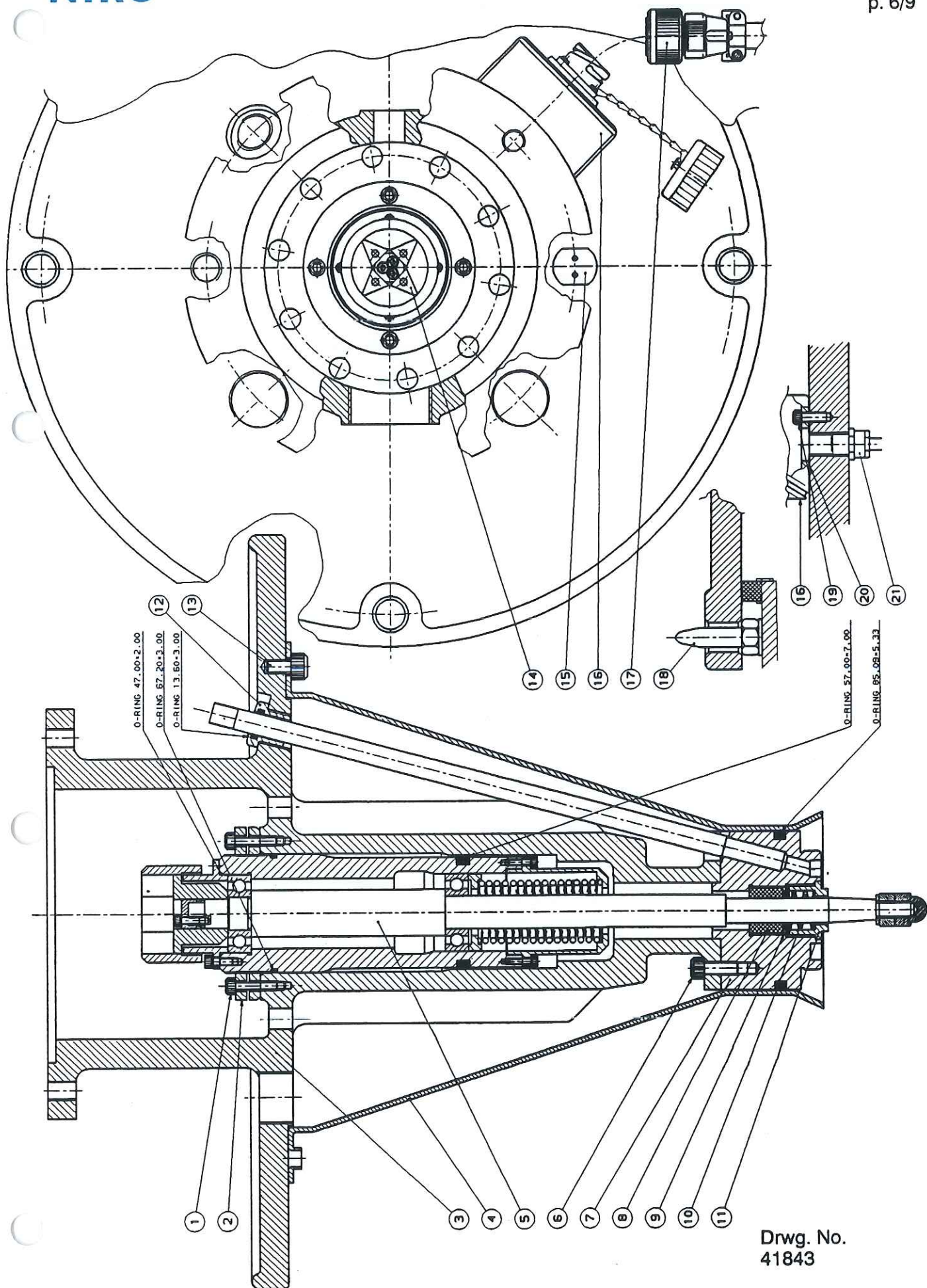
Disassemble the screws (1). Take out the spindle by using two threaded holes in the adjusting nut (2) together with the pushing screws 92119 from the tool box.

7. **MOUNTING THE SPINDLE** (Drwg. No. 41843)

Before fitting in of the spindle in the machine the bearing bush (sleeve) of the spindle is being lubricated with Molycote on the two parts where it gets into contact with the rest of the machine. This is done in order to avoid fretting corrosion between the bearing bushes and its fittings.

1. Mount the spindle completely, fitted with bearings and bushing in the lower part.
2. Fit the atomizer wheel on spindle.
3. Raise or lower the spindle by means of the adjusting nut (2) until the gap between the atomizer wheel and the skirt is 2 mm. (Note that one turn of the adjusting nut raises or lowers the spindle by 2 mm).
4. When the gap between wheel and skirt is approx. 2 mm, secure spindle and adjusting nut with screws (1).





8. **DISMANTLING AND ASSEMBLY REPLACEMENT OF BEARINGS ON SPINDLE** (Drwg. No. 41845)

In the following instruction abbreviations such as (20) refer to identifying symbols on the accompanying assembly drawing and parts list for the atomizer.

During dismantling and assembly of the atomizer, handle all components with care. Never place parts directly on dusty floors or tables. Always lay down a piece of cloth, cardboard etc. first.

Do not wipe with cotton waste – use non-fluffing cloth.

If it is necessary to knock any component sharply, use only a wooden mallet or plastic hammer.

If it is necessary to hold any component in a vice, the latter must be fitted with lead or aluminium jaws. Never grip a ball-bearing bushing radially in a vice. Even the slightest deformation of a ball-bearing bushing will reduce the life of the bearing.

All gaskets which have been exposed during dismantling should be renewed.

After completing the assembly turn the machine by hand and check that it runs freely without undue resistance or hard points.

It is assumed that the spindle has been removed from the atomizer as described under

Removal of bearings

1. Remove screws (19).
2. Remove clamp (14) and expansion ring (18).
3. Withdraw couplings from spindle.
4. Remove screws (17).
5. Remove retainer ring (12).
6. Slide bushing (11) in over the spindle (4) to free the upper bearing.
7. Withdraw bearing.
8. Remove screws (7).
9. Remove bushing and spring.
10. Withdraw bearing.

Assembly of bearings

1. Heat bearings (10) in an oven to a temperature of 100–110°C.
2. Fit the hot lower bearings (10) on the spindle (4).
3. Slide the long bushing (11) as far as possible onto bearing.
4. Fit the upper bearing (10) on the spindle.
5. Slide the long bushing (11) up over the upper bearing as far as it will go.
6. Fit retainer ring (12) and fasten with screws.
7. Locate the washer (8), the spring (6), and the bushing (5).
8. Locate expansion ring (18).
9. Fit the holder for the expansion ring and screws.
10. Fit the coupling and fasten the screw (19) with the tool from the tool box.

9. FITTING THE SPINDLE

Start-up after having changed bearings or motor

At start-up after change of bearings it is advised to secure that the lubrication in the bearings is properly distributed and that the bearing is correctly run. This is secured by running for 30 min. at 5,000–10,000–15,000–20,000–24,000 rpm. This is very important in order to secure long working life of the bearings.

10. MAINTENANCE OF THE ATOMIZER

To keep operational problems to a minimum and ensure long working life we recommend the following preventive maintenance:

<u>Working Hours</u>	<u>Preventive Maintenance</u>
24	Visual inspection
200	Inspect guide bearing. Clean liquid distributor and atomizer wheel.
1500	Motor bearing to be greased with 1 gram of grease Klüber Isoflex LDS18 spec. A to be used <u>only</u> . Spindle bearings not to be greased.
2000	Change of spindle bearings.
8000	Dismantle atomizer completely, inspect and clean components, replace worn parts.

11. TROUBLE SHOOTING

Always check first that the alarm system is plugged into the atomizer.

NOTE: Remember that faulty bulbs and cables put warning lamps out of operation.

ALARM: **Flooding**
A fluid indicator (41843-15) is mounted on the supporting plate. Provided the corresponding optional equipment is installed in the control panel – it registers whether product or water flows out from a leak on the plate. If so, the flooding alarm will lit (and sound). If the operator reacts quickly, it is often possible to track down the leak and correct the fault without interrupting the feed flow. If, however, product pours out in considerable quantity, cut off the feed supply immediately, trace and rectify the fault.

TROUBLE:

1. Leak in feed pipe immediately before atomizer.
2. Minor leaks from feed pipe gaskets or connections.

REMEDY:

1. Stop feed pump at once and repair leak.
2. Change gaskets, tighten connections.

ALARM: **Vibrations**

TROUBLE:

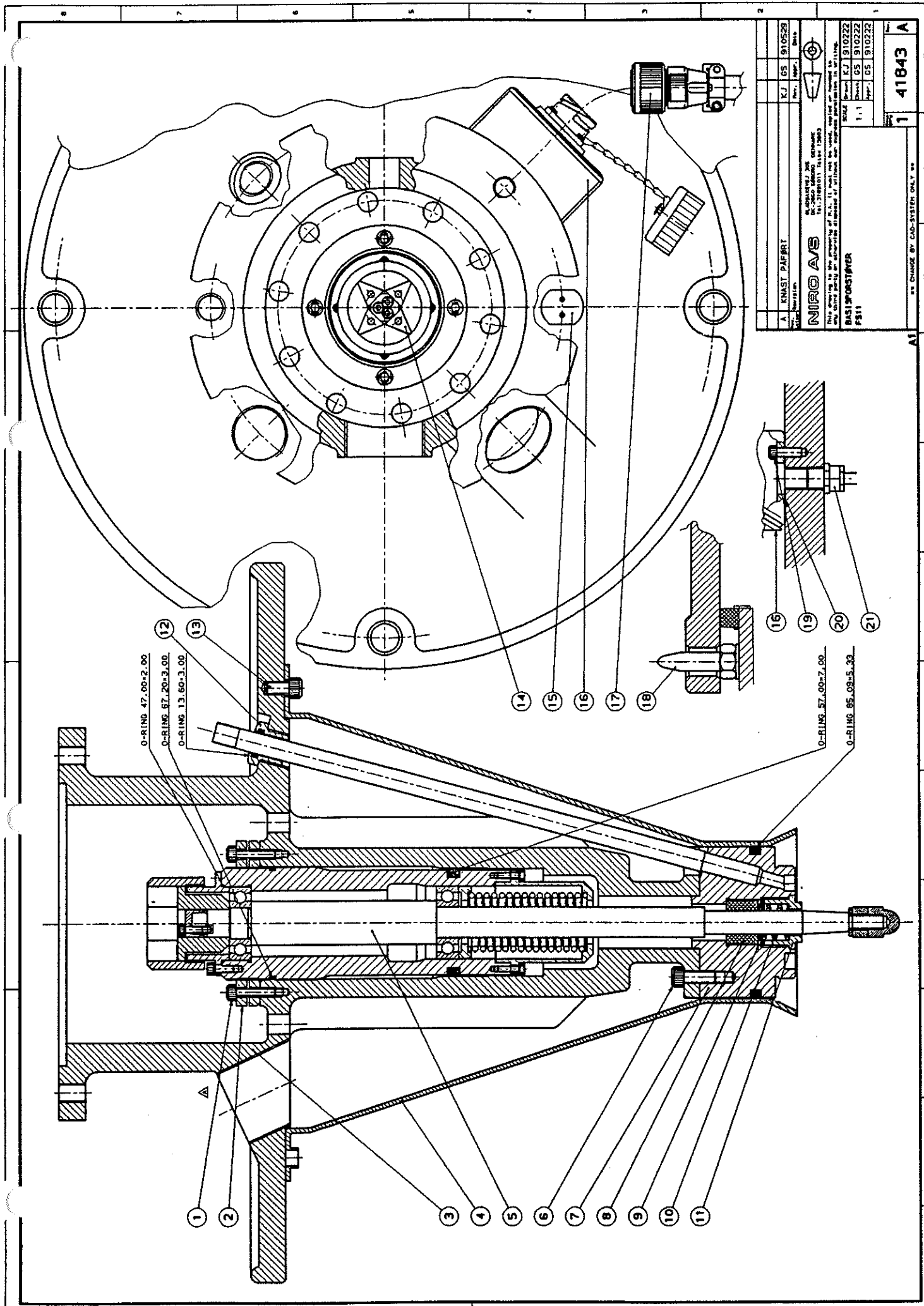
1. Atomizer wheel not in balance.
2. Liquid distributor choked.
3. Guide bearing worn.
4. Bearings worn.
5. Spindle distorted or otherwise damaged.

REMEDY:

1. Remove atomizer wheel and remove deposits. Dynamic balance can be checked by NIRO.
2. Dismantle distributor and clean.
3. Fit new guide bearing.
4. Fit new bearings.
5. Check to see whether spindle runs true. If not, fit new spindle and bearings. Max. 0,1 mm.

Part No.	Description	Approved date	Page
018752-0010	FORST. FS11 AVOG 00S STV ATOMIZER FS11 AVOG 00S STV ZERSTAEUBER FS11 AVOG 00S STV	22-AUG-91	1/1

Pos. No.	Part No.	Description	Quantity	Unit
1	041843-0001	BASIC ATOMIZER FS11	1.00	EA S
2	045241-0001	COOLING AIR TO SKIRT FS11	1.00	EA S
3	045352-0001	AIR TO SPINDLE FS11	1.00	EA S
4	045195-0001	TACHOMETER ARRENGEMENT FS11	1.00	EA S
5	044498-0002	VIBR.MONITORING SYSTEM FS11	1.00	EA S
6	086731-0001	CIRCUIT DIAGRAM FS11/15	1.00	EA
7	072001-0001	CIRCUIT DIAGRAM TACHO FU11	1.00	EA
8	061058-0001	CIRCUIT DIAGRAM, VIBR. MONITOR	1.00	EA

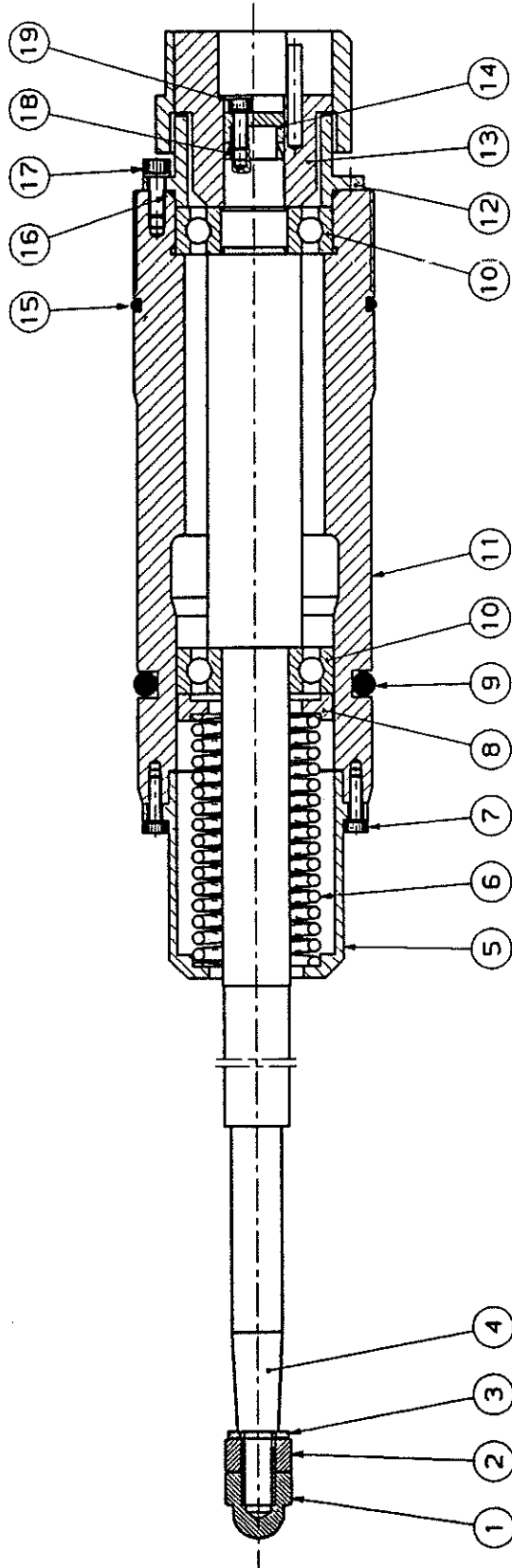


A KNAST PAPER		KJ	OS	910523
Version		Rev.	Appr.	Date
NIRO AS Engineering for Mechanical Engineering Tel: +45 46 11 11 11 Fax: +45 46 11 11 11				
This drawing is the property of N.A. It must not be used, copied or altered in any way without the written permission of N.A. and third party or otherwise disposed of without the written permission of N.A.				
SIZE: 1:1 Project: KJ 910523 Date: 05 910523 Appr.: 05 910523 FS11		1 41843 A		

ALL CHANGE BY CAD-SYSTEM ONLY !!

Part No.	Description	Approved date	Page
041843-0001	BASISFORSTØVER FS11 BASIC ATOMIZER FS11 BASISZERSTAEUBER FS11	06-MAY-91	1/1

Pos. No.	Part No.	Description	Quantity	Unit
1	014103-0620	ALLEN SCR. MC 6*20 DIN912-12.9	4.00	EA
2	089331-0001	ADJUSTING NUT FS11/15	1.00	EA
3	035428-0001	SUPPORTING PLATE FS11	1.00	EA S
4	012061-0001	SKIRT	1.00	EA
5	041845-0001	SPINDLE COMPLETE FS11	1.00	EA S
6	014104-0820	ALLEN SCREW MC 8*20 DIN912-FZB	3.00	EA
7	065861-0001	BRACKET WITH 1 FEED PIPE, FU11	1.00	EA S
8	010270-0001	GUIDE BEARING	1.00	EA
9	010271-0001	WASHER	1.00	EA
10	010272-0001	SPRING	1.00	EA
11	010273-0001	SPRING RETAINER	1.00	EA
12	035576-0001	STUFFING BOX FS11	1.00	EA
13	014301-1010	SETSCREW M 10*10 DIN933-A2	4.00	EA
14	085815-0001	COUPLING BLOCK FS11/15	4.00	EA
15	012402-0001	FLUID INDICATOR L=0,5M	1.00	EA S
16	074062-0001	CONNECTION BOX COMPLETE	1.00	EA S
17	012343-0001	PLUG WITH 17-CORE CABLE 6M	1.00	EA S
18	063702-0001	MOUNTING KIT FOR 11/10/15	1.00	SET S
19	014104-0516	ALLEN SCREW MC 5*16 DIN912-FZB	4.00	EA
20	056965-0001	GASKET F/CONNECTION BOX	1.00	EA
21	013229-0001	CABLE ENTRY PG21	1.00	EA
100	037846-0001	IDENTIFICATION PLATE FS11/15	1.00	EA
101	013391-0001	PACKING CASE FOR FU/FS11	1.00	EA
102	010298-0001	PROTECTION CAP	1.00	EA



Rev.		Revision		Date	
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<p>NIRO A/S GLADSAKEVEJ 305 DENMARK DK-2860 5860RS Tel. (01) 691011 Telex 15603</p> <p>This drawing is the property of N.A. It must not be used, copied or bonded to any third party or otherwise disposed of without our express permission in writing.</p>					
<p>SPINDLE COMPLETE FS 11 GREASE LUBRICATED SPINDLE BEARINGS</p>					
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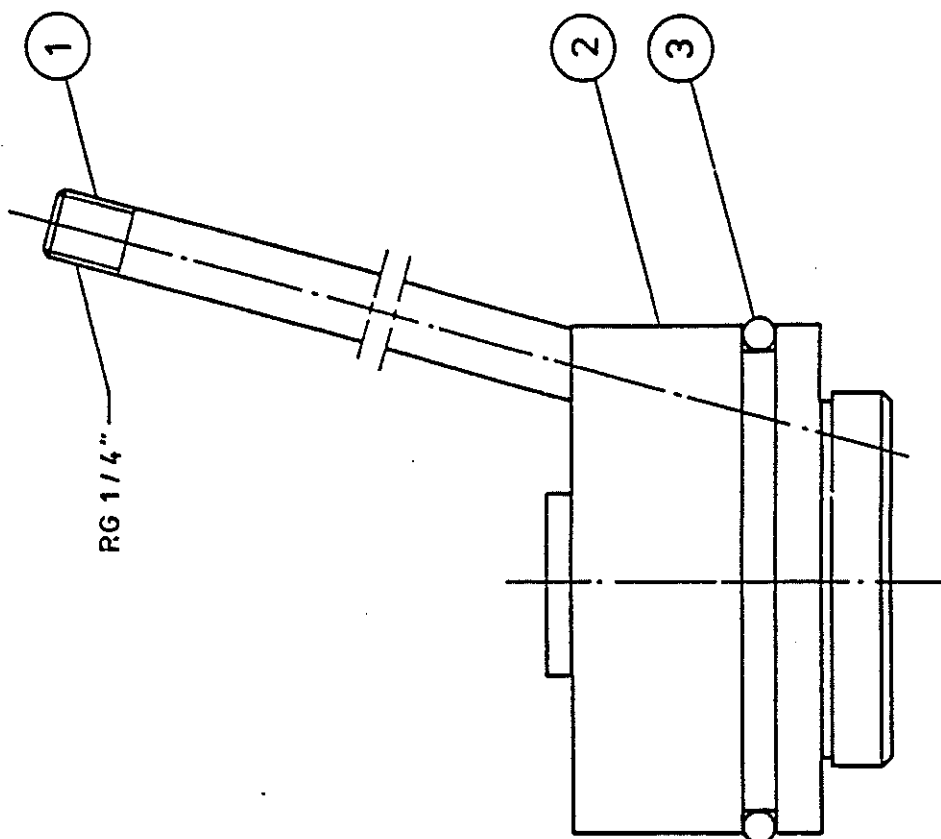
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Part No.	Description	Approved date	Page
041845-0001	SPINDEL KOMPLET FS11 SPINDLE COMPLETE FS11 SPINDEL KOMPLETT FS11	06-MAY-91	1/1

Pos. No.	Part No.	Description	Quantity	Unit
1	010227-0001	CLOSED NUT AISI 303	1.00	EA
2	010229-0001	NUT AISI 303	1.00	EA
3	011467-0001	DISC	1.00	EA
4	035578-0001	SPINDLE FS11	1.00	EA S
5	082762-0001	SPRING RETAINER FS11/15	1.00	EA
6	085819-0001	PRE-LOAD SPRING FS11/15	1.00	EA
7	014101-0416	ALLEN SCREW MC 4*16 DIN912-A2	4.00	EA
8	082761-0001	PRESSURE GUIDE FS11/15	1.00	EA
9	012620-0570	O-SEAL VITON 7.00*57.00	1.00	EA
10	014047-2047	BALL BEARING SPECIAL	2.00	EA
11	035577-0001	BALL BEARING CASING FS11	1.00	EA
12	088013-0001	BALL BEARING RING FS11/15	1.00	EA
13	098998-0001	COUPLING HALF LOWER CPL. FS11	1.00	EA S
14	012006-0001	RETAINING RING	1.00	EA
15	012558-0672	O-SEAL NITRIL 3,00*67,20	1.00	EA
16	012554-0470	O-SEAL NITRIL 2.00*47.00	1.00	EA
17	014101-0512	ALLEN SCREW MC 5*12 DIN912-A2	3.00	EA
18	013265-0001	RETAINER 14*18 RFN 8006	1.00	EA
19	014103-0410	ALLEN SCR. MC 4*10 DIN912-12.9	3.00	EA



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FØDERØRSBASIS MED 1 RØR	
FU - 11	

Rev.	GS	851218	DATE
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NIRO ATOMIZER GLAUSKÆLVEJ 375 DK-2860 SØRØG · DENMARK Tel (01) 691011 Telex 15653

Part No.	Description	Approved date	Page
065861-0001	FØDERØRSBASIS MED 1 RØR, FU11 BRACKET WITH 1 FEED PIPE, FU11 KONSOLE MIT 1 SPEISEROHR, FU11	24-MAR-86	1/1

Pos. No.	Part No.	Description	Quantity	Unit
1	065859-0001	FEED PIPE 1/4", FU11	1.00	EA
2	065852-0001	BRACKET FOR 1 FEED PIPE, FU11	1.00	EA
3	012564-0850	O-SEAL NITRIL 5,33*85,09	1.00	EA



Niro A/S · P.O. Box 45 · DK-2860 Soeborg · Denmark · Tel.: +45 39 69 10 11 · Telefax: +45 39 69 14 14 · Telex: 15603 · Reg.No. 12682

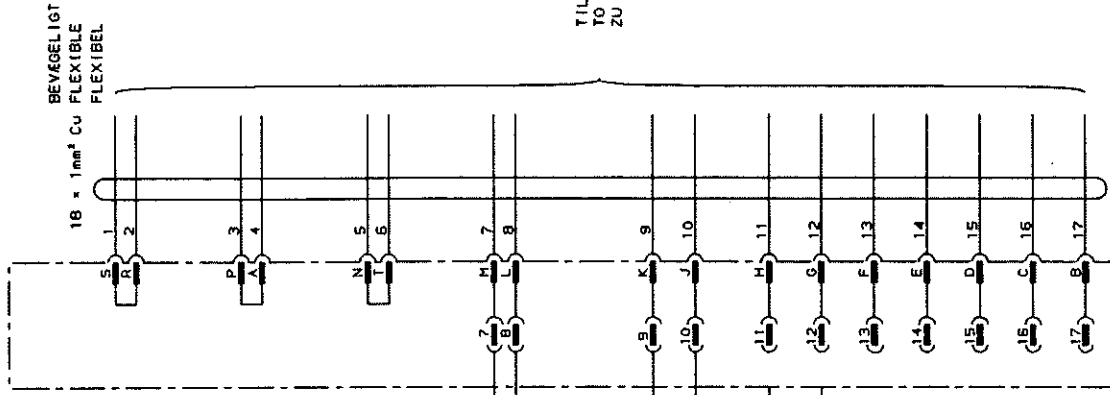
Part No.	Description	Approved date	Page
045241-0001	LUFT TIL SKØRT FS11 COOLING AIR TO SKIRT FS11 KUEHLLUFT ZUM MANTEL FS11	18-JUN-91	1/1

Pos. No.	Part No.	Description	Quantity	Unit
1	013156-0811	NIPPLE 1 1/2"*80, R-210 UHB	1.00	EA
2	041842-0001	BREATHER CAP, 1 1/2 RG	1.00	EA

Part No.	Description	Approved date	Page
045352-0001	LUFT TIL SPINDEL FS11 AIR TO SPINDLE FS11 LUFT ZUM SPINDEL FS11	19-JUN-91	1/1

Pos. No.	Part No.	Description	Quantity	Unit
1	013081-4553	SEAL USIT 17.3*23.9*2.1	1.00	EA
2	010265-0001	AIR VENT	1.00	EA
3	079542-0001	NIPPLE, FU11	1.00	EA
4	045351-0001	AIRTUBE F SPINDLE, FS11	1.00	EA
5	013129-0707	PIPE BOWL 1/4" BSP-1/4" BSP	1.00	EA

SAMLECASE
CONNECTION BOX
SAMMELDØSE



BEVÆGELIGT
TO CONTROL PANEL
FLEXIBEL
ZU STEUERSCHRANK

OVERSØMMELSELEKTRODER PÅ FORSTØVERBØREPLADE
FLOODING ELECTRODES ON ATOMIZER SUPPORTING PLATE
ÜBERSCHÜMMUNGSELEKTRODEN AUF ZERSTÄUBERTRAGPLATTE

FØLER FOR ØMREJNINGSTALSINDIKATOR
PICK-UP FOR R.P.N. INDICATOR
GEBER FÜR TACHOMETER

1) PT100-FØLER PÅ FØDERRØRSBASIS
PT100-PROBE AT FEEDPIPEBASIS
PT100-FØHLER IN SPEISERÖHRBASIS

NIRO A/S		GLADSAKEVEJ 305 DENMARK DK-2650 SØBORG Tel. (07) 870111 Telex 13603	
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FORSTØVER FS15/FS11		890223	
ELEKTRISK FORBINDELSSESKEMA		890223	
ATOMIZER FS15/FS11		890223	
ELECTRIC UNIT WIRING DIAGRAM		890223	
ZERSTÄUBER FS15/FS11		890223	
ELEKTRISCHE GERÄTEVERDRÄHTUNGSPLAN		890223	
Rev. 1		86731 A	
HHC PRR JP 910321		Date	
Rev. 1		Date	

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L K J H G F E D C B A

POWER SUPPLY
EINSPEISUNG

1N ~ 50-60 Hz 190-250V

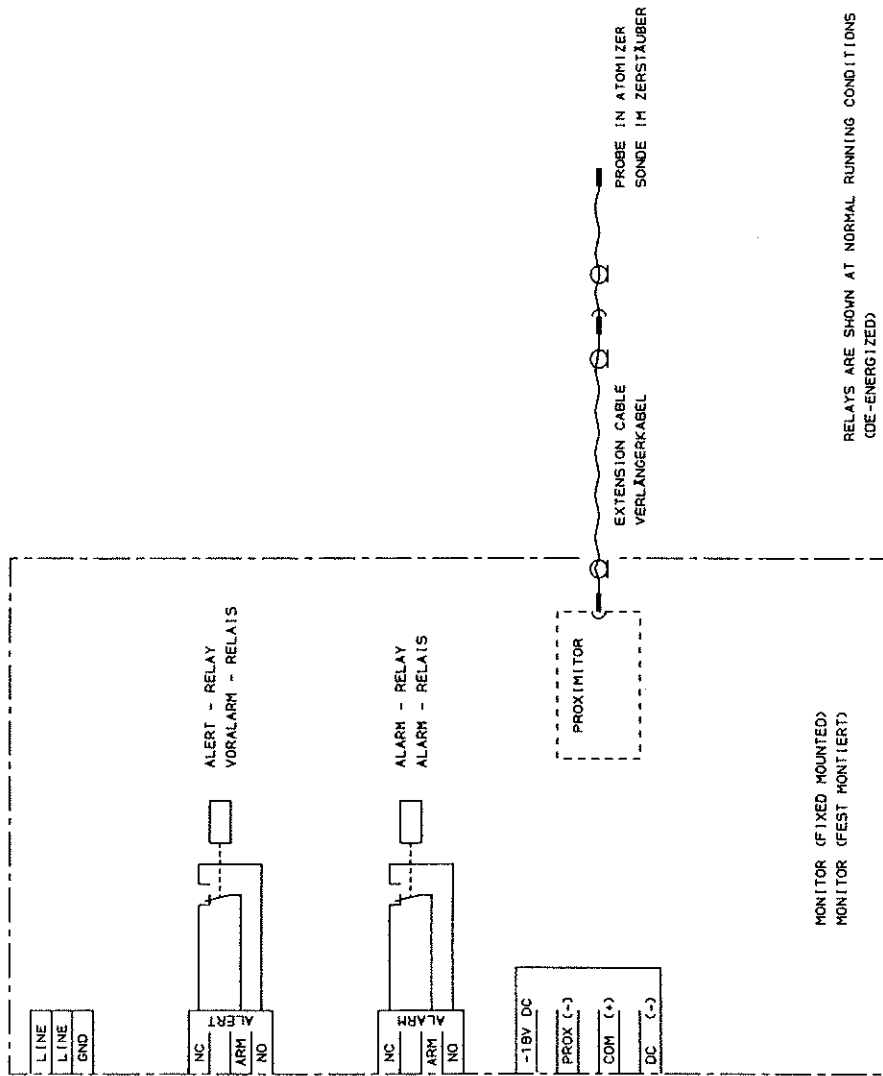
SIGNALS FOR ANNUNCIATION SYSTEM
SIGNALS FÜR MELDEANLAGE

SWITCHING CAPACITY ,
SA AT 28V DC (RESISTIVE LOAD)
SA AT 115V AC (RESISTIVE LOAD)
SCHALTLEISTUNG ,
SA BEI 28V GS (OHMSCHER LAST)
SA BEI 115V WS (OHMSCHER LAST)

REFERENCE FOR CALIBRATION
REFERENZ FÜR EICHUNG

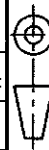
SIGNAL FOR PROBE-GAP SETTING
0-10V DC, R1 = 10k Ω (NOMINAL)
SIGNAL FÜR SONDE-SPALT EINSTELLUNG
0-10V GS, R1 = 10k Ω (NOMINELL)

SIGNAL FOR REMOTE INDICATION/RECORDING
0-10V DC, R1 = 10k Ω (NOMINAL)
SIGNAL FÜR FERN-ANZEIGUNG/REGISTRIERUNG
0-10V GS, R1 = 10k Ω (NOMINELL)



RELAYS ARE SHOWN AT NORMAL RUNNING CONDITIONS
(DE-ENERGIZED)
RELAYS SIND BEI NORMALEN BETRIEBSBEDINGUNGEN
GEZEIGT (RUHESTELLUNG)

C	GAH	GAH	B90221
B	KJN	GAH	B90213
A	GAH	GAH	B80829
Rev.	Rev.	Appr.	Date



GLADSAKEVEJ 305
DK-2600 SØRØ
TEL. (01) 281011

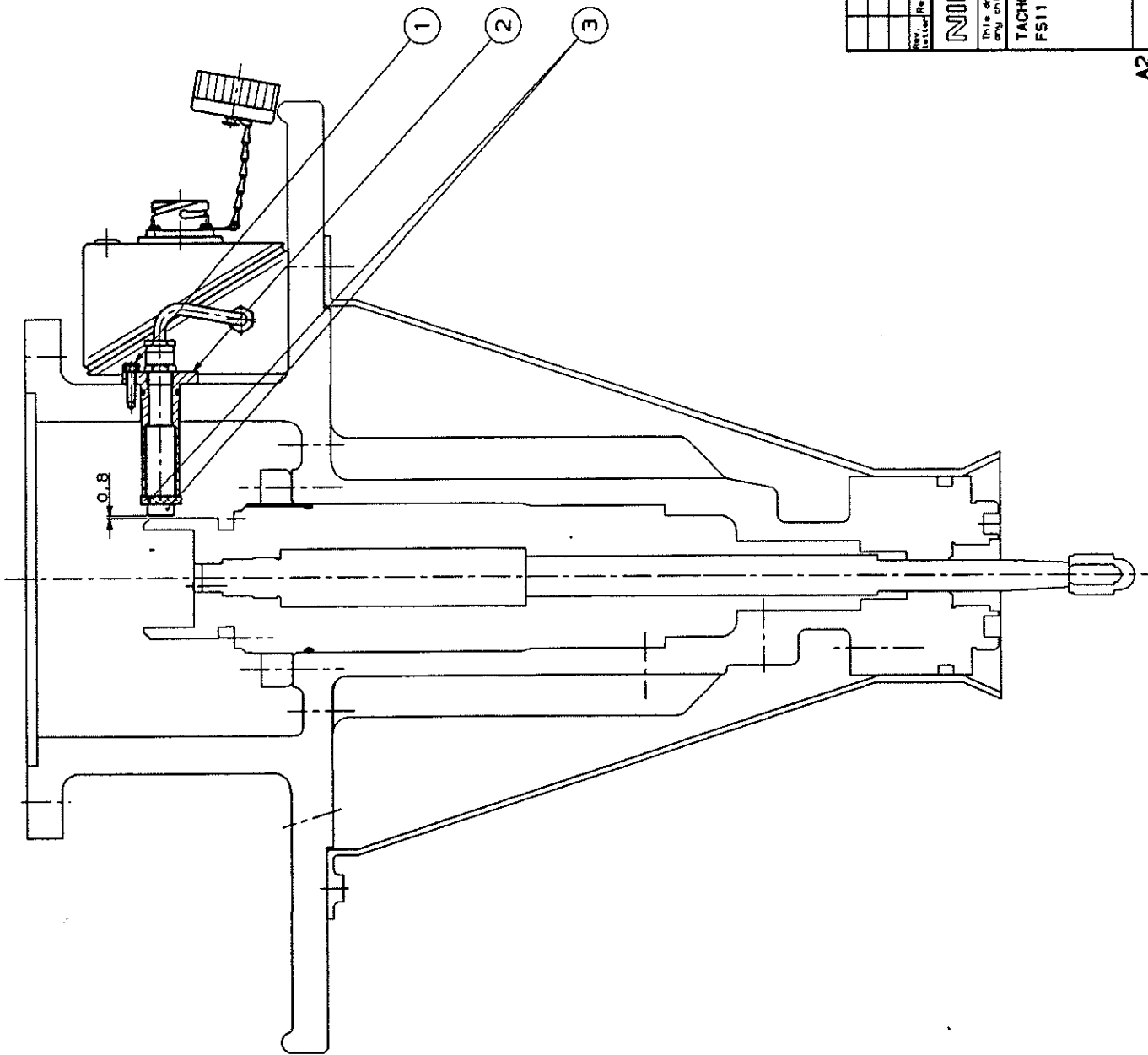
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NIRO A/S
 OLADAVEJ 305
 DK-2850 SØGBØR
 TEL.: +45 7691011 FAX: +45 7691414

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TACHOMETER ARRANGEMENT
 FS11

SCALE 1:1

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Part No.	Description	Approved date	Page
045195-0001	TACHOMETER ARRANGEMENT FS11 TACHOMETER ARRENGEMENT FS11 TACHOMETERAUFSTELLUNG FS11	17-JUN-91	1/1

Pos. No.	Part No.	Description	Quantity	Unit
1	014104-0512	ALLEN SCREW MC 5*12 DIN912-FZB	3.00	EA
2	097433-0001	BUSHING COMPL. F/TACHO FS11/15	1.00	EA S
3	017757-0001	TACHOMETER PROBE COMPLETE	1.00	EA S

INPUT POWER

95-125 Vac, 50-60 Hz, 1 Ph or 220 Vac, 50-60 Hz, 1 Ph.

POWER SUPPLY OUTPUT

-18 Vdc, zener diode regulated

CHANNELS

Model 5074 single channel, vibration input/displacement output.

PROXIMITOR

Type 3120, probe type 300 at 7,8 V/mm

RELAY FUNCTIONS

Alert relay and Danger relay
Hermetically sealed
5 amp, 115 Vac, resistive load
Form C contacts (SPDT)
Normally de-energized standard
Non-latching relays standard (customer field option for latching relays,
addition of external normally closed contacts across RESET terminals r
required for latching relays. Momentary opening for reset function).

RELAY GUARDS

3 second integrating delay
OK/Alert interlock standard

TRIP MULTIPLIER

External contact closure across the TM terminals required for 2X trip levels
(vibration channels only).

OUTPUT SIGNALS

Form C relay contacts for both Alert and Danger relays - NC, ARM, NO

PROX output (Proximitor signal)
DC Vibration output
COM (Common)

-18 Vdc for use with Remote Readout Units

PACKAGE

Explosion-proof housing

Operation connections for the 1700-series Monitor are made on the terminal strip or circuit boards, directly under the Monitor housing lid. The connections on the terminal strip include:

LINE		RESET
NEUT	AC Power	TM
GND		
NC		PROX
ARM	Alert Relay	COM
NO		DC
		-18 Vdc
NC		
ARM	Danger Relay	
NO		

The relay functions are available for connection to alarms, annunciators, or to initiative machine shutdown.

The Probe extension cable is connected direct to the appropriate Proximitors on the boards. The Proximitors signal is available at the terminal strip for machine performance diagnosis.

The calibration procedures are described in this manual.

The Probe gap can be set with a Voltmeter, following the Probe Calibration Graph, approx. 7 Vdc, to ensure operation in the linear range, the red LED gives warning if the Probe is outside this range. 7 Vdc have to be measured between PROX and COMMON on the terminal strip in the proximator/monitor box.

The Alert and Danger relay trip levels are factory set to 4 and 5 Volt respectively. They can be checked and adjusted on the trip board with a DC voltmeter and a screwdriver.

The vibration gain is factory set to 7,8 V/mm. It can be checked and adjusted with a DC voltmeter and a TK 3, following procedures outlined above and in the TK 3 instruction manual.

The TK 3 unit is simulating the mechanical vibration, and is used for recalibration of the system.

GENERAL DESCRIPTION

4
25/2-1976 GBVIBRATION BOARD, TYPE NO. A 175

The vibration board monitors the maximum peak-to-peak (double amplitude) motion of the observed shaft.

The complete type number of the vibration board describes the Probe - 300 - Proximitor type - 20 - to be used with the Vibration Board scale factor - 200.

Vibration Board purchase specification:

A 175 - 300 - 20 - 200.

In addition to the integral Proximitor, each Vibration Board includes an adjustable gain potentiometer for the peak-to-peak detector, an OK circuit with an OK/Alert interlock and an OK lamp (light-emitting diode), and Proximitor signal test points.

When the OK lamp is lit, it indicates that the Probe is gapped within its linear range and the connections and operations are correct. If the OK circuit detects a malfunction in the channel operation, the OK/Alert interlock trips the Alert relay.

Vibration Board operation may be checked at the two test points: Proximitor output signal (white), and dc vibration signal (orange).

When calibrating the Vibration Board, measure the output voltage from the Vibration Test point (orange) to common on the terminal strip. The voltage is negative with respect to common.

The Vibration Range is set by adjusting the potentiometer located next to the white test point.

TRIP BOARD, TYPE NO. T 176

The Trip Board controls the relay operation and provides trip setting test and adjustment points. The Trip Board type number describes the operation of the relays and delay time.

T 176-NDE-D3 is normally de-energized with 3 second integrating delay.

Available on request	T 176-NDE-DO.1	is normally de-energized with 0.1 second delay.
	T 176-NE-D3	is normally energized with 3 second integrating delay.
	T 176-NE-DO.1	is normally energized with 0.1 second delay.

The Trip Board includes adjustable trip level potentiometers, -18 Vdc, and trip set level test points. The test points are:

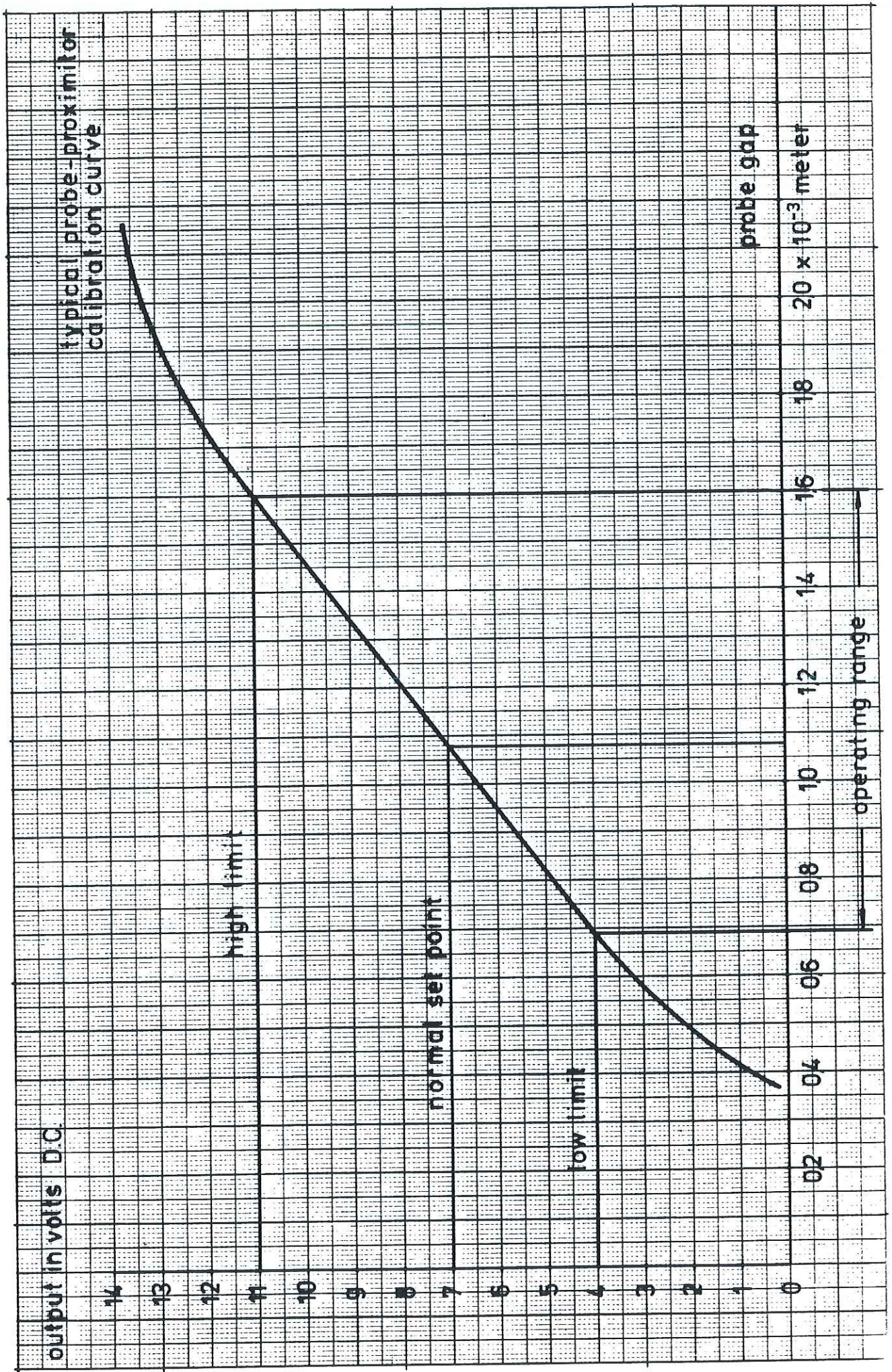
Black: Common
Red: -18 Vdc
Green: Alert set level
Yellow: Danger set level

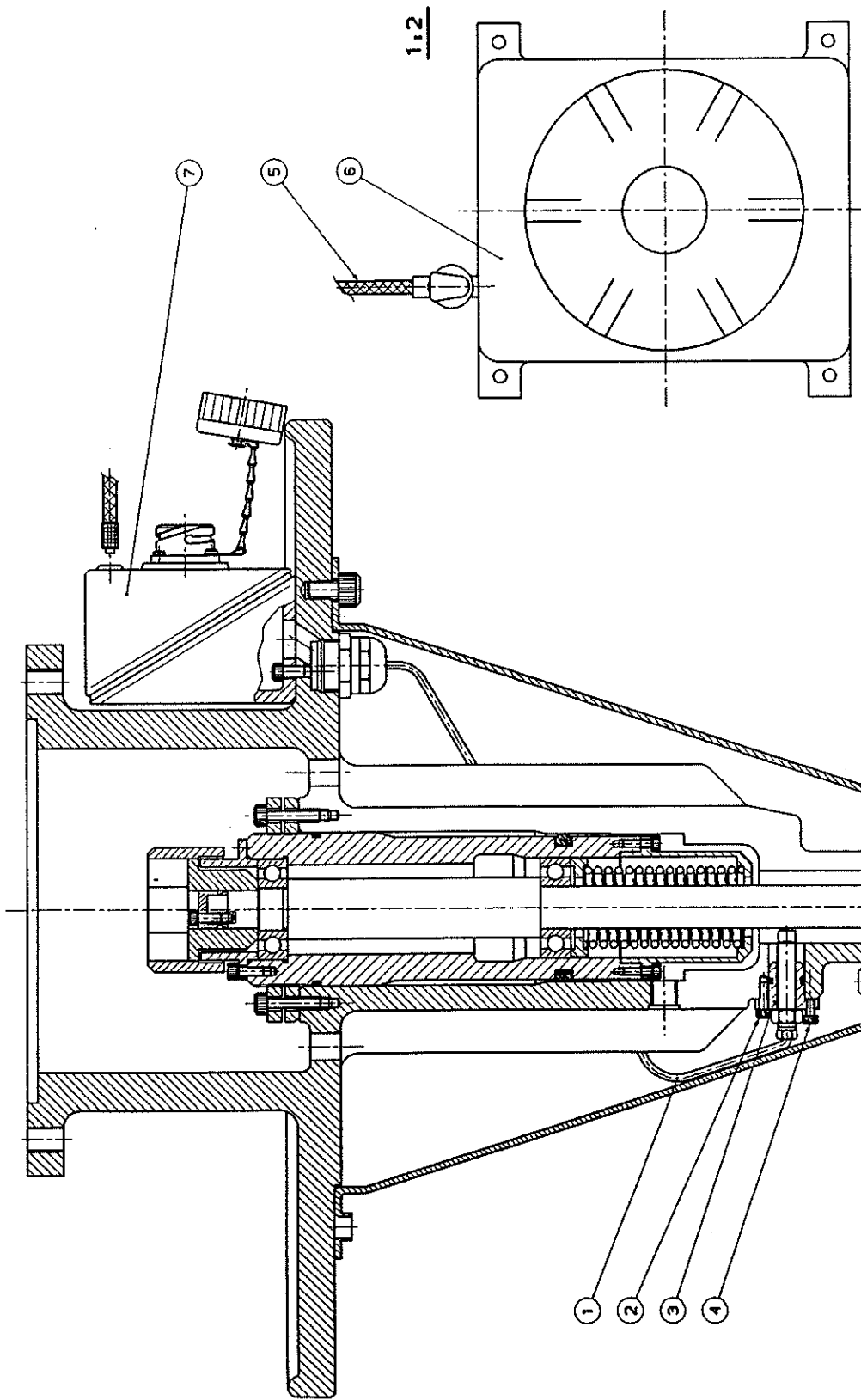
The Alert relay trip point is set by adjusting the potentiometer next to the green test point near the top of the board. The green test point is used to check the Alert relay trip level.

The Danger trip level is adjusted with the potentiometer below the yellow test point. The Danger trip set voltage is measured at the yellow test point.

Above voltages are negative with respect to common.

To calibrate the trip board use a voltmeter to measure the appropriate Test Point to common (black).





VARIANT	POS. NO. 5
-0001	110V 60Hz
-0002	220V 50Hz

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Part No.	Description	Approved date	Page
044498-0002	VIBR.UDSTYR 220V 50HZ FS11 VIBR.MONITORING SYSTEM FS11 VIBR.UEBERWACHUNGSANLAGE FS11	31-JAN-92	1/1

Pos. No.	Part No.	Description	Quantity	Unit
1	012355-0001	PROBE 95 OHM WITH CABLE	1.00	EA
2	014104-0410	ALLEN SCREW MC 4*10 DIN912-FZB	2.00	EA
3	013761-0001	RETAINER FOR PROBE,WITH O-RING	1.00	EA
4	014104-0408	ALLEN SCREW MC 4*8 DIN912-FZB	2.00	EA
5	012354-0001	EXTENSION CABLE 95 OHM	1.00	EA S
6	012356-0002	MONITOR/PROXIMITOR 220V 50HZ	1.00	EA S
7	088063-0001	CONNECTION BOX COMPL. FS11/15	1.00	EA S

Part No.	Description	Approved date	Page
013637-0001	VÆRKTØJSKASSE KOMPLET FS11 TOOL BOX COMPLETE FS11 WERKZEUGKASTEN KOMPLETT FS11	07-MAY-91	1/1

Pos. No.	Part No.	Description	Quantity	Unit
1	013317-0001	LUBRICANT, MOLYKOTE G-RAPID	1.00	EA
2	010057-0001	TOOL FOR DISTRIBUTOR	1.00	EA
3	012106-0001	TESTING ROD F/BEARING FU11/F15	1.00	EA
4	013227-0001	PADLOCK, CISA NO. 22010.40	1.00	EA
5	013578-0001	LABEL, ENGLISH	1.00	EA
6	013579-0001	LABEL, GERMAN	1.00	EA
7	013070-0001	SIGN FOR TOOL BOX	2.00	EA
8	013650-0001	TOOL BOX EMPTY SIZE 1	1.00	EA
9	013440-0017	SOCKET WRENCH NV17	1.00	EA
10	010270-0001	GUIDE BEARING	1.00	EA
11	013853-0008	ADJUSTABEL SPANNER 8"	1.00	EA
12	013575-4004	PIN SPANNER 18-40 Ø4	1.00	EA
13	013828-0005	SET OF ALLEN KEYS TM8	1.00	SET
14	092119-0001	DISMOUNTING SCREW FS15	2.00	EA
15	013594-0003	ALLEN KEY M3*300 T-HANDLE	1.00	EA
16	013594-0006	ALLEN KEY M6*300 T-HANDLE	1.00	EA
17	013594-0005	ALLEN KEY M5*300 T-HANDLE	1.00	EA
18	012304-0002	GUIDE PIN	2.00	EA

WARNING

Importance of Atomizer Wheel Maintenance

1. Introduction

Experience over many years shows that spray drying plants, when carefully operated and maintained in accordance with operating and maintenance instructions and normal industrial practice, do not constitute any health and safety risk. However, in recent years, dangerous incidents related to insufficient attention and maintenance to atomizer wheels, have been reported. Most of these incidents have occurred on old spray drying plant, but there have also been some on plant recently installed, where abrasive or corrosive feed stocks have been atomized.

NIRO wishes to bring the occurrence of these incidents to the attention of its customers, and at the same time emphasize that careful monitoring of the condition of atomizer wheels and regular maintenance is essential to prevent such incidents.

To assist customers in assessing the general condition of their wheels, NIRO offers a certified service programme for NIRO wheels, whereby it is recommended that wheels are returned to NIRO at regular intervals (depending upon the specific operational conditions and experience) so that the wheels can be tested and certified as being safe to continue operation. A handling charge will accompany this service.

2. General Remarks

The atomizer wheel is a key component in a spray drying system. For the purpose of generating the spray, the wheel is rotating at very high speed and is consequently exposed to very high centrifugal forces and high levels of tensile stress.

Based on NIRO's know-how and experience, the atomizer wheel is designed to withstand the high level of tensile stress by the following means:

- Careful mechanical design with emphasis on the need to avoid stress concentration and on securing an adequate cross section of high strength material in all parts of the wheel.
- Careful selection of the proper material that will withstand the influence of temperature, corrosion and wear during the operation of the atomizer machine and atomizer wheel.

Despite meeting these design criteria, the wheel may be subject to wear, corrosion and other degrading effects and should be carefully monitored and maintained by its operator. The purpose of this warning is to caution operators of rotary atomizer and atomizer wheels against effects that may potentially degrade the structural integrity of the atomizer wheel and cause the wheel to fragment at high speeds. In this situation, there is a risk of personnel injury when operational personnel are in the vicinity of the drying plant.

3. How to Reduce Risk of Atomizer Wheel Disintegration

For the spray dryer operator, it is essential to minimize any risk of wheel disintegration for which the main causes can be identified as:

- High Temperature
- Stress Corrosion Cracking
- Wear or Abrasion
- Material Fatigue
- Other Damage

3.1 High Temperature

Spray drying plants operating at high inlet air temperature levels may be equipped with a wheel protection water system which is designed to protect the atomizer wheel and its wear resistant, ceramic parts against overheating. It is essential that this system is working properly, not only with respect to water supply, but also with respect to system interlocking. NIRO recommends periodic inspection of the system as indicated in Section 4.

Discoloration of the atomizer wheel metal surfaces as well as hardening of O-rings are two of several indications of adverse high temperature effects.

3.2 Stress Corrosion Cracking

Spray drying plants operating with feed stocks containing even a low concentration of Chloride may be subject to stress corrosion cracking (SCC), which especially is harmful to atomizer wheels fabricated of stainless steels. SCC cannot be observed by visual means or other non-destructive testing. NIRO recommends a certified service inspection and spin test for any atomizer wheel exposed to chloride corrosion at regular intervals. (See Section 4).

3.3 Wear or Abrasion

For atomizer wheels designed to handle abrasive feed liquids, the wear resistant ceramic parts should be checked regularly and not less frequently than indicated in Section 4. It is recommended that such parts be replaced or repositioned as described in the Instruction Manual, if less than 3 mm of wear resistant material is left in the areas where wear has reached an advanced level.

For all atomizer wheels in general, any sign of wear or abrasion in the material should be monitored carefully. It is recommended that if wear has a depth of more than 3mm, the worn part should be replaced, or the entire wheel should be returned either directly or via the local NIRO office to NIRO's atomizer department at address below for certified service inspection, repair and spin test.

If it is found that abrasive wear has worn through the wear resistant parts and has damaged any structural metal part of the atomizer wheel, the entire atomizer, wheel should also be returned to NIRO for a certified service inspection, repair and spin test

3.4 Material Fatigue

Any material will develop signs of fatigue if subjected to stress fluctuations. Signs of fatigue may be microscopic surface cracks. In an atomizer wheel material fatigue may appear as a result of so-called low cycle fatigue caused by the wheel being subjected to many starts and stops over a period of several years.

It is recommended especially to check for any cracks resulting from this degrading effect if the atomizer wheels are more than 10 years of age. Cracks can be revealed by means of the dye penetrant method. A certified service inspection by NIRO involves a check for fatigue cracks.

3.5 Other Damage

Any other sign of damage or suspicion thereof, e.g. following the dropping of a wheel, should seriously be taken into consideration by the operator. In cases of doubt about the condition of the wheel, the entire wheel should be returned to NIRO for certified service inspection, repair and spin test.

3.6 Operating and Maintenance Instructions

The safe operation of all NIRO equipment, including the atomizer wheel, depends upon the operation and maintenance of the equipment in strict compliance with the operating and maintenance instructions provided in the manuals and any other training programme for the customer. It is imperative that the customer ensures that his operators are aware of these operating and maintenance instructions. With respect to the atomizer wheel, attention is called for in the following instructions:

- Never run the atomizer wheel at speeds higher than those specified or recommended by NIRO.
- Never run the atomizer wheel when it might be only partially assembled, i.e. without upper plate.
- Never attempt an atomizer wheel repair.
- Never use acids in atomizer wheel cleaning procedures.

4. Schedule

4.1 Inspection Periods

This schedule specifies recommended inspection periods for atomizer wheels. Inspection means the procedure whereby the operator, by visual or other means, investigates if the atomizer wheel shows any signs of degradation.

The recommended periods between inspections depend upon the type of atomizer wheel, the feed stock handled and the operating inlet air temperature of the spray dryer. The periods indicated are guidelines only.

Types of Atomizer Wheel:

Straight Vane Wheel	Type SL or SH
Curved Vane Wheel	Type CL or CH
Abrasion Resistant Wheel	Type AX or AM

Inspection Periods:

Feed Properties/ Inlet Air Temperature	Potential Cause of Wheel Damage			Recommended Period	Recommended Period
	High air temp.	SCC	Wear/ Abrasion	SL or SH CL or CH	AX or AM
Solutions/Emulsions:					
Strong acid pH 0-6	-	-	+	1000 h	500 h
Neutral pH 6-8	-	-	+	1000 h	500 h
Strong alkali pH 8-14	-	-	+	1000 h	500 h
Suspensions/Slurries:					
Strong acid pH 0-6	-	-	+	100 h	500 h
Neutral pH 6-8	-	-	+	100 h	500 h
Strong alkali pH 8-14	-	-	+	100 h	500 h
Chloride content	-	+	-	1000 h	1000 h
Inlet Temperature <250 °C	+	-	-	3000 h	3000 h
Inlet Temperature >250 °C	+	-	-	2000 h	2000 h
Inlet Temperature >550 °C	+	-	-	1000 h	1000 h

4.2 Service Periods

The Certified Service Programme requires that the entire atomizer wheel is returned to NIRO's atomizer department at the below address for inspection, repair and spin test. The wheel can be sent via the local NIRO office.

The service procedure comprises careful inspection for all of the described degrading effects. Unless the wheel is considered to be unsafe or damaged beyond repair, the service also includes repair or replacement of damaged parts. The service procedure is concluded by balancing of the wheel parts as well as the assembled wheel.

A spin test of the wheel is then carried out at a speed in excess of the maximum operational speed for the specific wheel in order to ensure the structural integrity of the refurbished wheel. An atomizer wheel certificate documenting the service is then issued.

NIRO recommends that every atomizer wheel is submitted to NIRO's facilities for a certified service at certain times in its operational life. The recommended points in time are:

1st service:	First operational year + 5 years
2nd service:	First operational year + 8 years
3rd service:	First operational year + 10 years

Thereafter, service is recommended each year.

These recommendations are guidelines only. As stated above in section 3, any signs of damage or suspicion thereof should be taken seriously into consideration by the operator. In cases of doubt about the condition of the wheel, the entire wheel should be returned to NIRO for a certified service inspection, repair and spin test.

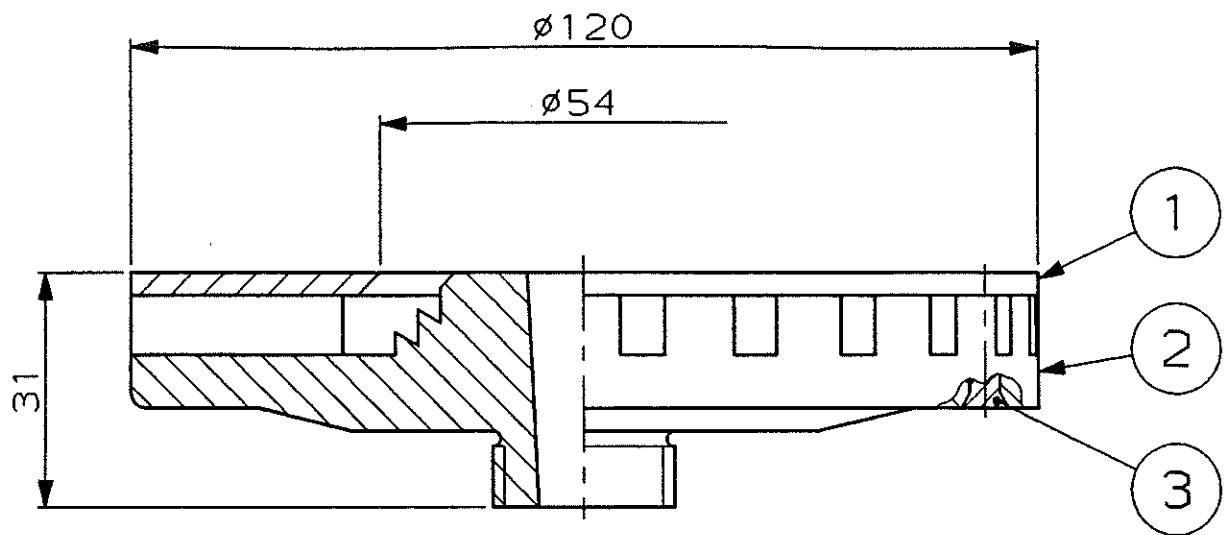
5. Concluding Remarks

This document on the importance of atomizer wheel maintenance is an extension of the NIRO customer service. Experience shows that spray drying plants, carefully operated and maintained in accordance with operating and maintenance instructions and sound industrial practice, do not constitute any unusual risk.

Certain operational conditions may, however, have a long term, adverse effect on the structural integrity of atomizer wheels.

Since the control of the operational conditions is solely in the hands of the operator, NIRO cannot guarantee wheel performance beyond what is provided in its contract terms. However, NIRO and the operator have a common interest to avoid the potential risk of personal injury and damage to equipment. Therefore, operators are urged to be aware of the need to give proper attention

to the condition, operation and maintenance of atomizer wheels as outlined both in NIRO's operating and maintenance instructions and in this document. Furthermore, it is advisable to make use of NIRO's service facilities as part of a preventive maintenance programme.



VARIANT	MATR.	MAX. RPM.
-0001	STAINLESS 329	24350
-0002	NIKKEL C-276	24350
-0003		

LIQUID DISTRIBUTOR } 10087-0001
VERTEILER

A	OMTEGNET TIL CAD	KJ	KHJ	911223	
Rev. Letter	Revision	Rev.	Appr.	Date	
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NIRO A/S GLADSAXEVEJ 305 DK-2860 SOEBORG DENMARK TEL. +4539691011 FAX +4539691414		SCALE	Drawn	AB	810708
		1:1	Check.	AM	810708
*** CHANGE BY CAD-SYSTEM ONLY ***		Appr.	KHJ	911223	
ATOMIZER WHEEL/ZERSTÄUBER RAD SL24-210 F10/FU11		Category	10694		Rev. A


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Part No.	Description	Approved date	Page
010694-0001	FORST.HJUL SL24-120 FU11/F10 ATOM. WHEEL SL24-120 FU11/F10 ZERST.RAD SL24-120 FU11/F10	23-DEC-91	1/1

Pos. No.	Part No.	Description	Quantity	Unit
1	020084-0001	UPPERPART SL24-120 329 F10	1.00	EA S
2	017307-0001	LOWER PART SL24-120 329 F10	1.00	EA S
3	020000-0425	RIVETS DIA.4*25 304	12.00	EA

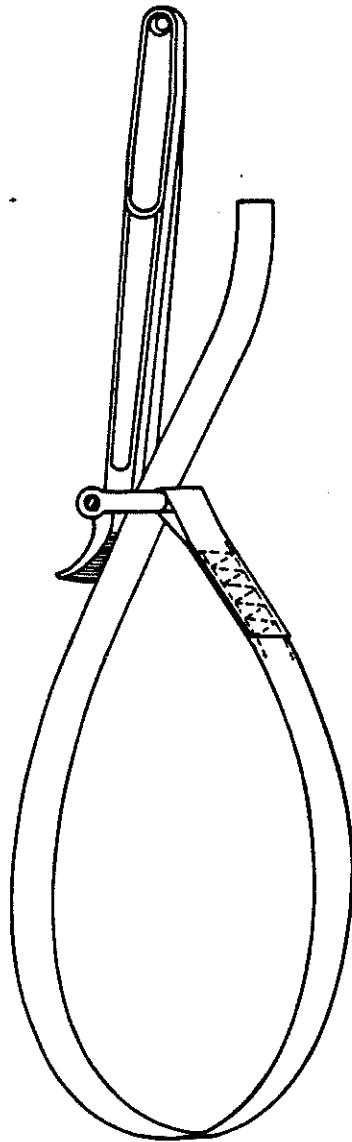
010694-0001

A technical drawing of a mechanical assembly, likely a pump or motor component, shown in a cross-sectional view. The drawing includes three numbered callouts: 1 points to the main cylindrical body, 2 points to the base or mounting flange, and 3 points to a small circular feature on the top surface. The assembly consists of a central shaft with multiple blades or vanes, a base flange with mounting holes, and a top cover or cap. The drawing is oriented vertically with the shaft pointing upwards.

Rev. Letter	Revision	Rev.	Appr.	Date	This drawing is the property of N.A.A. It must not be used, copied or handed to any third party, or otherwise disposed of without our express permission in writing.				
NIRO A/S GLADSTREVEJ 308 DK-2600 SØBORG DENMARK Tel. (01) 681 011 Telex 15603		SCALE	Drawn	KJ 910212	SHEET	HØJFREKVENSMOTOR KOMPLET 3 KW. 12000-24000 RPM FS11	Code 1	Rev.	
		1 : 2.5	Check.	GS 910212					
		Appr.	GS 910212						
*** CHANGE BY CAD-SYSTEM ONLY ***									

Part No.	Description	Approved date	Page
041844-0001	HØJFREKV.MOTOR M/KOBLING FS11 HIGH FREQ. MOTOR W/COUPL. FS11 HOCHFREQ.MOTOR M/KUPPLUNG FS11	09-AUG-91	1/1

Pos. No.	Part No.	Description	Quantity	Unit
1	045559-0001	HIGH FREQUENCY MOTOR FS11	1.00	EA
2	099001-0001	COUPLING HALF UPPER FS11	1.00	EA
3	014407-0008	RING BOLT M 8 DIN580-C15 FZB	1.00	EA
4	043540-0001	ID-PLATE 3kW MOTOR FS11	1.00	EA



MATR: NØGLE DOWIDAT 36/1
BÅND: 25 x 4 mm
L: 700

REVISED:	MED/UDEN STYKLISTE	
A/s NIRO ATOMIZER		It is prohibited to entrust this drawing, which must be returned when called for, to third party without our written consent.
GLADSAXEVEJ 105, SØBORG COPENHAGEN TEL.: 69 10 11, TELEX: 5403		SCALE S
HOLDEVÆRKTØJ FOR FORSTØVERHJUL STR. 1 Ø 80 - Ø 150 FU 11, F 10		Drawn by: AJ 22-6-73 Cop. by: -- -- -- Check. by: -- -- -- Appr. by: [Signature] 28-6-73
		REPLACEMENT FOR:
		12110
		REPLACED BY:

DENNE TEGNING ER VOR EGENDOM OG MÅ IKKE UDEN SKRIFTLIG TILLADELSE OVERLÅDES TIL BENYTTES ELLER KOMERES AF UVEDKOMMENDE. VI FORBEHOLDER OS RET TIL AT KRÆVE TEKNISGEN RETURNERET.

CE PLAN ETANT NOTRE PROPRIÉTÉ IL N'EST PAS PERMIS DE LE PRÉSENTER À TIÈRE PERSONNE NI DE LE COPIER SANS NOTRE AUTORISATION PAR ÉCRIT. NOUS NOUS RÉSERVONS LE DROIT DE RETIRER LE PLAN.

DIESE ZEICHNUNG BLEIBT UNSER EIGENTUM. OHNE UNSERE SCHRIFTLICHE BESTÄTIGUNG DARF SIE WEDER KOPIERT NOCH DRITTEN, UNBETRIEBLICHEN PERSONEN VORGEZEIGT WERDEN. WIR BEHALTEN UNS DAS RECHT VOR, SIE ZURÜCKZUFORDERN.

