C0	31/10/08	Emissione per approvazione	DV	DL	YE
REVISIONE		DESCRIZIONE	EL.	CON.	APP.

MINISTERO DELLE INFRASTRUTTURE E DEI TRASPORTI

MAGISTRATO ALLE ACQUE

NUOVI INTERVENTI PER LA SALVAGUARDIA DI VENEZIA

LEGGE N. 798 DEL 29-11-1984

CONVENZIONE REP. 7191 DEL 04-10-1991

ATTO ATTUATIVO REP. 8249 DEL 28-12-2007 (PROGETTAZIONE)

INTERVENTI ALLE BOCCHE LAGUNARI PER LA REGOLAZIONE DEI FLUSSI DI MAREA

CUP: D51B02000050001

PROGETTO ESECUTIVO

WBS: LN.L1.50

BOCCA DI LIDO: SAN NICOLO' – TREPORTI

IMPIANTI

MEZZI PER LA RIMOZIONE DEI SEDIMENTI

SPECIFICA TECNICA - IMPIANTI DI BORDO - APPENDICE A - COMPONENTI PRINCIPALI

ELABORATO	CONTROLLATO	APPROVATO
D. Varisco	D. Lesina	Y. Eprim
N. ELABORATO	**CODICE FILE**	**DATA**
MV146P-PE-GNS-2005-C0	MV146P-PE-GNS-2005-C0.doc	31 Ottobre 2008

CONSORZIO "VENEZIA NUOVA"

COORDINAMENTO PROGETTAZIONE

VERIFICATO: S. Pastore

CONTROLLATO: M.T. Brotto

CONSORZIO VENEZIA NUOVA

PROGETTAZIONE

IL RESPONSABILE :

PROGETTAZIONE SPECIALISTICA

TECON

ORDINE DEGLI INGEGNERI DELLA PROVINCIA DI MILANO
DOTT. ING. ALBERTO SCOTTI
Sez. A Settori:
a) civile e ambientale
b) industriale
c) dell'informazione
n° A 9782

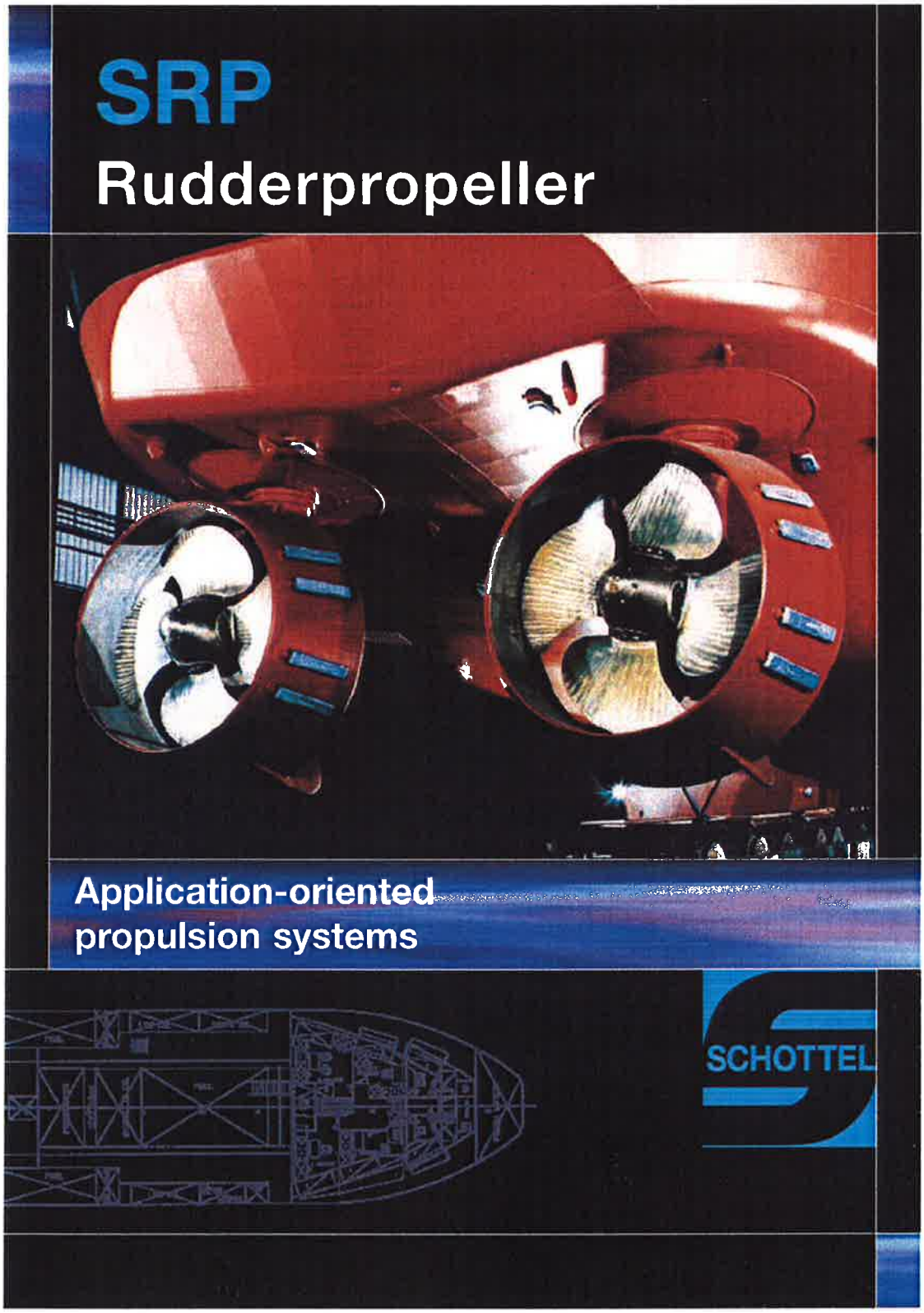
INDICE

1. SCOPO DEL DOCUMENTO

La presente Appendice riporta informazioni tecniche relative ai seguenti componenti degli impianti di bordo, con caratteristiche similari a quelle riportate nella Specifica N. MV146P-PE-GNS-1004:

- Eliche di propulsione
- Eliche di manovra
- Pompe
- Compressore aria
- Depuratore
- Separatore di sentina
- Impianto di condizionamento
- Ventilazione
- Impianto CO2

2. ELICHE DI PROPULSIONE



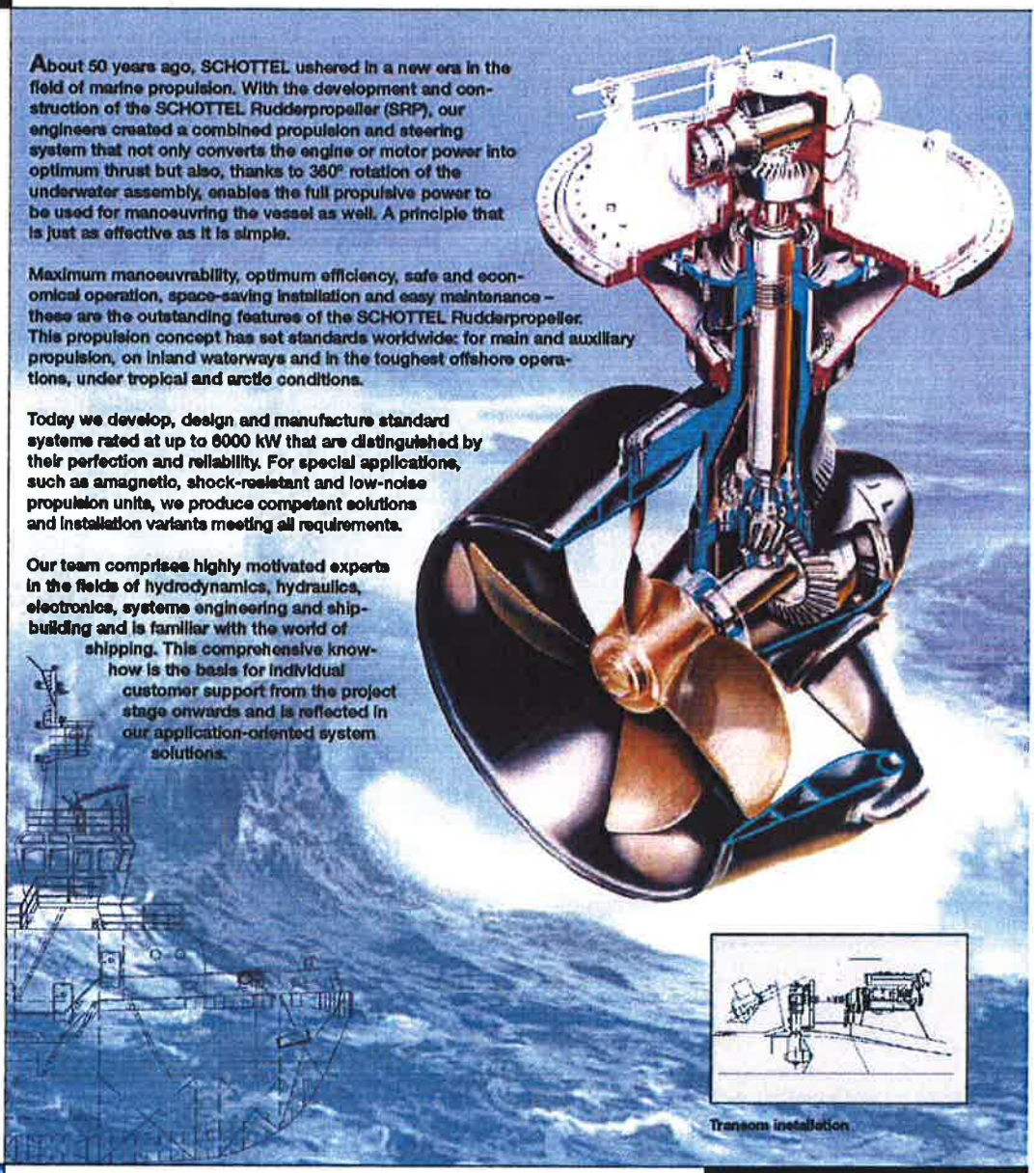
The SCHOTTEL Rudderpropeller – the superior propulsion system for vessels of all kinds

About 50 years ago, SCHOTTEL ushered in a new era in the field of marine propulsion. With the development and construction of the SCHOTTEL Rudderpropeller (SRP), our engineers created a combined propulsion and steering system that not only converts the engine or motor power into optimum thrust but also, thanks to 360° rotation of the underwater assembly, enables the full propulsive power to be used for manoeuvring the vessel as well. A principle that is just as effective as it is simple.

Maximum manoeuvrability, optimum efficiency, safe and economical operation, space-saving installation and easy maintenance – these are the outstanding features of the SCHOTTEL Rudderpropeller. This propulsion concept has set standards worldwide: for main and auxiliary propulsion, on inland waterways and in the toughest offshore operations, under tropical and arctic conditions.

Today we develop, design and manufacture standard systems rated at up to 6000 kW that are distinguished by their perfection and reliability. For special applications, such as amagnetic, shock-resistant and low-noise propulsion units, we produce competent solutions and installation variants meeting all requirements.

Our team comprises highly motivated experts in the fields of hydrodynamics, hydraulics, electronics, systems engineering and shipbuilding and is familiar with the world of shipping. This comprehensive know-how is the basis for individual customer support from the project stage onwards and is reflected in our application-oriented system solutions.



Transom installation

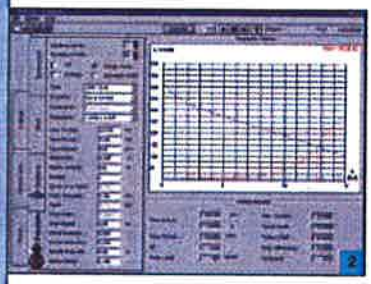
SCHOTTEL

Steering and control systems

Quality

The application of CAD in development and design, the implementation of advanced manufacturing technologies, the use of high-grade materials, skilful assembly and professional installation on site are the major foundations for the top quality of our products. This is impressively confirmed by the certification of our quality management system according to DIN EN ISO 9001 by American Bureau of Shipping, Bureau Veritas, Det Norske Veritas and Germanischer Lloyd.

Research and Development

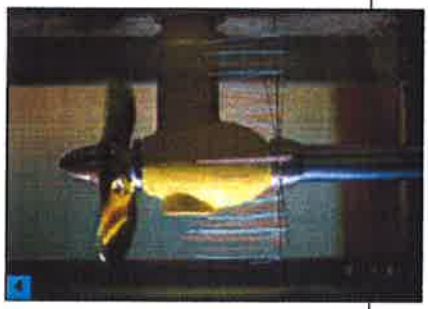


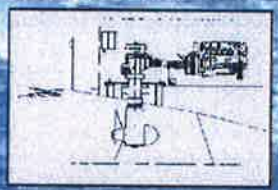
1 Our tailored steering and control systems have been service-proven and type-tested for decades.

2 HYDRA (Hydrodynamic Analysis) is a software program developed by SCHOTTEL. We use this "tool" for achieving an optimum design of our propulsion and manoeuvring systems.

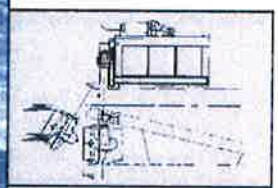
3 Existing Rudderpropeller models are optimized and new types developed using state-of-the-art calculation methods.

4 Developed in intensive cooperation with internationally renowned research institutes, the hydrodynamic design of our systems is acknowledged throughout the industry as trend-setting.

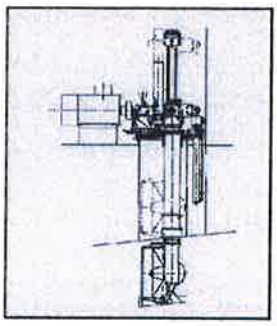




Well installation



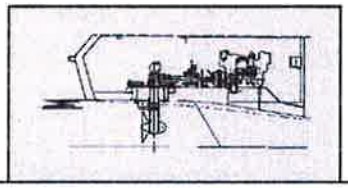
Navigator installation



Retractable unit

Installation variants

Passenger vessels
Ferries

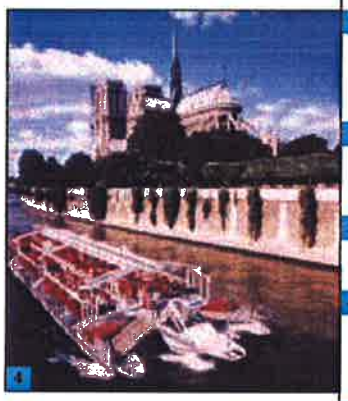


Passenger vessel, 2 x SRP 170 (284 kW each)
Shipyard: Deutsche Binnenwerften GmbH, Germany
Owner: Rainer Abicht Elbreederei GmbH, Germany

Double-ended ferry, 2 x SRP 350/350 (404 kW each)
Shipyard: Åsi Verken, Sweden
Owner: Swedish National Road Administration and Ferry Operation, Sweden

Passenger vessel, 2 x SRP 170 (285 kW each)
Shipyard: Schiffswerft Lux, Germany
Owner: Bingen-Rüdesheimer Fähr- und Schiffahrtsgesellschaft, Germany

SCHOTTEL



1 Passenger vessel, 2 x SRP 200 (298 kW each)
Shipyard: Oceanfast Marine Pty Ltd, Freemantle, Australia
Owner: Captain Cook Cruises Pty Ltd, Sydney, Australia

2 Double-ended ferry, 2 x SRP 170 (320 kW each)
Shipyard: Saigon Shipbuilding Company, Vietnam
Owner: Ministry of Transport, Vietnam

3 Double-ended ferry, 2 x SRP 170 (250 kW each)
Shipyard: Karstensens Shipyard, Denmark
Owner: Ministry of Transport, Cambodia

4 Trimaran, 1 x SRP 110 (175 kW), 1 x SRP 60 (100 kW)
Shipyard: Chantiers de Bateaux Parisiens, France
Owner: Bateaux Parisiens, France

5 Double-ended ferry, 4 x NAV 110 (190 kW each)
Shipyard/Owner: Deghan Sanat Co., Iran

5

Double-ended ferry, 4 x SRP 170 (250 kW each)
Shipyards: Lürssen-Werft/Kröger Werft, Germany
Owner: Verkehrsbetriebe Wesermarsch GmbH, Germany

SRP 110

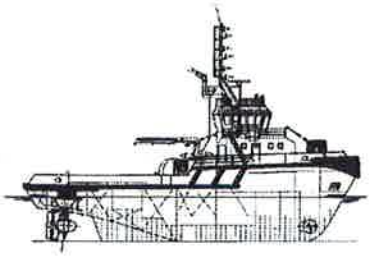
Tug boats

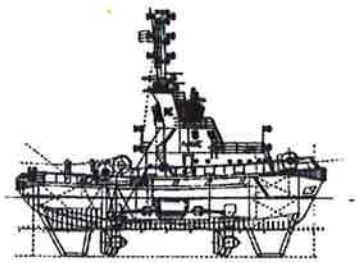
Stern tug, 2 x SRP 1515 CP (1850 kW each), 60 t bollard pull
Shipyard: Cheoy Lee Shipyards Ltd, Hong Kong
Owner: Wijsmuller Salvage BV, The Netherlands

Stern tug, 2 x SRP 1212 CP (1545 kW each), 50 t bollard pull
Shipyard: Damen Shipyards, The Netherlands
Owner: Rimorchiatori Spezzini, Italy

SRP 1212 CP

Tractor tug, 2 x SRP 1010
(1325 kW each), 45 t bollard pull
Shipyard: Astilleros Zamakona, Spain
Owner: Remolcadores de Barcelona, Spain





Stern tug, 2 x SRP 1212 CP
(1545 kW each), 50 t bollard pull
Shipyard: Cooperativa Tomassi, Italy
Owner: Rimorchiatori Laziali S.p.A., Italy

Stern tug, 2 x SRP 1010
(1250 kW each), 40 t bollard pull
Shipyard: Bharati Shipyard, India
Owner: Reliance Industries Ltd., India

Stern tug, 2 x SRP 1515 (2100 kW each),
67 t bollard pull
Shipyard: Astilleros Zamakona, Spain
Owner: Fairplay Schleppdampfschiffs-Reederei Richard Borchard GmbH, Germany

Tractor tug, 2 x SRP 503/505
(640 kW each), 26 t bollard pull
Shipyard: Johann Oelkers, Germany
Owner: Kieler Verkehrs-AG, Germany

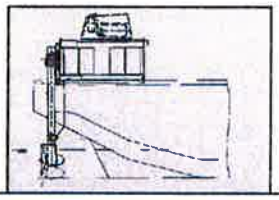
Rotor Tug®, 3 x SRP 1212
(1560 kW each), 80 t bollard pull
Shipyards: Construcciones Navales Freire, Spain · Maschinefabriek Padmos BV, The Netherlands
Owner: Kotug & Tugboat Co Adriaan Kooren BV, The Netherlands

Stern tug · 2 x SRP 1212
(1864 kW each), 60 t bollard pull
Shipyard: Eastern Shipbuilding, Panama City, Florida/USA
Owner: Mc Allister Towing & Transportation, New York/USA

Stern tug
2 x SRP 1212 CP (1545 kW each),
50 t bollard pull
Shipyard: Dubai Drydocks, Dubai
Owner: Dubai Port Authority, Dubai

Stern tugs, 2 x SRP 1212 (2 x 1470 kW) each,
50 t bollard pull · Shipyard: J. G. Hitzler Schiffswerft & Maschinenfabrik, Germany
Owner: Augustea Empresa Marittime e di Salvataggi S.p.A., Italy

Special vessels



Suction hopper dredger, 2 x NAV 1010 (876 kW each)
Shipyard: Scheepswerf Bijholt, The Netherlands
Owner: Naßbeggerei Anton Müsing, Germany.

Research vessel
2 x SRP 1010 (900 kW each)
Shipyard: Mjellem & Karlsen, Norway
Owner: ARAMCO, Saudi Arabia

Pollution control and recovery vessel
2 x SRP 350 LS CP (600 kW each)
Shipyard: C. Lühring, Germany
Owner: German Navy

1 Buoy-laying vessel,
2 x SRP 1010 (1100 kW each)
Shipyard: Damen Shipyards,
The Netherlands
Owner: Commissioners of Irish Lights,
Ireland

2 Cable-laying vessel, 2 x SRP 1212
(1200 kW each), 1 x SRP 1212 ZSV
(1200 kW), 1 x STT 1010 (1100 kW)
Shipyard: Scheepswerf De Hoop Lobith BV,
The Netherlands
Owner: Van Der Stoel-Cable,
The Netherlands

3 Split barge, 2 x NAV 330/545 (545 kW each)
Shipyard: Peene-Werft, Germany
Owner: August Reiners Bauunternehmung
und Naßbaggerei, Germany

4 Floating crane, 4 x NAV 330/465 (465 kW each)
Shipyard: Huisman Itrec, The Netherlands
Owner: Scaldis Salvage & Marine
Contractors N.V., The Netherlands

5 Floating crane, 2 x NAV 110/125 (125 kW each)
Shipyard: Schiffswerft Boost, Germany
Owner: Wasser- und Schiffahrtsamt Bingen,
Germany

Offshore
Sea-going vessels

SCHOTTEL

1 FPSO, 2 x SRP 1212 (1500 kW each)
Shipyard Harland & Wolff, United Kingdom
Owner: BP Exploration Operating Comp., United Kingdom

2 Semi-submersible drilling rig
8 x SRP 2020 (2240 kW each)
Shipyard: Texas Drydocks, USA
Owner: ENSCO International Inc., USA

3 Semi-submersible drilling rig,
2 x SRP 4500 (5000 kW each)
Shipyard: Hyundai Heavy Industries Co Ltd, Korea
Owner: Reading & Bates Falcon Exploration Company, Houston, USA

4 Oceanographic research vessel,
2 x SRP 3030 (3000 kW each),
1 x SRP 1212 CP (2000 kW)
Shipyard: Langsten Yard, Norway
Owner: Norwegian Defence Research Establishment, Norway

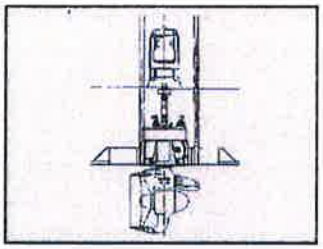
5 Ice-breaking multi-purpose vessel,
2 x SRP 3030 (2900 kW each)
1 x SPJ 520 (2600 kW)
Shipyard: Volkswerft GmbH Stralsund, Germany
Owner: Wasser- und Schiffahrtsdirektion Nord, Germany

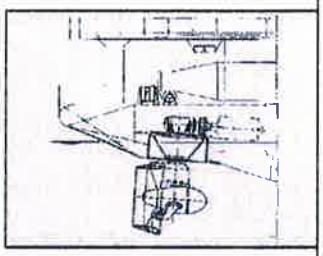
6 Offshore supply vessel,
2 x SRP (STP) 1010 (954 kW each)
2 x STT 170 LK (350 kW each)
Shipyard: Astill. Balenciaga, S.A., Spain
Owner: Khalifa A. Algosaibi, Saudi Arabia

7 Floating crane, 4 x SRP 4500 (6000 kW each)
Shipyard: Fincantieri – Cantieri Navali Italiani S.p.A., Italy
Owner: Saipem S.p.A., Italy

8 Offshore supply vessels, 2 x SRP 1212 (2 x 1470 kW) each, 50 t bollard pull
Shipyard: President Marine Pte. Ltd., Singapore
Owner: Boa Ltd., Taubatkompaniet A/S, Norway

SRP 1212 CP





Standard types

Specification is subject to change without notice. Status: August 2002.

Type	Rating*	Input power max. [kW]	Input speed [rpm]	Propeller Ø [mm]	Weight [kg]**
SRP 60	A	100	2500	700	540
	B	120			
	C	130			
SRP 110	A	195	2100	850	880
	B	230			
	C	260			
SRP 170	A	270	1800/2000	1050	1650
	B	310			
	C	350			
SRP 200	A	310	1800/2100	1100	2100
	B	370			
	C	410			
SRP 330	A	470	1800	1400	3600
	B	550			
	C	620			
SRP 550	A	750	1000/1600/1800	1700	9600
	B	920			
	C	1000			
SRP 1010	A	1040	750/1000/ 1200/1600/1800	2100	15000
	B	1250			
	C	1380			
SRP 1212	A	1380	750/1000/ 1200/1600/1800	2300	17500
	B	1650			
	C	1800			
SRP 1215	A	1500	1000/1600	2400	19500
	B	1800			
	C	2000			
SRP 1515	A	1750	1000/1600	2600	27500
	B	2100			
	C	2300			
SRP 2020	A	2200	1000/1200	2800	31000
	B	2600			
	C	2900			
SRP 3030	A	2850	750-1200	3400	51000
	B	3400			
	C	3600			
SRP 4040	A	3350	750-1200	3800	78000
	B	4000			
	C	4450			
SRP 4500	A	4000	750/900	4200	65000
	B	4750			
	C	6000			

* Rating A Full power continuous rating 24 hours service
Rating B Intermittent service with occasional full load
Rating C Auxiliary installations

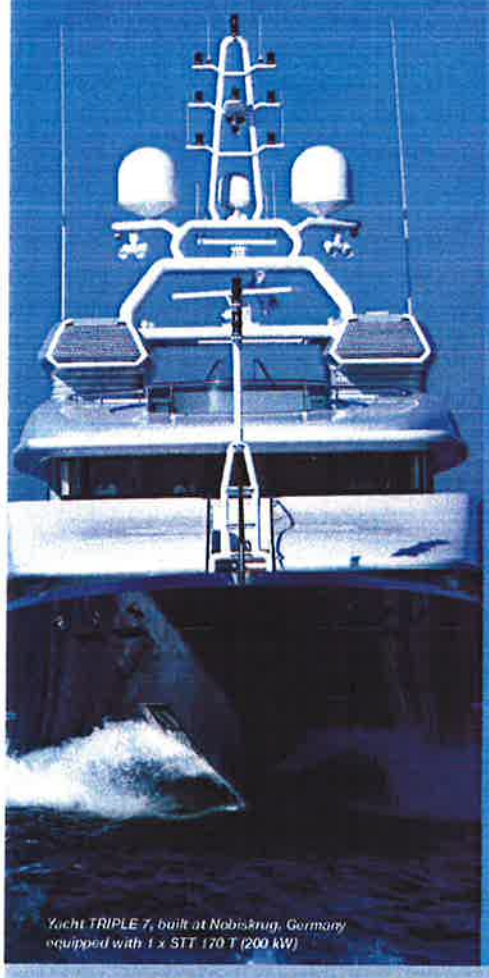
** Weight only SRP, well installation, with propeller and oil at PAL min. (from SRP 550 upwards with nozzle)

11


SCHOTTEL for the Shipping World
Constant customer support
Professional commissioning world-wide
Preventive maintenance and repairs
State-of-the-art modernizations
Reconditioned second-hand units
Close-knit sales and service network
SCHOTTEL
CERTIFICATE
Innovators in steerable propulsion
SCHOTTEL GmbH & Co. KG · Mainzer Str. 99 · D-56322 Spay / Germany
Tel.: +49 (0) 26 28 / 6 10 · Fax: +49 (0) 26 28 / 6 13 00 · e-Mail: info@schottel.de · www.schottel.de

3. ELICHE DI MANOVRA

STT The SCHOTTEL Transverse Thruster



Yacht TRIPLE 7, built at Nobiskrug, Germany equipped with 1 x STT 170 T (200 kW)

Tunnel thrusters are used as auxiliary propulsion units either in the bow or stern of vessels. This considerably improves manoeuvrability. They can be used for light-duty service, such as harbour manoeuvring, with only a few hours of operation per year, up to heavy offshore service all year round, including dynamic positioning.

Depending on this and the vessel's geometry, SCHOTTEL specifies the mechanical components and designs the propellers of every SCHOTTEL Transverse Thruster STT individually. In this way, performance is optimized and the unit meets the client's requirements.

Essentially, the thrusters can be diesel-powered, or driven hydraulically or electrically. Electric prime movers can be included in the SCHOTTEL scope of supply. The thruster accepts either horizontal or vertical drive applications, thus optimizing prime mover location and allowing economical, space-saving installation. Being an L-drive thruster, the power is transmitted to the propeller via a single pair of bevel gears. Thrust direction is reversed through an intermediate reverse gear in diesel applications, or by reversing the electric or hydraulic motor direction. Instead of fixed-pitch thrusters, controllable-pitch units are available for our STT 1- 4. They are installed in the same way as fixed-pitch thrusters; however, for diesel drive the reverse gear is not required.

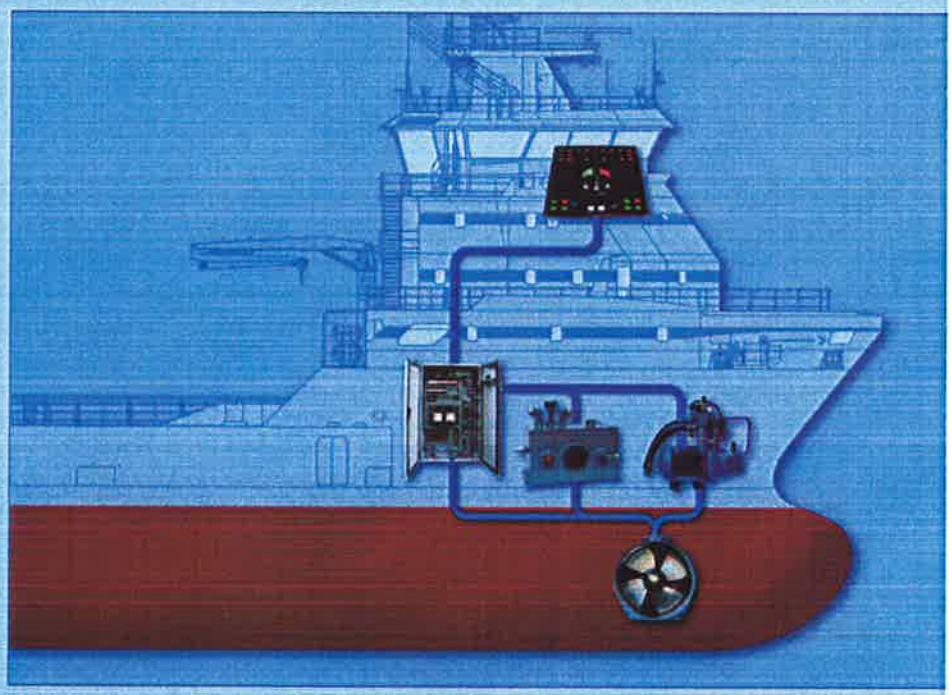
The SCHOTTEL tradition of precise engineering with over 50 years of experience, combined with high quality and workmanship, has given rise to an outstanding record of reliability and operational efficiency and has established SCHOTTEL thrusters as the standard of excellence in the shipping industry. For almost 10 years, SCHOTTEL has been producing tunnel thrusters at SCHOTTEL Suzhou in China. The manufacturing processes and the quality are closely monitored by German engineers in China and Germany. The growing demand leading to the creation of additional production capacity confirms that the concept was the right idea.

Excellent gear housing protection is achieved by sandblasting and coating the lower gearboxes with BELZONA 1321 (Ceramic S-metal), which is extremely resistant against abrasion, cavitation and electrolytic corrosion. Due to the high manufacturing quality and the use of reinforcing rings around the tunnel and appropriate material thicknesses, the gap between tunnel and propeller can be minimized, thus improving the overall efficiency of the bow thruster.

All SCHOTTEL Transverse Thrusters are equipped with a stainless steel wearing ring in the path of the propeller. This reduces wear and tear and therefore improves durability. Additionally, the tunnel is stiffened in order to reduce vibration and noise.

Essential for Manoeuvring and Position Keeping

◀ 2|3 ▶



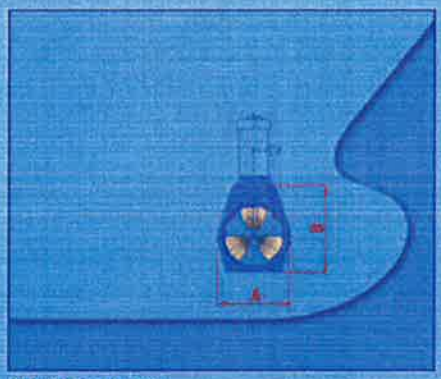
The SCHOTTEL Transverse Thruster, incl. oil header tank, hydraulic unit, switch box and panel (STT here in CP configuration), provides an efficient and economical solution for simple manoeuvring in harbours as well as heavy-duty service in offshore vessels.

SCHOTTEL Transverse Thrusters are designed to meet the specific demands of operators, yards and owners. The main advantages are:

- Compact design
- Optimized power ranges from intermittent to heavy-duty
- Well adjusted reduction ratios for a number of different common drive speeds
- Introduction of new technologies, such as sealing and lubrication systems
- Additional supporting ribs and rings

German know-how manufactured in China – our production standards determine our quality worldwide. Unit no. 1000 was proudly presented in Suzhou.

STT The SCHOTTEL Transverse Thruster



STT with electric motor

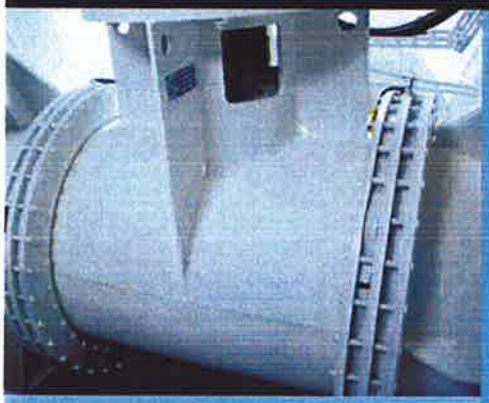
Main data

Type	Power (kW)	n (r.p.m.)	Frequency of board net (Hz)	Gear reduction	Tunnel diameter (mm)	Propeller diameter (mm)	Tunnel wall thickness (mm)	Tunnel length (mm)	Approx. weight (kg)**	Basic dimensions without prime mover A/B (mm)
Standard operation with FP propeller and electric prime mover*										
STT 110	200	1470	50	1.86	815	790	15	1000	890	1045/1383.5
STT 110	200	1170	60	1.86	815	790	15	1000	890	1045/1383.5
STT 170I	315	1770	60	2.7	1015	990	20	1500	1660	1295/1605.5
STT 170I	315	1470	50	2.7	1015	990	20	1500	1660	1295/1605.5
STT 170	350	1770	60	3.07	1115	1090	20	1500	1730	1355/1635.5
STT 170	350	1470	50	2.7	1115	1090	20	1500	1730	1355/1635.5
STT 170	280	1170	60	2.7	1115	1090	20	1500	1730	1355/1635.5
STT 1	530	1470	50	3.07	1265	1240	20	1500	3000	1545/1890.5
STT 1	530	1770	60	3.62	1265	1240	20	1500	3000	1545/1890.5
Standard operation with CP propeller and electric prime mover*										
STT 1	600	1470	50	3.07	1315	1290	20	1700	3500	1610/1923
STT 1	600	1770	60	3.62	1315	1290	20	1700	3500	1610/1923
STT 2	850	1470	50	3.73	1590	1540	20	2000	4600	1920/2214
STT 2	850	1770	60	4.27	1590	1540	20	2000	4600	1920/2214
STT 3	1100	1470	50	4.08	1780	1740	20	2100	6500	2120/2470
STT 3	1100	1770	60	4.77	1780	1740	20	2100	6500	2120/2470
STT 4	1400	1170	60	3.79	2030	1990	25	2280	9500	2080/2715
STT 4	1400	1470	50	4.54	2030	1990	25	2280	9500	2080/2715

* For continuous duty, diesel as prime mover and/or DRIVE power reduction is necessary.
** Weight for STT only (without prime mover)
STT 2-4 also available as FP units
Specification is subject to change without notice. Status: September 2007

SCHOTTEL Transverse Thrusters have proved their reliability and durability in vessels of all shapes and sizes.

STT The SCHOTTEL Transverse Thruster



The optional resilient mounting of the SCHOTTEL Transverse Thruster reduces noise generation.

In order to reduce the noise level, SCHOTTEL has designed special forward skew CP propeller blades which are individually engineered for specific customer applications. As a special configuration, SCHOTTEL thrusters can also be resiliently mounted.

The thrusters are suitable for heavy-duty operation in offshore service and for yachts. Therefore the units are oversized and the propeller tip speed is reduced. In this way, the propeller load is also reduced. These measures lead to increased durability of the thruster seals, bearings, propeller hub and blades. Moreover, noise is reduced, since the propeller blade speed is the main source of structurally borne noise. Furthermore, the frictional losses of the propeller blades in water are considerably reduced at reduced blade tip speed. As standard, a stainless steel ring is welded into the tunnel, near the propeller, to prevent wear of the tunnel.

The electrical system for the propeller pitch control of the thrusters can be adapted to several networks. Switch boxes can be optionally equipped with common DP or other interfaces. This serves to meet the demands of offshore fleet operators.

If required SCHOTTEL can provide a PLC based CP transverse thruster control with the following additional features:

- Built-in web server with access to web browser
- Fault and process value monitoring with trend views for effective fault analysis
- Automatic nominal load regulation depending on the actual operation conditions
- Interface to integrated bridge

Professional partnership – throughout the vessel's life
As a SCHOTTEL customer you will experience individual, prompt and extensive assistance throughout all stages of a project, from planning and commissioning through to operation and preventive maintenance. Spare parts are supplied at short notice and, where required, accompanied by highly qualified engineers. We are proud of our reputation for first class service and endeavour to maintain it worldwide.

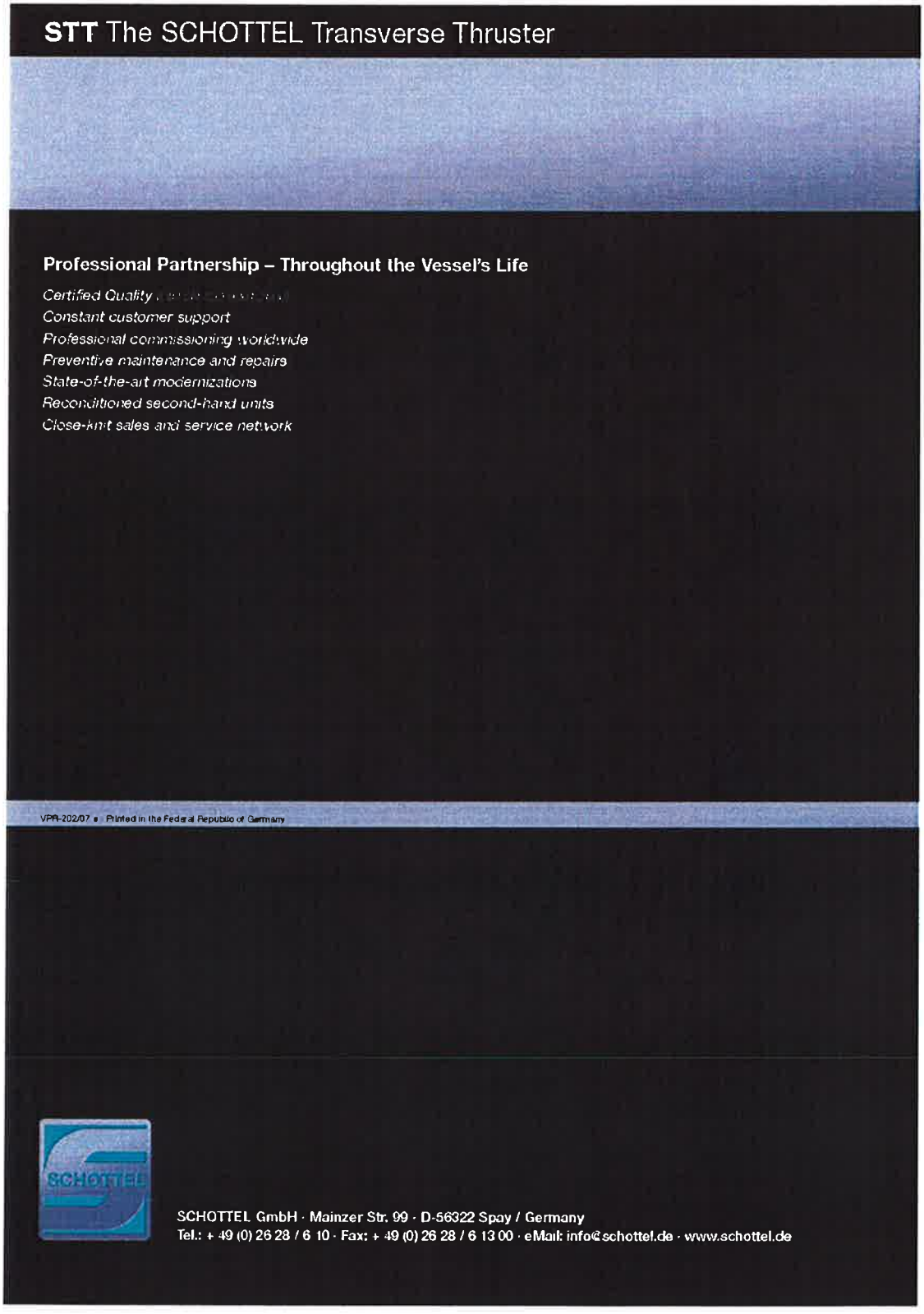
Main data

Type	STT 1		STT 2		STT 3		STT 4	
Heavy DP operation with CP propeller and electric prime mover*								
P (kW) max	430	450	610	635	790	825	1060	1000
n (r.p.m.)	1170	1470	1170	1470	1170	1470	980	1170
Frequency of board net (Hz)	60	50	60	50	60	50	50	60
Dprop (m)	1.29	1.29	1.54	1.54	1.74	1.74	1.99	1.99
Max tip speed (m/s)	25.7	27.5	25.3	27.7	26.1	28.1	27.0	26.9
Propeller load (kW/sq.m)	328	344	327	341	332	347	341	322

* For FP propeller, diesel as prime mover and/or DNV power reduction is necessary.

Specification is subject to change without notice. Status: September 2007

Whether in mega-yachts or offshore vessels – the STT excels as a dependable assistant.


STT The SCHOTTEL Transverse Thruster
Professional Partnership – Throughout the Vessel's Life
Certified Quality
Constant customer support
Professional commissioning worldwide
Preventive maintenance and repairs
State-of-the-art modernizations
Reconditioned second-hand units
Close-knit sales and service network
VPR-202/07 ■ Printed in the Federal Republic of Germany
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4. POMPE

4.1 Pompe centrifughe ad asse orizzontale

MU

CENTRIFUGAL PUMPS ACCORDING TO EN 733 STANDARDS

POMPE CENTRIFUGHE NORMALIZZATE EN 733

COMMON AND GENERAL USE

Fresh and sea water, condensate, oils, chemical and petrochemical products.

IMPIEGHI

Per acqua, acqua mare, condensato, prodotti chimici, petrolchimici.

MAIN APPLICATIONS

Shipbuilding industry, heating plants, air conditioning system, aqueducts, effluent treatment plants, fire fighting, petrochemical plants.

PRINCIPALI APPLICAZIONI

Applicazioni per uso caratteristico, impianti di riscaldamento, impianti di condizionamento, acquedotti, trattamento acque, antincendio, convogliamento idrocarburi.

MAIN FEATURES

CARATTERISTICHE COSTRUTTIVE

PUMP: centrifugal type, end-suction single volute casing, single flow and axial inlet.

POMPA: centrifuga con corpo a spirale orizzontale monostadio ad unico flusso ed aspirazione assiale.

IMPELLER: high efficiency, close type, statically and dynamically balanced. Low axial thrust thanks to impeller provided with balancing holes.

GIRANTE: di tipo chiuso ad elevato rendimento, equilibrata staticamente e dinamicamente. Equilibratura della spinta assiale mediante camera anulare sita posteriormente alla girante stessa munita di fori di bilanciamento.

MOUNTING SYSTEM: shaft supported by radial and thrust type bearings placed in an oil bath bracket or, upon request, by self lubricated or grease lubricated ball bearings. The bracket is usually made of cast-iron, bronze or stainless steel for special executions (non magnetic pumps).

SUPPORTAZIONE: albero supportato da cuscinetti radiali ed assiali posizionati in un supporto a bagno d'olio o a richiesta con cuscinetti autolubrificanti o lubrificati a grasso. Supporto costruito normalmente in ghisa, il quale può essere prodotto in bronzo o in acciaio inox per utilizzi speciali (pompe amagnetiche).

SEAL: single mechanical seal to DIN 29960. Special mechanical seal or cartridge type for specific application or aggressive liquids. Possibility to install soft-packing with external flushing. For temperature higher than 120°C, it is possible to fit the pump with a cooling chamber.

TENUTA: tenuta meccanica singola normalizzata DIN 29960. Tenute speciali e a cartuccia per liquidi ed applicazioni particolari. Possibilità di installare tenuta a baderna con flussaggio esterno. Per temperature superiori ai 120 °C possibilità di dotare la pompa di camera di raffreddamento della tenuta.

SELF-PRIMING: Small and medium size pumps can be equipped with built-in priming element; all sizes can be supplied in self-priming version with an additional air ejector.

AUTOADESCANTE: taglie piccole e medie possono essere fornite di elemento autoadescante ad anello liquido; tutte le taglie possono essere fornite con eiettore ad aria automatico.

BACK PULL OUT

It is possible to remove the rotating components without disturbing pipes, pump casing and motor by using a flexible spacer coupling.

SMONTAGGIO

Impiegando un giunto spaziatore è possibile sfilare la parte rotante senza intervenire sulle tubazioni, corpo-pompa e motore.

BASE PLATE

The base plate is generally built of welded steel and it can be provided with drain-pan for possible drippings.
To comply with special requirements (non magnetic and/or anti vibration) it can be manufactured in stainless steel (AISI 316) and equipped with anti vibration and/or anti-shock resilient mountings.

BASAMENTO

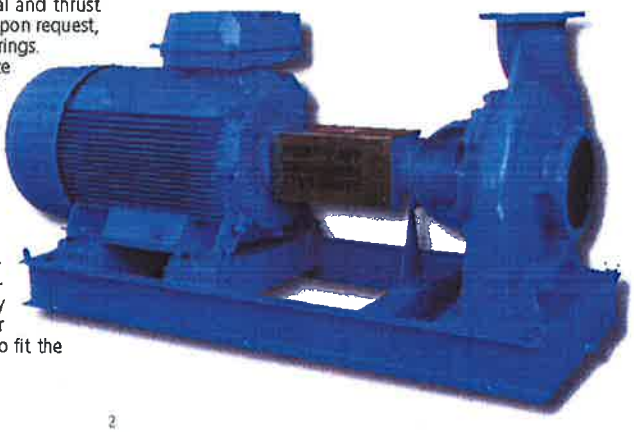
Il basamento è costruito normalmente in acciaio elettro-saldato, lo stesso può essere corredato di drenaggi per eventuali stillicidi della pompa. Per esecuzioni speciali (amagnetiche e/o antivibrazione) può essere costruito in acciaio inox e corredato di resilienti antivibrazione e antishock.

SPECIAL VERSIONS

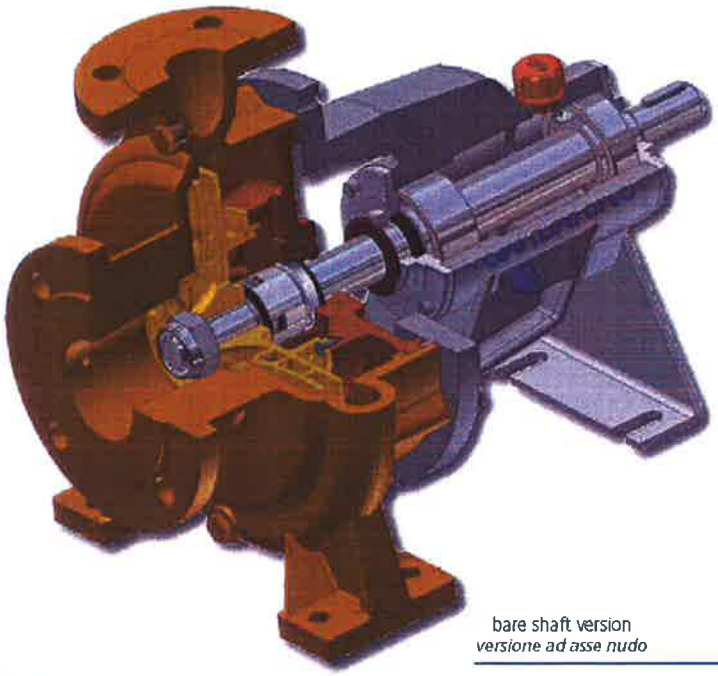
Special versions according to Naval Rules are also available: shock-proof, vibration-proof, noise-proof, non magnetic.

COSTRUZIONI SPECIALI

Sono previste costruzioni a norma MARINA MILITARE: antishock, antivibrazione, antirumore, amagnetiche



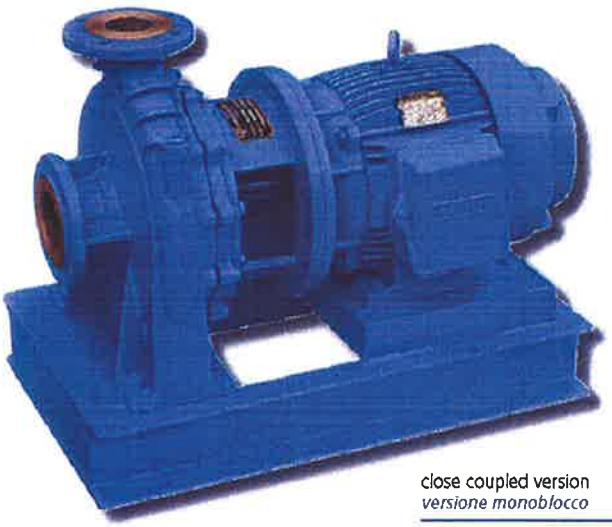
GARBARINO



bare shaft version
versione ad asse nudo

MATERIALS *MATERIALI*	MAX. WORKING PRESSURE *PRESSIONE MAX. ESERCIZIO*
CAST IRON *GHISA*	10 bar
STAINLESS STEEL, BRONZE, SPECIAL ALLOY *ACCIAIO INOX, BRONZO, LEGHE SPECIALI*	16 bar
NOTE: SPECIAL EXECUTIONS EXCEEDING THE ABOVE LIMITS AVAILABLE ON REQUEST *NOTA: ESECUZIONI SPECIALI AL DI FUORI DEI LIMITI SOPRAESPOSTI REALIZZATE SU RICHIESTA*	

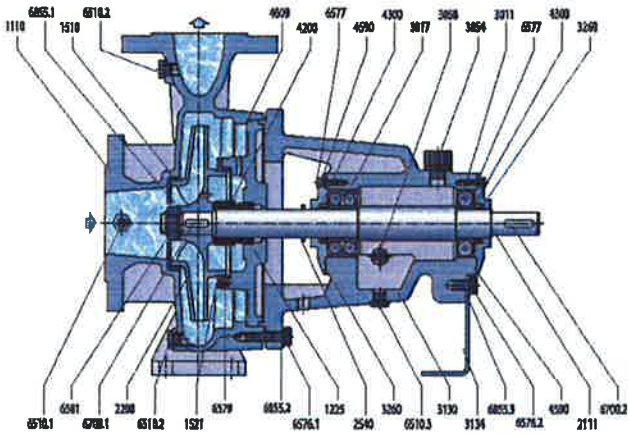
MODELS *MODELLI*	45
INTERCHANGEABILITY *INTERCAMBIABILITÀ:*	
CASINGS *CORPI*	45
IMPELLERS *GIRANTI*	45
SHAFTS *ALBERI*	6
BEARING BRACKETS *SUPPORTI*	6
COVERS *COPERCHI*	6
MECHANICAL SEALS *TENUTE MECCANICHE*	6



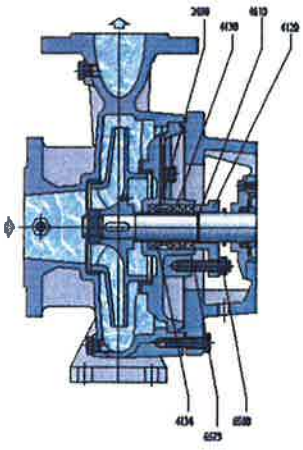
close coupled version
versione monoblocco

self priming element with liquid ring
elemento autoadescante ad anello liquido

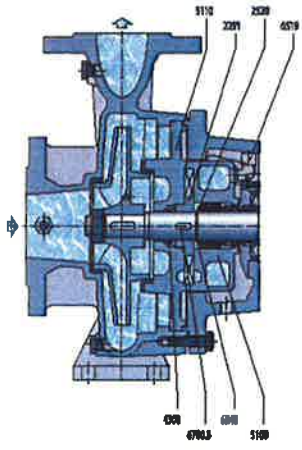
3



LONGITUDINAL SECTION
SEZIONE LONGITUDINALE



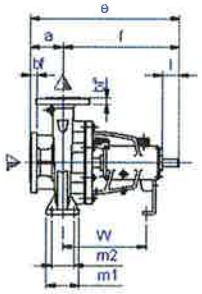
SOFT PACKING VERSION
VERSIONE TENUTA A BADERNA



SELF-PRIMING VERSION
VERSIONE AUTOADESCANTE

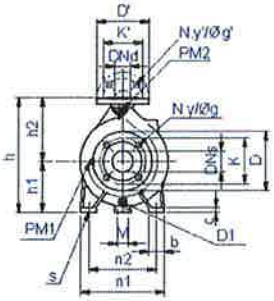
Pos	Description Descrizione
1110	Pump casing *Corpo pompa*
1225	Casing cover *Coperchio del corpo*
1510	Wear ring *Anello di usura*
1521	Wear ring *Anello di usura*
2111	Pump shaft *Albero della pompa*
2200	Impeller *Girante*
2291	Priming stage impeller *Girante stellare*
2450	Shaft sleeve *Camicia d'albero*
2520	Shoulder ring *Anello spallamento*
2540	Deflector *Deflettore*
3011	Radial ball bearing *Cuscinetto radiale*
3017	Angular ball bearing *Cuscinetto obliquo*
3130	Bearing bracket *Supporto doppio*
3134	Support foot *Piede del supporto*
3260	Bearing cover *Coperchio supporto*
3854	Oil filler plug *Tappo per l'olio*
3858	Oil level *Spia dell'olio*
4120	Stuffing box gland *Premitreccia*
4130	Gland packing *Guarnizione a treccia*
4134	Lantern ring *Anello lanterna*
4200	Mechanical seal *Tenuta meccanica*
4300	Radial shaft seal *Anello di tenuta*
4590	Gasket *Guarnizione*
4609	O-Ring *O-Ring*
4610	O-Ring *O-Ring*
5100	Priming stage casing *Corpo autoadescante*
5110	Priming stage cover *Coperchio autoadescante*
6510.1	Plug *Tappo*
6510.2	Plug *Tappo*
6510.3	Plug *Tappo*
6519	Thread fitting *Raccordo*
6545	Seeger *Seeger*
6573	Stud *Prigioniero*
6576.1	Screw *Vite*
6576.2	Screw *Vite*
6577	Screw *Vite*
6579	Screw *Vite*
6580	Nut *Dado*
6581	Impeller nut *Dado girante*
6700.1	Key *Chiavetta*
6700.2	Key *Chiavetta*
6700.3	Key *Chiavetta*
6855.1	Washer *Rosetta*
6855.2	Washer *Rosetta*
6855.3	Washer *Rosetta*

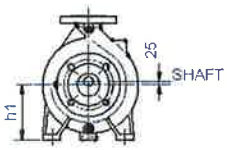
GARBARINO



SHAFT END
ESTREMITÀ D'ALBERO

KEY ACCORDING TO UNI 6604
CHIAVETTA SECONDO UNI 6604





ONLY FOR MU 250-400
SOLO PER MU 250-400

PUMP DIMENSIONS *DIMENSIONI POMPA*												SHAFT *ALBERO*					PUMP TYPE *POMPA TIPO*	SUCTION FLANGE *BOCCA ASP.*	DELIVERY FLANGE *BOCCA MANDATA*	FLANGES DIMENSIONS *DIMENSIONI FLANGE (UNI 2223-2229 PN 10 UNI 2223-2229 PN 16*)*								HOLES NUMBER *NUMERO FORI*		DRAINAGE *DRENAGGIO*	VACUUM GAUGE *MANOVUOTOMETRO*	PRESSURE GAUGE *MANOMETRO*	PUMP WEIGHT *PESO POMPA*
a	f	e	h	h1	h2	b	c	m1	n2	n1	s	l	M	V2	d	t	u		DNs	DNd	D	D2	bf	hf	K	K'	q	q'	r	r	D1	PM1	PM2	Kg
63	237	300	272	112	160	50	12	100	70	220	180	12	36	90	161	19	21,5	6	25-160	25	25	115	115	16	16	85	85	14	14	4	4	1/4"G	1/4"G	1/4"G	22
80	360	440	340	180	180	50	15	100	70	240	190	14	50	110	260	24	27	8	25-200	40	25	150	115	18	16	110	85	18	14	4	4	1/4"G	1/4"G	1/4"G	41
80	360	440	292	132	160	50	15	100	70	240	190	14	50	110	260	24	27	8	32-160	50	32	165	140	20	18	125	100	18	18	4	4	1/4"G	1/4"G	1/4"G	43
80	380	440	340	160	180	50	15	100	70	240	190	14	50	110	260	24	27	8	32-200	50	32	165	140	20	18	125	100	18	18	4	4	1/4"G	1/4"G	1/4"G	43
110	380	470	405	180	225	65	18	125	95	320	250	14	50	110	280	24	27	8	32-250	50	32	165	140	20	18	125	100	18	18	4	4	1/4"G	1/4"G	1/4"G	62
80	380	440	292	132	180	50	15	100	70	240	190	14	50	110	260	24	27	8	40-160	65	40	185	150	20	18	145	110	18	18	4	4	1/4"G	1/4"G	1/4"G	43
100	360	460	340	160	180	50	15	100	70	265	212	14	50	110	260	24	27	8	40-200	65	40	185	150	20	18	145	110	18	18	4	4	1/4"G	1/4"G	1/4"G	45
100	360	480	405	180	225	65	15	125	95	320	250	14	50	110	280	24	27	8	40-250	65	40	185	150	20	18	145	110	18	18	4	4	1/4"G	1/4"G	1/4"G	60
125	470	595	480	200	280	65	20	125	95	345	280	14	80	110	340	32	35	10	40-315	65	40	185	150	20	18	145	110	18	18	4	4	1/4"G	1/4"G	1/4"G	98
100	360	460	340	160	180	50	15	100	70	265	212	14	50	110	260	24	27	8	50-160	65	50	185	165	20	20	145	125	18	18	4	4	1/4"G	1/4"G	1/4"G	48
100	360	460	360	160	200	50	15	100	70	265	212	14	50	110	280	24	27	8	50-200	65	50	185	165	20	20	145	125	18	18	4	4	1/4"G	1/4"G	1/4"G	48
100	360	460	405	180	225	65	15	125	95	320	250	14	50	110	280	24	27	8	50-250	65	50	185	165	20	20	145	125	18	18	4	4	1/4"G	1/4"G	1/4"G	60
125	470	595	505	225	280	65	25	125	95	345	280	14	80	110	340	32	35	10	50-315	65	50	185	165	22	20	145	125	18	18	4	4	1/4"G	1/4"G	1/4"G	100
100	360	460	360	160	200	65	15	125	95	280	212	14	50	110	260	24	27	8	65-160	80	65	200	185	22	20	160	145	18	18	4	4	1/4"G	1/4"G	1/4"G	49
100	360	460	405	180	225	65	15	125	95	320	250	14	50	110	280	24	27	8	65-200	80	65	200	185	22	20	160	145	18	18	4	4	1/4"G	1/4"G	1/4"G	55
100	470	570	450	200	250	80	18	160	120	360	280	18	80	110	340	32	35	10	65-250	80	65	200	185	22	20	160	145	18	18	4	4	3/8"G	1/4"G	3/8"G	80
125	470	595	505	225	280	80	25	160	120	400	315	18	80	110	340	32	35	10	65-315	80	65	200	185	22	20	160	145	18	18	4	4	3/8"G	1/4"G	3/8"G	101
125	470	595	605	250	355	80	25	160	120	420	335	18	80	110	340	32	35	10	65-400	80	65	200	185	22	20	160	145	18	18	4	4	3/8"G	1/4"G	3/8"G	130
125	360	485	405	180	225	65	15	125	95	320	250	14	50	110	280	24	27	8	80-160	100	80	220	200	22	22	180	160	18	18	8	4	1/4"G	1/4"G	1/4"G	60
125	470	595	430	180	250	65	18	125	95	345	280	14	80	110	340	32	35	10	80-200	100	80	220	200	22	22	180	160	18	18	8	4	3/8"G	1/4"G	3/8"G	75
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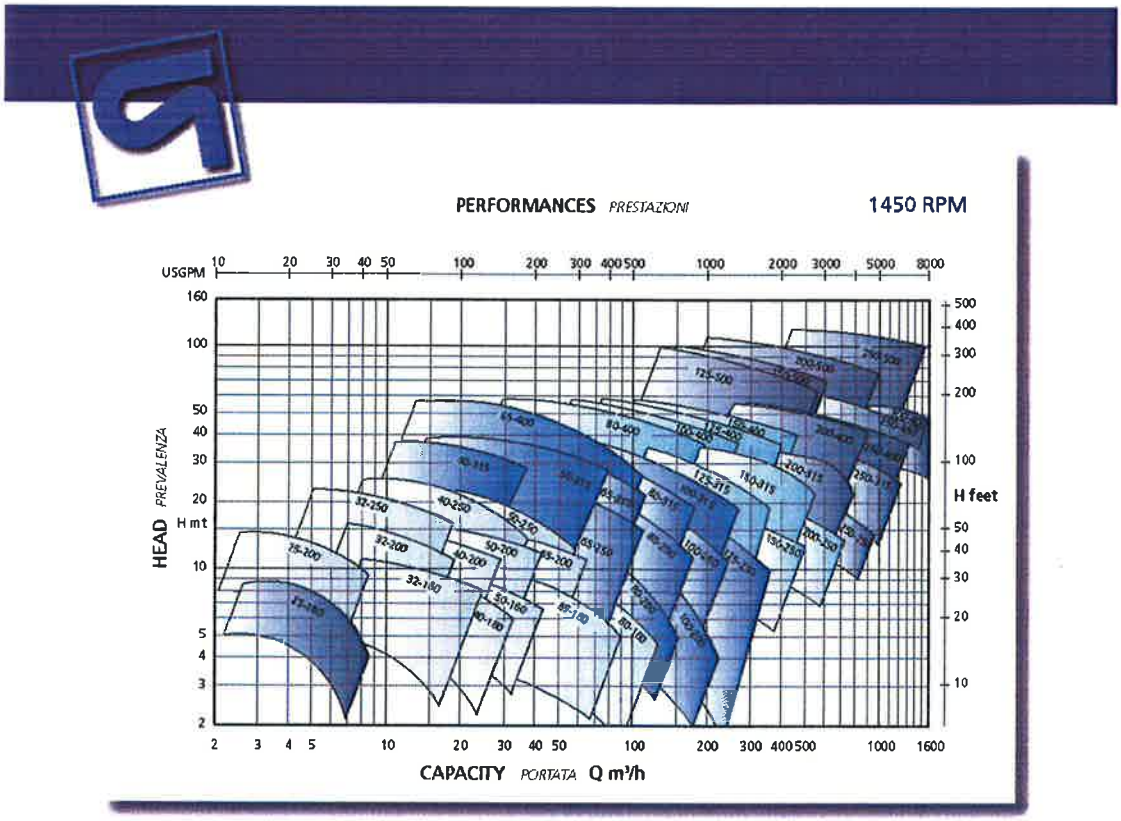
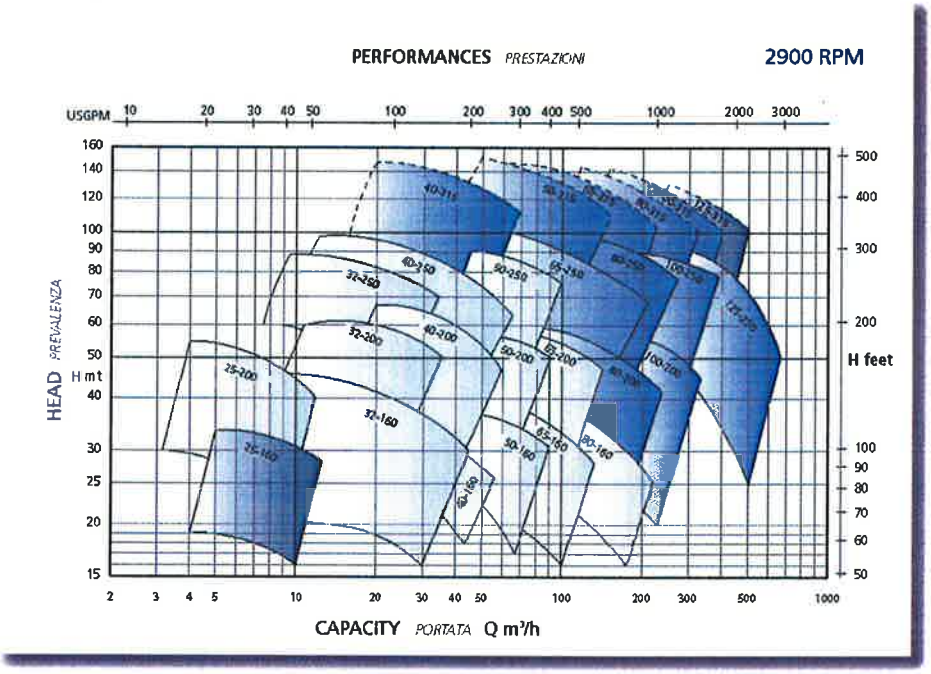
125	470	595	565	250	315	80	25	160	120	400	315	18	80	110	340	32	35	10	80-315	100	80	220	200	22	22	180	160	18	18	8	4	3/8"G	1/4"G	3/8"G	111
125	530	655	635	280	355	80	25	160	120	435	355	18	110	110	370	42	45	12	80-400	100	80	220	200	22	22	180	160	18	18	8	4	3/8"G	1/4"G	3/8"G	155
125	470	595	480	200	280	80	18	160	120	380	280	18	80	110	340	32	35	10	100-200	125	100	250	220	24	22	210	180	18	18	8	8	3/8"G	1/4"G	3/8"G	85
140	470	610	505	225	280	80	18	160	120	400	315	18	80	110	340	32	35	10	100-250	125	100	250	220	24	22	210	180	18	18	8	8	3/8"G	1/4"G	3/8"G	105
140	470	610	565	250	315	80	18	160	120	400	315	18	80	110	340	32	35	10	100-315	125	100	250	220	24	22	210	180	18	18	8	8	3/8"G	1/4"G	3/8"G	116
140	530	670	635	280	355	100	25	200	150	500	400	22	110	110	370	42	45	12	100-400	125	100	250	220	24	22	210	180	18	18	8	8	3/8"G	1/4"G	3/8"G	190
140	470	610	605	250	355	80	18	160	120	400	315	18	80	110	340	32	35	10	125-250	150	125	285	250	24	24	240	210	22	18	8	8	3/8"G	1/4"G	3/8"G	120
140	530	670	635	280	355	100	25	200	150	500	400	22	110	110	370	42	45	12	125-315	150	125	285	250	24	24	240	210	22	18	8	8	3/8"G	1/4"G	3/8"G	180
140	530	670	715	315	400	100	25	200	150	500	400	22	110	110	370	42	45	12	125-400	150	125	285	250	24	24	240	210	22	18	8	8	3/8"G	1/4"G	3/8"G	205
180	635	815	900	400	500	140	28	280	200	680	540	28	140	110	430	60	64	18	125-500	150*	125*	285	250	26	26	240	210	22	18	8	8	3/4"G	3/8"G	3/8"G	400
180	530	690	655	280	375	100	27	210	150	510	400	22	110	110	370	42	45	12	150-250	200	150	340	285	26	24	295	240	22	22	8	8	3/8"G	1/4"G	3/8"G	200
160	530	690	680	280	400	100	25	200	150	550	450	22	110	110	370	42	45	12	150-315	200	150	340	285	26	24	295	240	22	22	8	8	3/8"G	1/4"G	3/8"G	190
160	530	690	765	315	450	100	25	200	150	550	450	22	110	110	370	42	45	12	150-400	200	150	340	285	26	24	295	240	22	22	8	8	3/8"G	1/4"G	3/8"G	235
180	640	820	950	400	550	140	28	280	200	680	540	28	140	160	435	60	64	18	150-500	200*	150*	340	285	30	26	295	240	22	22	12	8	3/4"G	1/4"G	3/8"G	500
180	530	710	780	355	425	100	30	210	150	560	450	22	110	110	432	42	45	12	200-250	200	200	340	340	26	26	295	295	22	22	8	8	3/8"G	1/4"G	3/8"G	250
200	605	805	805	355	450	110	30	210	150	580	450	25	110	160	432	60	64	18	200-315	250	200	395	340	28	26	350	295	22	22	12	8	3/8"G	1/4"G	3/8"G	330
200	605	805	855	355	500	140	28	280	200	680	540	28	110	160	432	60	64	18	200-400	250	200	395	340	32	26	350	295	22	22	12	8	1"G	1/4"G	3/8"G	410
200	640	840	1055	455	600	150	30	320	250	800	690	28	140	160	435	60	64	18	200-500	250*	200*	405	340	32	29	355	295	25	22	12	12	3/4"G	3/8"G	3/8"G	600
250	605	855	960	400	580	130	30	280	200	700	560	25	110	160	432	60	64	18	250-250	300	250	445	395	28	28	400	350	22	22	12	12	3/8"G	1/4"G	3/8"G	450
250	805	855	960	400	580	130	30	280	200	700	560	25	110	160	430	60	64	18	250-315	300	250	445	395	28	28	400	350	22	22	12	12	3/8"G	1/4"G	3/8"G	480
225	805	880	1000	375	625	110	30	300	220	800	680	25	110	160	432	60	64	18	250-400	300	250	445	395	28	28	400	350	22	22	12	12	3/8"G	3/8"G	3/8"G	485
250	730	1000	1100	450	650	135	30	300	220	800	665	28	140	160	526	65	69	18	250-450	300	250	445	395	28	28	400	350	22	22	12	12	3/8"G	3/8"G	3/8"G	550
280	640	920	1145	475	670	140	30	260	190	810	670	28	140	160	435	60	64	18	250-500	300*	250*	480	405	32	32	410	355	25	25	12	12	3/4"G	3/8"G	3/8"G	650
300	754	970	1280	530	750	160	35	320	250	960	790	28	140	160	470	65	69	18	300-400	350	300	533	483	36	32	460	400	22	22	16	12	3/4"G	3/8"G	3/4"G	750
280	754	950	1020	430	600	140	35	280	200	720	580	28	140	160	470	65	69	18	300-500	350	300	533	483	36	32	460	400	22	22	16	12	3/4"G	3/8"G	3/4"G	650


PERFORMANCES PRESTAZIONI
1450 RPM
USGPM
HEAD PREVALENZA
H mt
H feet
CAPACITY PORTATA Q m³/h


PERFORMANCES PRESTAZIONI
2900 RPM
USGPM
HEAD PREVALENZA
H mt
H feet
CAPACITY PORTATA Q m³/h

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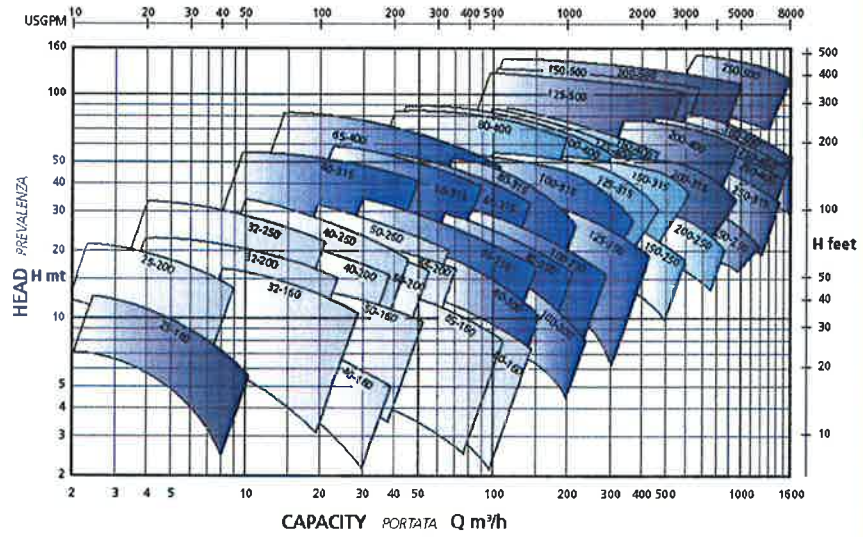
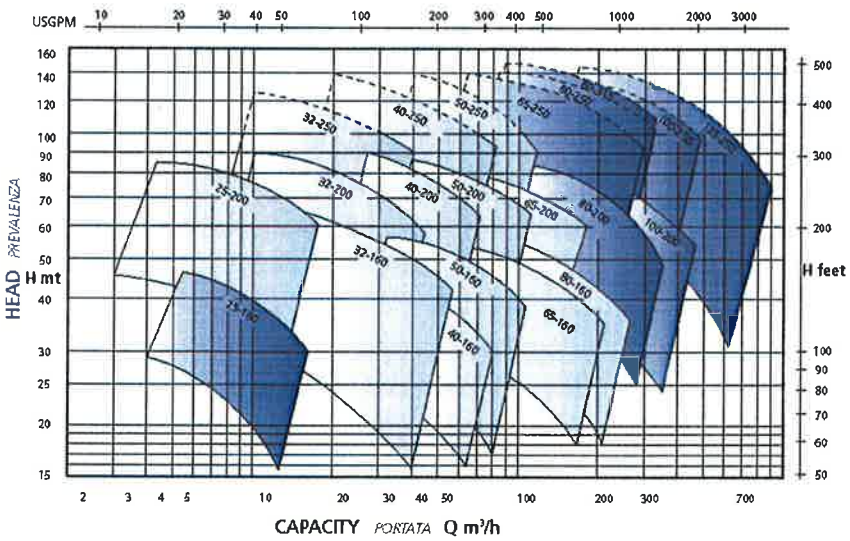
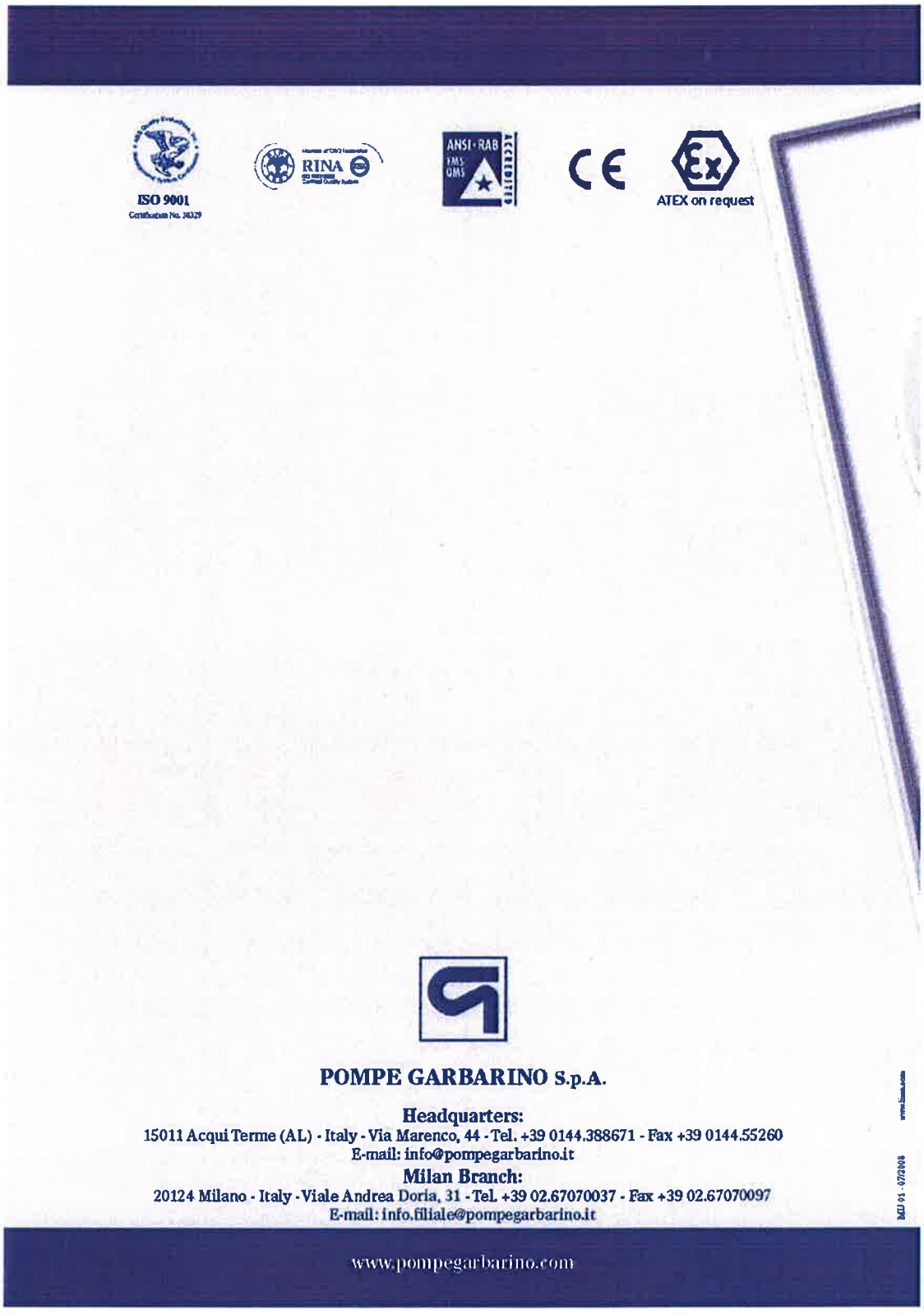
PERFORMANCES *PRESTAZIONI* **1750 RPM**



PERFORMANCES *PRESTAZIONI* **3500 RPM**

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4.2 Pompe centrifughe ad asse verticale

MU-L

VERTICAL IN LINE CENTRIFUGAL PUMPS

POMPE CENTRIFUGHE VERTICALI IN LINE

USE

Fresh and sea water, condensate, oils chemical and petrochemical products.

IMPIEGHI

Per acqua dolce, acqua mare, condensato, prodotti chimici, petrolchimici.

MAIN APPLICATIONS

Shipbuilding industry, heating plants, air conditioning systems, aqueducts, effluent treatment plants, fire fighting, petrochemical plants, etc...

PRINCIPALI APPLICAZIONI

Applicazioni per uso caratteristico, impianti di riscaldamento, impianti di condizionamento, acquedotti, trattamento acque, antincendio, convogliamento idrocarburi.

MAIN FEATURES

CARATTERISTICHE COSTRUTTIVE

PUMP: centrifugal type with volute casing, vertical construction, single stage, single flow, in line flanges.

POMPA: centrifuga con corpo a spirale orizzontale monostadio ad unico flusso ed aspirazione assiale

IMPELLER: high efficiency, close type, statically and dynamically balanced.
Axial thrust balancing by means of annular chamber with balancing holes located behind the impeller.

GIRANTE: di tipo chiuso ad elevato rendimento, equilibrata staticamente e dinamicamente.
Equilibratura della spinta assiale mediante camera anulare situata posteriormente alla girante stessa e munita di fori di bilanciamento.

MOUNTING SYSTEM: shaft supported by radial and thrust ball bearings either grease or self-lubricated. The bracket is normally made of cast-iron or manufactured in bronze or stainless steel for special executions (non-magnetic pumps).

SUPPORTAZIONE: albero supportato da cuscinetti radiali a sfera a singola e doppia corona di sfere in grado di reggere alle spinte assiali e radiali con lubrificazione a grasso o in versione autolubrificata. Supporto costruito normalmente in ghisa, oppure in bronzo o acciaio inox per utilizzi speciali (pompe amagnetiche).

SEAL: single mechanical seals to DIN 29960. Special mechanical seals or cartridge type, for specific application or aggressive liquids. Possibility to install soft packing with external flushing. For temperature higher than 120°C, it is possible to fit the pump with a cooling chamber.

TENUTA: tenuta meccanica singola normalizzata DIN 29960. Tenute speciali e a cartuccia per liquidi ed applicazioni particolari. Possibilità di installare tenute a baderna con flussaggio esterno. Per temperature superiori ai 120 °C possibilità di dotare la pompa di camera di raffreddamento della tenuta.

SELF-PRIMING: some listed models can be supplied with a self-priming element either with liquid ring or with air ejector.

AUTOADESCANTE: alcuni i modelli elencati possono essere forniti di elemento autoadescante ad anello liquido o con eiettore ad aria.

BACK PULL OUT

It is possible to remove the rotating components without disturbing pipes, pump casing and motor by using a flexible spacer coupling.

SMONTAGGIO

Impiegando un giunto spaziatore è possibile sfilare la parte rotante senza intervenire sulle tubazioni, corpo-pompa e motore.

BASE PLATE

The base plate is usually cast with pump casing for small and medium size pumps in order to increase the structural stiffness. For larger pumps a welded steel base plate is provided.

BASAMENTO

La base è realizzata in una unica fusione con il corpo per le pompe medio/piccole, di carpenteria per quelli di taglia maggiore.

MOTOR FRAME

The motor frame supporting the electric motor is normally made of welded steel. For special executions (non magnetic) it can be manufactured in stainless steel.

LANTERNA

La lanterna di unione pompa-motore elettrico è costruita normalmente in acciaio elettrosaldato. Per esecuzioni speciali (amagnetiche) può essere costruita in acciaio inox.

SPECIAL VERSIONS

Special versions according to Naval Rules are also available: shock-proof, vibration-proof, noise-proof, non magnetic version.

COSTRUZIONI SPECIALI

Sono previste costruzioni a norma MARINA MILITARE: antishock, antivibrazione, antirumore, amagnetiche.

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MU-LDS

VERTICAL IN LINE DOUBLE SUCTION CENTRIFUGAL PUMPS

POMPE CENTRIFUGHE VERTICALI IN LINE A DOPPIA ASPIRAZIONE

DESCRIPTION

Single stage vertical centrifugal pumps in spacer coupling design. Casing with in-line flanges and with high efficiency double inlet impeller, low NPSH required and balanced axial thrust, flow rate up to 3.500 m³/h.

DESCRIZIONE

Pompe centrifughe monostadio verticali con giunto elastico spaziatore. Corpo con flange in-line, girante a doppia aspirazione con alto rendimento, basso NPSH richiesto e spinta assiale bilanciata, portata fino a 3.500 m³/h.

MAIN APPLICATIONS

Fresh water, sea water, industrial water, condensate, brine, oils and other clean liquids.
Shipbuilding industry: ballast, hull and general services, cooling, circulation.
Land based industry: circulation, cooling, water supply and general services.

PRINCIPALI APPLICAZIONI

Acqua dolce, acqua di mare, acqua industriale, condensato, brine, idrocarburi ed altri liquidi puliti.
Settore navale: servizi di zavorra, bilanciamento, servizi generali, raffreddamento, circolazione.
Settore industriale: circolazione, raffreddamento, servizi vari.

VERSIONS

MU-LDS pumps are now available in six sizes. Wetted material can be in cast iron, nickel-aluminium bronze, stainless steel or special alloy. Automatic priming system execution by means of ejector or vacuum pump.
Special executions according to Naval rules: shock-proof, noise-proof, vibration-proof, non magnetic.

VERSIONI

Le pompe MU-LDS sono disponibili in sei grandezze. Le parti bagnate possono essere in ghisa, bronzo al nickel alluminio, acciao inox o leghe speciali. Sistema di autoadescamento automatico con eiettore ad aria o pompa del vuoto.
Sono previste costruzioni a norma MARINA MILITARE: antishock, antirumore, antivibrazione, amagnetiche.

MAIN FEATURES

CARATTERISTICHE COSTRUTTIVE

MU-LDS pumps are designed in order to offer best possible performance and lowest possible maintenance. BACK PULL-OUT design allows maintenance on internal parts without removing motor and pipes. Easy replacement of bearings and seal without pump dismantling.

Le pompe MU-LDS sono progettate per offrire le migliori performance con la minima manutenzione. La costruzione BACK PULL-OUT permette l'estrazione delle parti interne senza dover rimuovere il motore e le tubazioni. E' anche possibile la sostituzione della tenuta meccanica e dei cuscinetti senza smontare completamente la pompa.

CASING: Casing is of the double volute type to reduce radial load on impeller and ensure maximum working life of bearings and mechanical seal.

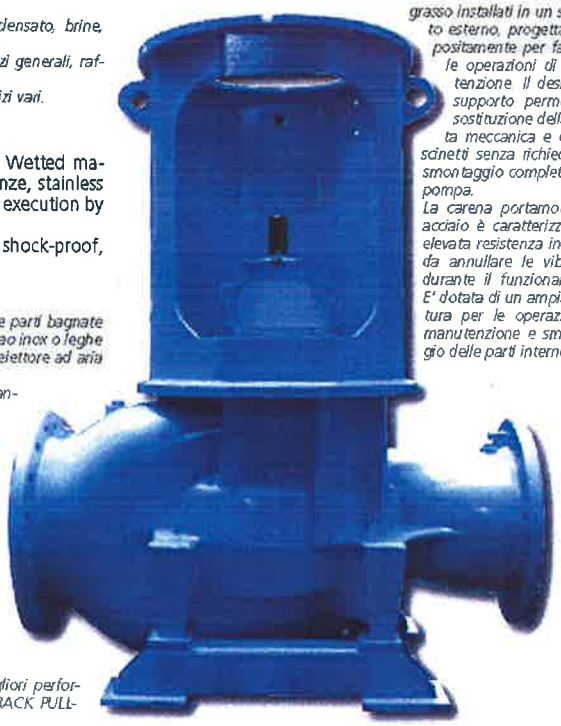
CORPO: : Il corpo è di tipo a doppia voluta per minimizzare la spinta radiale sulla girante ed aumentare la durata di cuscinetti e tenuta meccanica.

MECHANICAL SEAL: High quality mechanical seal (silicon carbide/silicon carbide/viton) for a wide range of applications. Mechanical seal is cartridge design for easy installation and removing. Soft packing is also available

TENUTA MECCANICA: Tenuta meccanica di alta qualità (carburo di silicio/carburo di silicio/viton) per un ampia gamma di applicazioni. La tenuta è del tipo a cartuccia per una facile installazione e rimozione. E' disponibile anche la versione con tenuta a badema

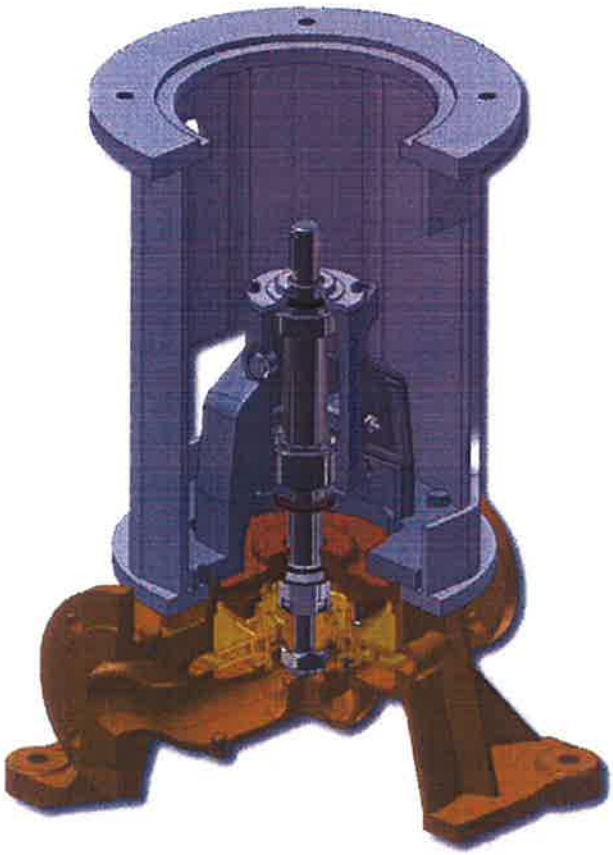
BEARING BRACKET AND MOTOR STOOL: External grease bearings in special bracket specially designed for ease of maintenance. Bracket design allows the replacement of mechanical seal and bearings without dismantling the pump completely.
The motor stool in welded steel to reduce vibrations has got a wide opening to facilitate maintenance.

SUPPORTO E CARENA: : Cuscinetti a grasso installati in un supporto esterno, progettato appositamente per facilitare le operazioni di manutenzione. Il design del supporto permette la sostituzione della tenuta meccanica e dei cuscinetti senza richiedere lo smontaggio completo della pompa.
La carena portamotore in acciaio è caratterizzata da elevata resistenza in modo da annullare le vibrazioni durante il funzionamento. E' dotata di un ampia apertura per le operazioni di manutenzione e smontaggio delle parti interne.



MODELS (MU-L) *MODELLI*	39
INTERCHANGEABILITY *INTERCAMBIABILITÀ:*	
CASINGS *CORPI*	39
IMPELLERS *GIRANTI*	39
SHAFTS *ALBERI*	6
BEARING BRACKETS *SUPPORTI*	6
COVERS *COPERCHI*	6
MECHANICAL SEALS *TENUTE MECCANICHE*	6

MATERIALS (MU-L) *MATERIALI*	MAX. WORKING PRESSURE *PRESSIONE MAX. ESERCIZIO*
CAST IRON *GHISA*	10 bar
STAINLESS STEEL, BRONZE, SPECIAL ALLOY *ACCIAIO INOX, BRONZO, LEGHE SPECIALI*	16 bar
NOTE: SPECIAL EXECUTIONS EXCEEDING THE ABOVE LIMITS AVAILABLE ON REQUEST *NOTA: ESECUZIONI SPECIALI AL DI FUORI DEI LIMITI SOPRA ESPOSTI REALIZZATE SU RICHIESTA*	

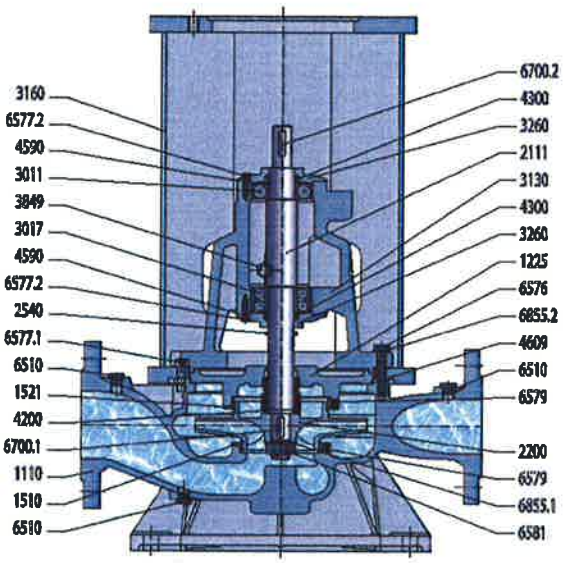


bare shaft version
versione ad asse nudo

closed impeller
girante chiusa

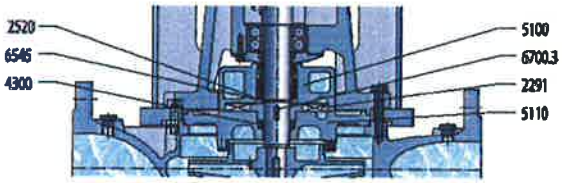
self priming element
with liquid ring
elemento autoadescante ad anello liquido

close coupled version
versione monoblocco



LONGITUDINAL SECTION
SEZIONE LONGITUDINALE

SOFT PACKING VERSION
VERSIONE TENUTA A BADERNA



SELF-PRIMING VERSION
VERSIONE AUTOADESCANTE

Pos.	Description *Descrizione*
1110	Pump casing *Corpo pompa*
1225	Casing cover *Coperchio del corpo*
1510	Wear ring *Anello di usura*
1521	Wear ring *Anello di usura*
2111	Pump shaft *Albero della pompa*
2200	Impeller *Girante*
2291	Priming stage impeller *Girante stellare*
2450	Shaft sleeve *Camida d'albero*
2520	Shoulder ring *Anello spallamento*
2540	Deflector *Deflettore*
3011	Radial ball bearing *Cuscinetto radiale*
3017	Angular ball bearing *Cuscinetto obliquo*
3130	Bearing bracket *Supporto doppio*
3160	Motor stool *Lanterna del motore*
3260	Bearing cover *Coperchio supporto*
3849	Greaser *Ingrassatore*
4120	Stuffing box gland *Premitreccia*
4130	Gland packing *Guarnizione a treccia*
4134	Lantern ring *Anello lanterna*
4200	Mechanical seal *Tenuta meccanica*
4300	Radial shaft seal *Anello di tenuta*
4590	Gasket *Guarnizione*
4609	O-Ring *O-Ring*
4610	O-Ring *O-Ring*
5100	Priming stage casing *Corpo autoadescante*
5110	Priming stage cover *Coperchio autoadescante*
6510	Plug *Tappo*
6545	Seeger *Seeger*
6573	Stud *Prigioniero*
6576	Screw *Vite*
6577.1	Screw *Vite*
6577.2	Screw *Vite*
6579	Screw *Vite*
6580	Nut *Dado*
6581	Impeller nut *Dado girante*
6700.1	Key *Chiavetta*
6700.2	Key *Chiavetta*
6700.3	Key *Chiavetta*
6855.1	Washer *Rosetta*
6855.2	Washer *Rosetta*

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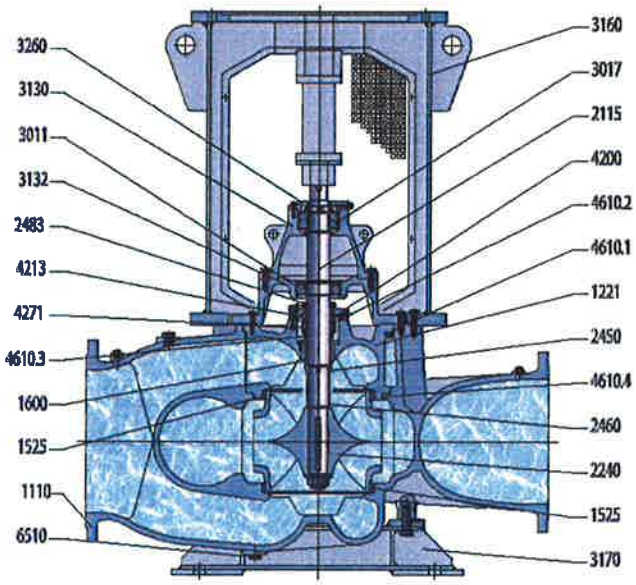
bare shaft version
versione ad asse nudo

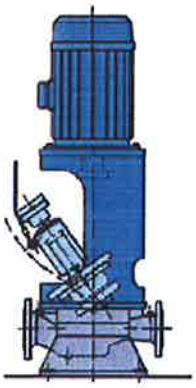
double suction impeller
girante a doppia aspirazione

MODELS (MU-LDS) *MODELLI*	6
INTERCHANGEABILITY *INTERCAMBIABILITÀ:*	
CASINGS *CORPI*	6
IMPELLERS *GIRANTI*	7
SHAFTS *ALBERI*	7
BEARING BRACKETS *SUPPORTI*	3
COVERS *COPERCHI*	6
MECHANICAL SEALS *TENUTE MECCANICHE*	6



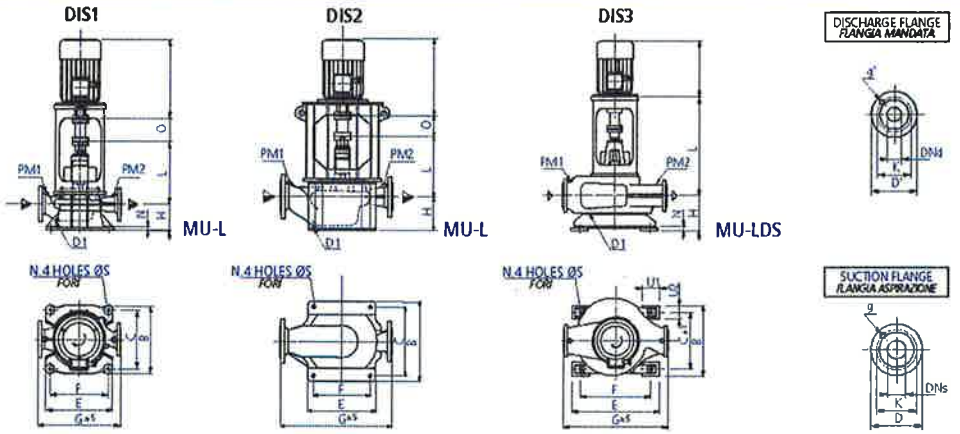
LONGITUDINAL SECTION
SEZIONE LONGITUDINALE

Pos.	Description *Descrizione*
1110	Pump casing *Corpo pompa*
1221	Casing cover *Coperchio del corpo*
1525	Wear ring *Anello di usura*
1600	Bush *Boccola*
2115	Pump shaft *Albero della pompa*
2240	Impeller *Girante*
2450	Shaft sleeve *Camicia d'albero*
2460	Spacer sleeve *Bussola distanziatrice*
2483	Locating sleeve *Bussola bloccaggio*
3011	Radial ball bearing *Cuscinetto radiale*
3017	Angular ball bearing *Cuscinetto obliquo*
3132	Bearing bracket *Supporto*
3130	Bearing bracket *Supporto doppio*
3160	Motor stool *Lanterna del motore*
3260	Bearing cover *Coperchio supporto*
4200	Mechanical seal *Tenuta meccanica*
4213	Mechanical seal cover *Coperchio per tenuta*
4271	Shaft sleeve *Camicia d'albero*
4610.1	O-Ring *O-Ring*
4610.2	O-Ring *O-Ring*
4610.3	O-Ring *O-Ring*
4610.4	O-Ring *O-Ring*
6510	Plug *Tappo*



Disassembly support group
Smontaggio gruppo supporto

MATERIALS (MU-LDS) *MATERIALI*	MAX. WORKING PRESSURE *PRESSIONE MAX. ESERCIZIO*
CAST IRON *GHISA*	10 bar
STAINLESS STEEL, BRONZE, SPECIAL ALLOY *ACCIAIO INOX, BRONZO, LEGHE SPECIALI*	16 bar
NOTE: SPECIAL EXECUTIONS EXCEEDING THE ABOVE LIMITS AVAILABLE ON REQUEST *NOTA: ESECUZIONI SPECIALI AL DI FUORI DEI LIMITI SOPRA ESPOSTI REALIZZATE SU RICHIESTA*	



	PUMP DIMENSIONS DIMENSIONI POMPA												PUMP TYPE TIPO POMPA	FLANGES DIMENSIONS DIMENSIONI FLANGE (UNI 2223-2229 PN 10 UNI 2223-2229 PN 16*)								HOLES N. N. FORI		DRAINAGE DRENAGGIO	V.GAUGE VUOTOMETRO	P.GAUGE MANOMETRO	WEIGHT** PESO**
DIS	B	C	E	F	G	H	L	N	S	O	D1	D2	MU	DNs	DNd	D	Df	K	Ks	g	g'	DNs	DNd	D1	PM1	PM2	Kg
1	320	270	320	270	360	100	237	19	18	140	-	-	25-160 L	40	25	150	115	110	85	18	14	4	4	1/4"G	1/4"G	1/4"G	60
1	340	310	340	310	395	130	360	19	18	140	-	-	32-160 L	50	40	165	150	125	110	18	18	4	4	1/4"G	1/4"G	1/4"G	90
1	350	295	350	295	395	135	360	26	18	140	-	-	32-200 L	50	40	165	150	125	110	18	18	4	4	1/4"G	1/4"G	1/4"G	90
1	390	295	350	295	420	145	360	24	18	140	-	-	40-160 L	65	50	185	165	145	125	18	18	4	4	1/4"G	1/4"G	1/4"G	95
1	380	310	360	310	440	150	360	27	18	140	-	-	40-200 L	65	50	185	165	145	125	18	18	4	4	1/4"G	1/4"G	1/4"G	100
1	380	310	360	310	475	135	360	24	18	140	-	-	40-250 L	65	50	185	165	145	125	18	18	4	4	1/4"G	1/4"G	1/4"G	105
1	520	465	520	465	700	165	470	27	18	140	-	-	40-315 L	65	50	185	165	145	125	18	18	4	4	3/8"G	3/8"G	3/8"G	235
1	390	295	350	295	490	155	360	27	18	140	-	-	50-160 L	80	65	200	185	160	145	18	18	4	4	1/4"G	1/4"G	1/4"G	100
1	380	310	360	310	480	150	360	22	18	140	-	-	50-200 L	80	65	200	185	160	145	18	18	4	4	1/4"G	1/4"G	1/4"G	100
1	425	370	425	370	510	150	360	22	18	140	-	-	50-250 L	80	65	200	185	160	145	18	18	4	4	1/4"G	1/4"G	1/4"G	120
1	520	465	520	465	760	160	470	22	18	140	-	-	50-315 L	80	65	200	185	160	145	18	18	4	4	3/8"G	3/8"G	3/8"G	245
1	385	330	385	330	510	165	360	27	18	140	-	-	65-160 L	100	80	220	200	180	160	18	18	8	4	1/4"G	1/4"G	1/4"G	110
1	415	360	415	360	510	160	360	22	18	140	-	-	65-200 L	100	80	220	200	180	160	18	18	8	4	1/4"G	1/4"G	1/4"G	115
1	455	400	455	400	705	193	470	28	18	140	-	-	65-250 L	100	80	220	200	180	160	18	18	8	4	3/8"G	3/8"G	3/8"G	200
1	520	465	520	465	760	170	470	27	18	140	-	-	65-315 L	100	80	220	200	180	160	18	18	8	4	3/8"G	3/8"G	3/8"G	250
1	620	565	620	565	850	205	470	40	22	140	-	-	65-400 L	100	80	220	200	180	160	18	18	8	4	3/8"G	3/8"G	3/8"G	305
1	415	360	415	360	540	170	380	22	18	140	-	-	80-160 L	125	100	250	220	210	180	18	18	8	8	1/4"G	1/4"G	1/4"G	125
1	490	400	490	400	720	215	470	22	18	140	-	-	80-200 L	125	100	250	220	210	180	18	18	8	8	3/8"G	3/8"G	3/8"G	200
1	455	400	455	400	720	196	470	22	18	140	-	-	80-250 L	125	100	250	220	210	180	18	18	8	8	3/8"G	3/8"G	3/8"G	220
1	520	465	520	465	780	205	470	27	18	140	-	-	80-315 L	125	100	250	220	210	180	18	18	8	8	3/8"G	3/8"G	3/8"G	260
1	620	565	620	565	890	218	530	25	22	180	-	-	80-400 L	125	100	250	220	210	180	18	18	8	8	3/8"G	3/8"G	3/8"G	375
1	520	465	520	465	730	235	470	25	18	140	-	-	100-200 L	150	125	285	250	240	210	22	18	8	8	3/8"G	3/8"G	3/8"G	220
1	530	480	530	480	790	245	470	30	18	140	-	-	100-250 L	150	125	285	250	240	210	22	18	8	8	3/8"G	3/8"G	3/8"G	230
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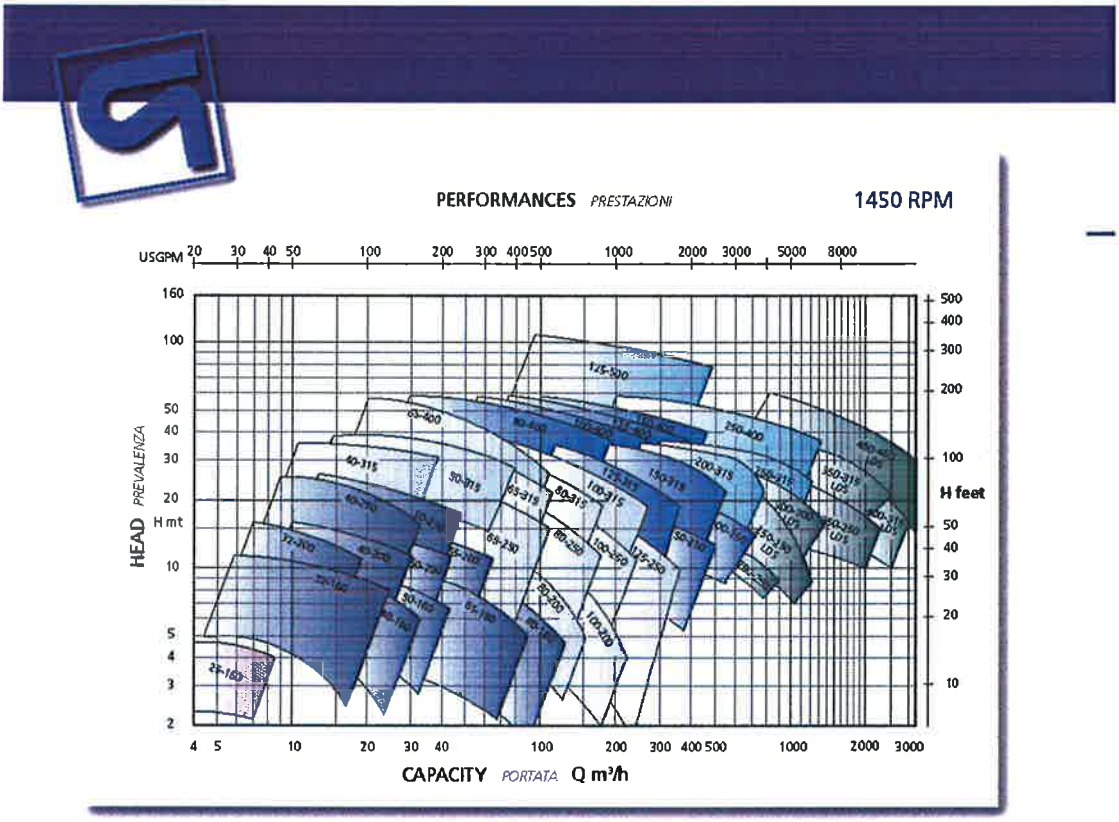
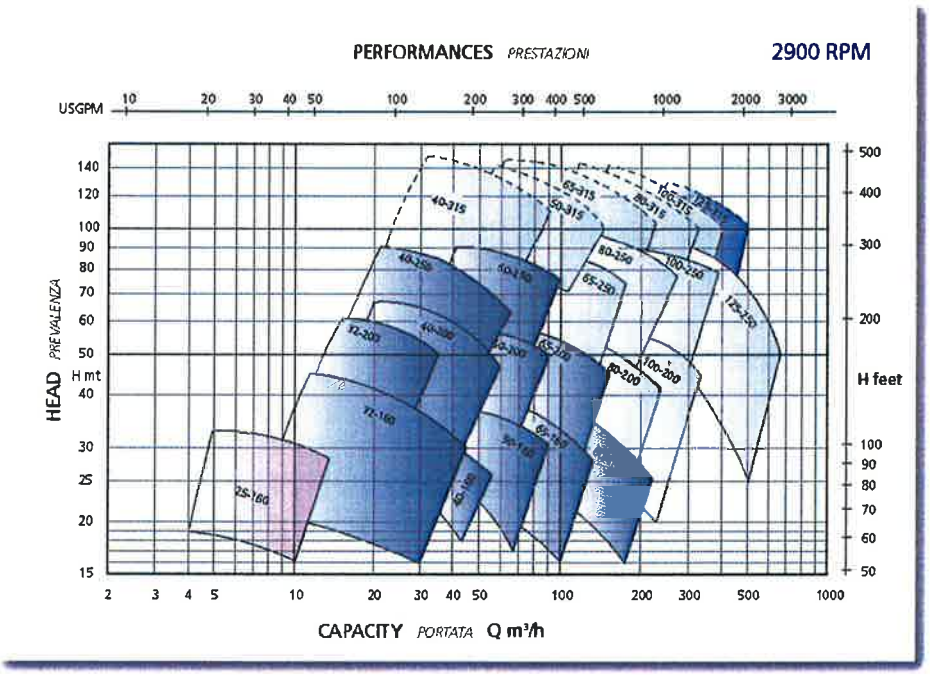
1	620	565	620	565	820	255	470	29	22	140	-	-	125-250 L	200	150	340	285	295	240	22	22	8	8	3/8"G	3/8"G	3/8"G	290
1	620	565	620	565	880	260	530	30	22	180	-	-	125-315 L	200	150	340	285	295	240	22	22	8	8	3/8"G	3/8"G	3/8"G	355
1	620	565	620	565	920	275	530	32	22	180	-	-	125-400 L	200	150	340	285	295	240	22	22	8	8	3/8"G	3/8"G	3/8"G	435
1	660	605	660	605	960	250	911	18	22	-	-	-	125-450 L	200	150	340	285	295	240	22	22	12	8	3/8"G	3/8"G	3/8"G	480
2	660	605	660	605	960	250	911	18	22	-	-	-	125-450 L	200	150	340	285	295	240	22	22	12	8	3/8"G	3/8"G	3/8"G	480
2	640	900	730	570	1050	275	635	27	26	X	180	140	125-500 L	150*	125*	285	250	240	210	22	18	8	8	3/8"G	3/8"G	3/8"G	600
1	620	565	620	565	880	325	530	30	22	180	-	-	150-250 L	250	200	395	340	350	295	22	22	12	8	3/8"G	3/8"G	3/8"G	375
2	750	565	620	565	880	325	530	30	22	180	-	-	150-250 L	250	200	395	340	350	295	22	22	12	8	3/8"G	3/8"G	3/8"G	375
1	620	565	620	565	930	290	530	30	22	180	-	-	150-315 L	250	200	395	340	350	295	22	22	12	8	3/8"G	3/8"G	3/8"G	390
1	660	605	660	605	1000	283	530	25	22	180	-	-	150-400 L	250	200	395	340	350	295	22	22	12	8	3/8"G	3/8"G	3/8"G	420
1	750	680	750	680	1020	340	530	40	25	180	-	-	200-250 L	250	250	395	395	350	350	22	22	12	12	3/8"G	3/8"G	3/8"G	490
1	750	650	640	540	1055	322	605	30	30	180	-	-	200-315 L	300	250	445	395	400	350	22	22	12	12	2x3/8"G	3/8"G	3/8"G	760
2	750	660	640	550	1055	322	605	-	30	180	-	-	200-315 L	300	250	445	395	400	350	22	22	12	12	2x3/8"G	3/8"G	3/8"G	760
2	750	650	610	510	1000	330	530	-	27	180	-	-	250-250 L	300	250	445	395	400	350	22	22	12	12	3/8"G	3/4"G	3/8"G	800
1	960	890	980	890	1265	385	605	30	25	300	-	-	250-315 L	350	300	505	445	460	400	22	22	16	12	3/8"G	3/8"G	3/8"G	950
2	960	860	800	700	1265	385	605	-	30	300	-	-	250-315 L	350	300	505	445	460	400	22	22	16	12	3/8"G	3/8"G	3/8"G	920
1	1025	945	1025	945	1300	385	605	35	25	300	-	-	250-400 L	350	300	505	445	460	400	22	22	16	12	3/8"G	3/8"G	3/8"G	1050
2	960	860	800	700	1300	385	605	-	30	300	-	-	250-400 L	350	300	505	445	460	400	22	22	16	12	3/8"G	3/8"G	3/8"G	920
2	1400	1200	1300	1100	1800	400	1500	40	40	400	-	-	300-710 L	400	300	597	483	515	400	25	22	16	12	2x3/4"G	3/8"G	3/8"G	4000
3	620	480	670	510	1000	330	1150	27	26	-	180	140	250-250 LDS	300	250	483	406	400	350	22	22	12	12	2x3/4"G	3/8"G	3/8"G	900
3	670	530	730	570	1200	330	1160	27	26	-	180	140	300-300 LDS	350	300	533	483	460	400	22	22	16	12	2x3/4"G	3/8"G	3/8"G	1100
3	750	590	820	660	1300	375	1238	27	30	-	200	160	350-250 LDS	400	350	597	533	515	460	25	22	16	16	2x3/4"G	3/8"G	3/8"G	1100
3	775	615	820	660	1300	375	1215	27	30	-	200	160	350-315 LDS	400	350	597	533	515	460	25	22	16	16	2x3/4"G	3/8"G	3/8"G	1200
3	807	647	820	660	1400	405	1260	27	30	-	200	160	400-315 LDS	450	400	640	597	565	515	25	25	20	16	2x3/4"G	3/8"G	3/8"G	1300
3	1020	940	950	870	1580	480	1415	33	28	-	100	180	450-450 LDS	600	450	840	640	725	565	25	25	20	20	2x3/4"G	3/8"G	3/8"G	1500

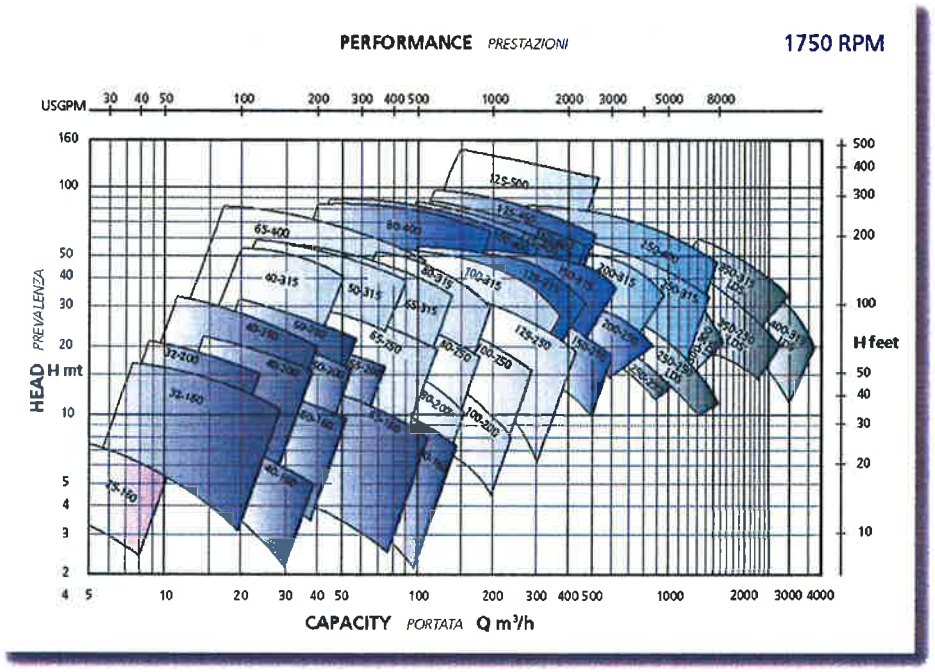
X= 280 FOR MOTOR SIZE 250+280 X= 250 FOR MOTOR SIZE 315 **BARE SHAFT BRONZE PUMP POMPA AD ASSE NUDO IN BRONZO

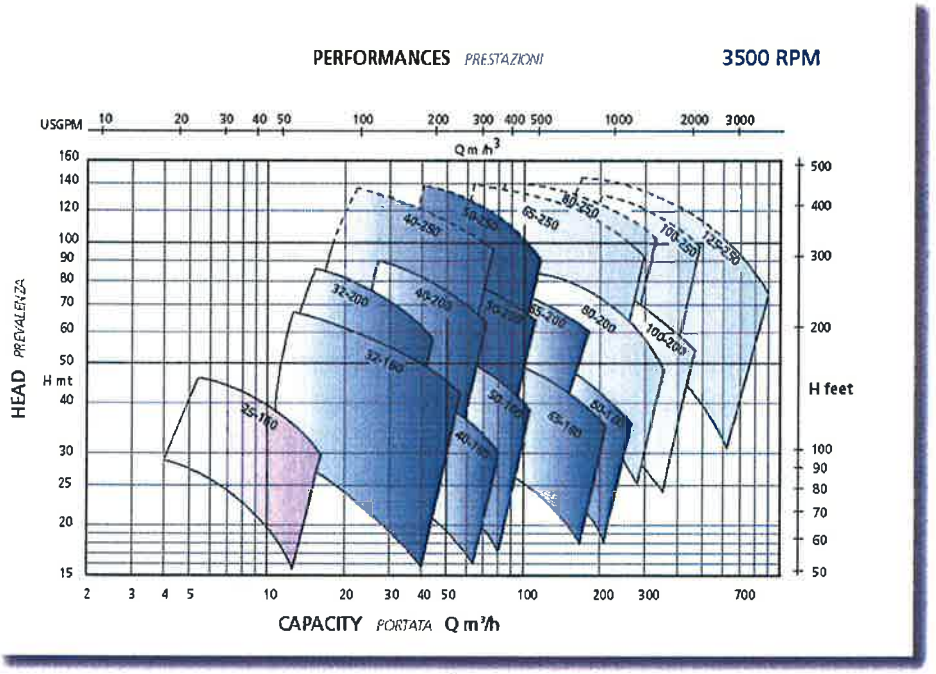
DIS 1= CAST BASE PIEDE IN FUSIONE DIS 2= WELDED STEEL BASE PIEDE IN CARPENTERIA


PERFORMANCES PRESTAZIONI
1450 RPM
USGPM 20 30 40 50 100 200 300 400 500 1000 2000 3000 5000 8000
HEAD PREVALENZA H mt
H feet
CAPACITY PORTATA Q m³/h


PERFORMANCES PRESTAZIONI
2900 RPM
USGPM 10 20 30 40 50 100 200 300 400 500 1000 2000 3000
HEAD PREVALENZA H mt
H feet
CAPACITY PORTATA Q m³/h

GARBARINO


PERFORMANCE PRESTAZIONI
1750 RPM
USGPM
HEAD PREVALENZA H mt
H feet
CAPACITY PORTATA Q m³/h


PERFORMANCES PRESTAZIONI
3500 RPM
USGPM
Q m h³
HEAD PREVALENZA H mt
H feet
CAPACITY PORTATA Q m³/h

9


ISO 9001
RINA
ANSI-RAB
CE
ATEX on request
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E-mail: info.filiale@pompegarbarino.it
www.pompegarbarino.com

4.3 Pompe centrifughe draganti e soffianti

FLYGT

Technical specification

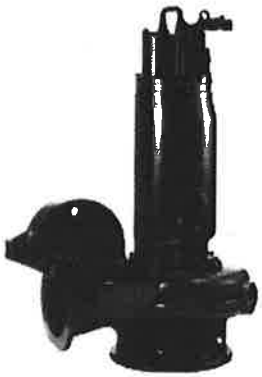
Submersible pump C 3400, 50 Hz

Flygt

ITT Industries

FLYGT

C 3400



C 3400

Product

Submersible pump for pumping waste water containing solids or long-fibred material.

Denomination

Product code	3400/705
Product code	3400/735
Product code	3400/765
Product code	3400/805
Product code	3400/835
Product code	3400/865
Installation	P, T, Z

Process data

Liquid temperature	max +40 °C
Depth of immersion	max 20 m
The pH of the pumped liquid	pH 6-11
Liquid density	max. 1100 kg/m^3
Impeller throughlet	See Motor rating table

Motor data

Frequency	50 Hz
Insulation class	H (+180 °C)
Voltage variation	
- continuously running	max ± 5%
- intermittent running	max ± 10%
Voltage imbalance between phases	max 2%
No. of starts/hour	max 15

Cable

SUBCAB®	To be dimensioned by ITT Flygt

Monitoring equipment

Thermal contacts opening temperature	140 °C
Analogue temperature sensor in main bearing	Pt100
Leakage sensor in stator housing	Ball float switch

Leakage sensor in junction box

Drive unit	Sensor
7XX	FLS
8XX	-

Material

Pump housing	Cast iron
Stator housing	Cast iron
O-rings	Nitrile rubber

Mechanical face seals

Alternative	Inner seal	Outer seal
1	Corrosion resistant cemented carbide/ Corrosion resistant cemented carbide	Corrosion resistant cemented carbide/ Corrosion resistant cemented carbide

Impeller

Alternative	Material
1	Cast iron
2	Stainless steel

Shaft

Alternative	Material
1	Steel
2	Stainless steel

Surface Treatment

All cast parts are primed with a water-borne primer. The finishing coat is a high-solid two pack paint.

Weight

See dimensional drawing.

Option

3400/715	Ex. proof version
3400/745	Ex. proof version
3400/775	Ex. proof version
3400/815	Ex. proof version
3400/845	Ex. proof version
3400/875	Ex. proof version
Analogue temperature sensors in stator	Pt100
Analogue temperature sensor in support bearing	Pt100
Leakage sensor in oil housing	CLS

FLYGT

C 3400

Leakage sensor in junction box

Drive unit	Sensor
7XX	-
8XX	Ball float switch

Other cables

Surface treatment — Epoxy treatment

Zinc anodes

Accessories

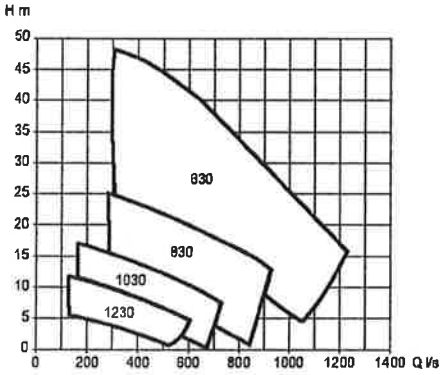
Discharge connections, adapters, hose connections and other mechanical accessories.

Electrical accessories such as pump controller, control panels, starters, monitoring relays.

See separate booklet or www.flygt.com, for further information.

Motor rating and performance curve

Curve/impeller No	Drive unit	Rated power, kW	Rated current, A	Starting current, A	Power factor cos φ	Impeller throughlet, mm	Ex proof version available	Installation P	T	Z	
400 V, 50 Hz, 3 ~, 490 r/min											
1230	705	30	61	289	0,60	110	•	•	•	•	
1230	705	40	110	390	0,59	110	•	•	•	•	
400 V, 50 Hz, 3 ~, 590 r/min											
1030	705	40	88	385	0,73	110	•	•	•	•	
1030	705	60	135	550	0,71	110	•	•	•	•	
1030	735	90	227	940	0,64	110	•	•	•	•	
400 V, 50 Hz, 3 ~, 730 r/min											
830	705	90	182	775	0,79	110	•	•	•	•	
830	735	125	245	1070	0,81	110	•	•	•	•	
830	765	150	292	1330	0,81	110	•	•	•	•	
830	805	160	305	1360	0,81	110	•	•	•	•	
400 V, 50 Hz, 3 ~, 990 r/min											
630	805	180	330	1765	0,83	110	•	•	•	•	
630	835	250	465	2645	0,82	110	•	•	•	•	
630	865	310	575	3370	0,82	110	•	•	•	•	



FLYGT

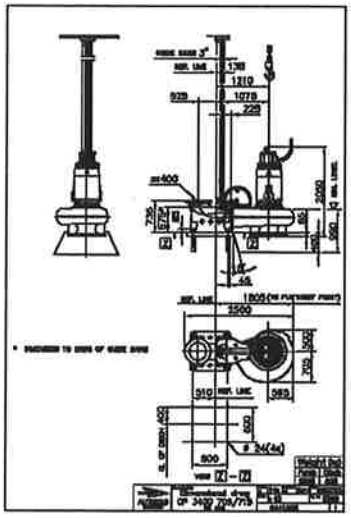
C 3400

Dimensional drawing

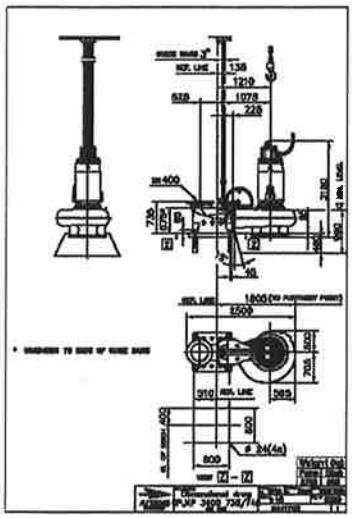
All drawings are available as Acrobat documents (.pdf) and AutoCad drawings (.dwg). Download the drawings from www.flygt.com or contact your ITT Flygt representative for more information.

All dimensions are in mm.

Drive unit 705/715, P-installation



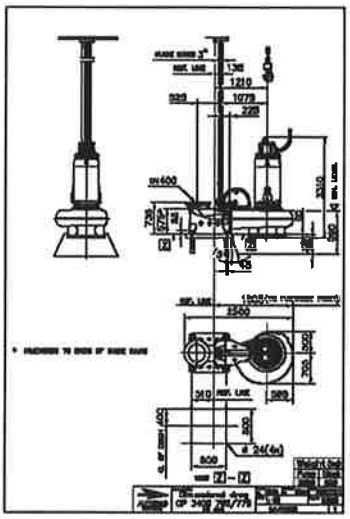
Drive unit 735/745, P-installation



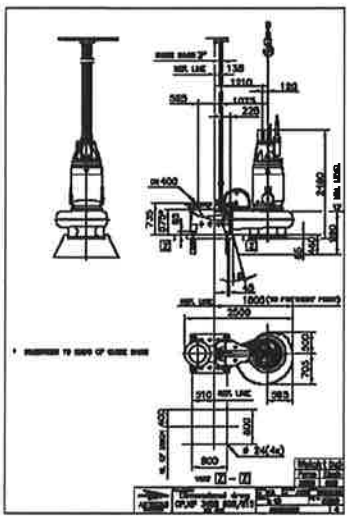
FLYGT

C 3400

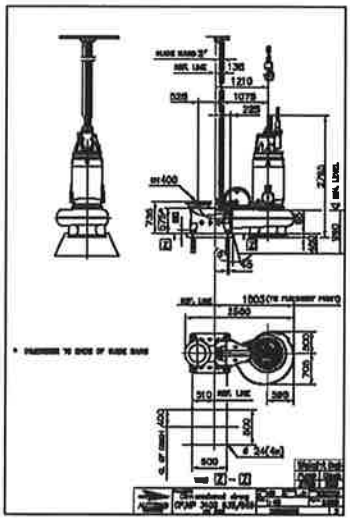
Drive unit 765/775, P-installation



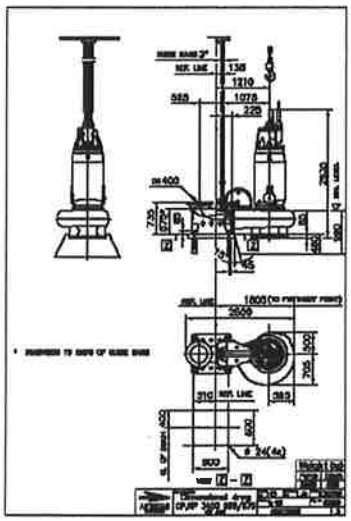
Drive unit 805/815, P-installation



Drive unit 835/845, P-installation



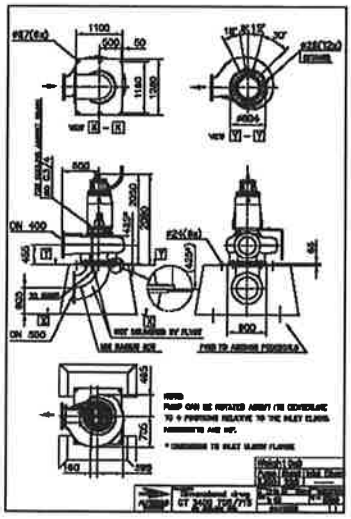
Drive unit 865/875, P-installation



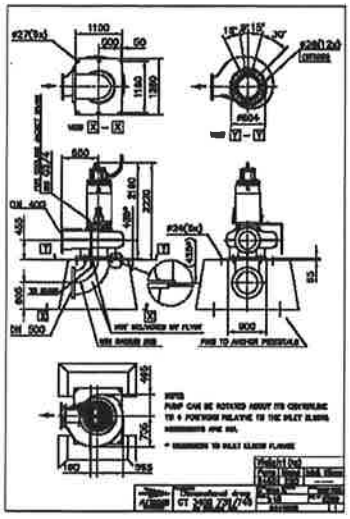
FLYGT

C 3400

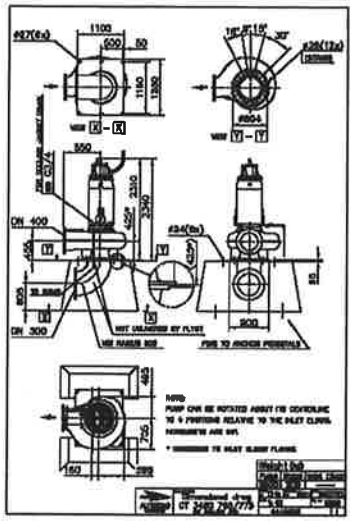
Drive unit 705/715, T-installation



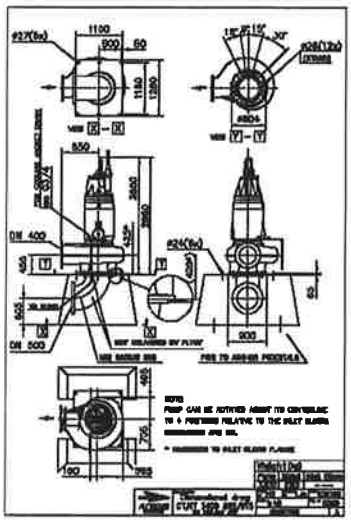
Drive unit 735/745, T-installation



Drive unit 765/775, T-installation



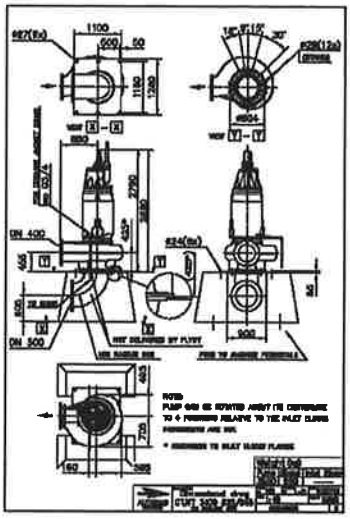
Drive unit 805/815, T-installation



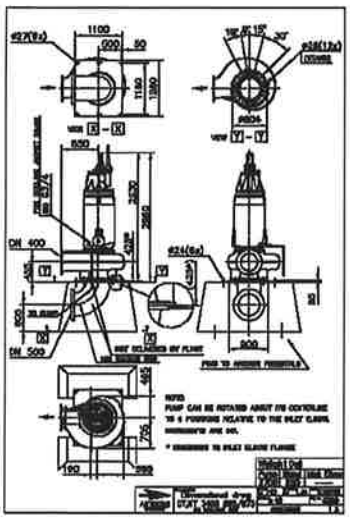
FLYGT

C 3400

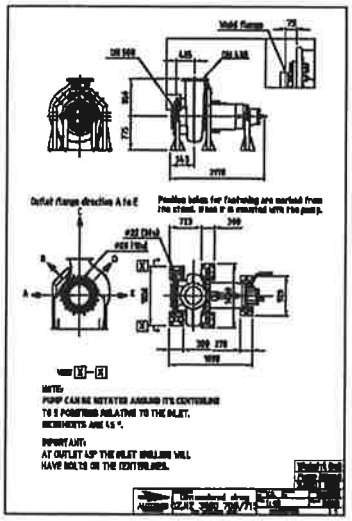
Drive unit 835/845, T-installation



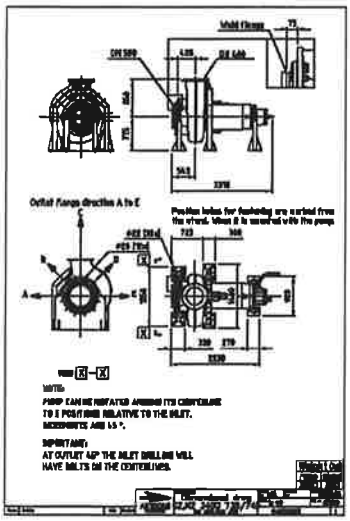
Drive unit 865/875, T-installation



Drive unit 705/715, Z-installation



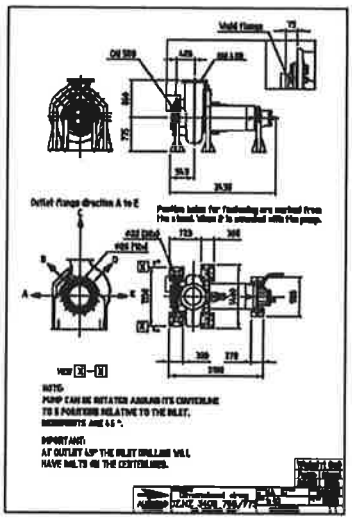
Drive unit 735/745, Z-installation



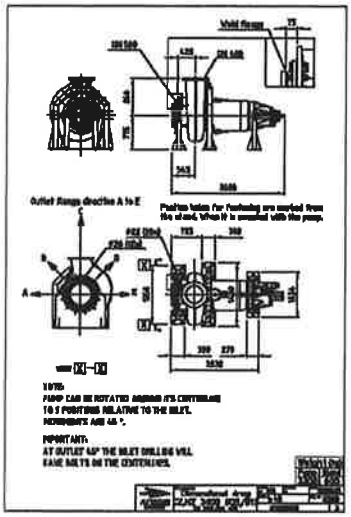
FLYGT

C 3400

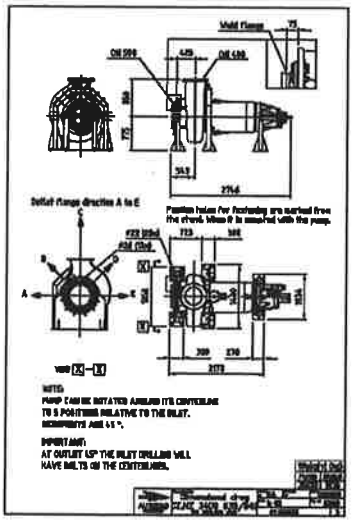
Drive unit 765/775, Z-installation



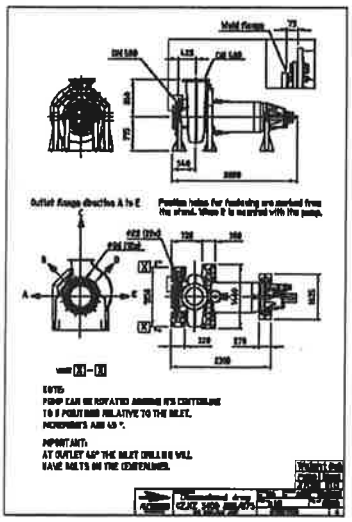
Drive unit 805/815, Z-installation



Drive unit 835/845, Z-installation



Drive unit 865/875, Z-installation



4.4 Pompe centrifughe carico

FLYGT

Technical specification

Submersible pump N 3312, 50 Hz

Flygt

ITT Industries

FLYGT

N 3312

N 3312

Product

Submersible pump for pumping waste water containing solids or long-fibred material.

Denomination

Product code	3312/705
Product code	3312/735
Product code	3312/765
Product code	3312/835
Installation	P, S, T, Z

Process data

Liquid temperature	max +40 °C
Depth of immersion	max 20 m
The pH of the pumped liquid	pH 6-11
Liquid density	max. 1100 kg/m^3
Impeller throughlet	See Motor rating table

Motor data

Frequency	50 Hz
Insulation class	H (+180 °C)
Voltage variation	
- continuously running	max ± 5%
- intermittent running	max ± 10%
Voltage imbalance between phases	max 2%
No. of starts/hour	max 15

Cable

SUBCAB®	To be dimensioned by ITT Flygt

Monitoring equipment

Thermal contacts opening temperature	140 °C
Leakage sensor in stator housing	Ball float switch
Analogue temperature sensor in main bearing	Pt100

Leakage sensor in junction box

Drive unit	Sensor
7X5	FLS
8X5	Float switch

Material

Impeller	Cast iron
Pump housing	Cast iron
Stator housing	Cast iron
O-rings	Nitrile rubber

Mechanical face seals

Alternative	Inner seal	Outer seal
1	Corrosion resistant cemented carbide/ Corrosion resistant cemented carbide	Corrosion resistant cemented carbide/ Corrosion resistant cemented carbide

Shaft

Alternative	Material
1	Steel
2	Stainless steel

Surface Treatment

All cast parts are primed with a water-borne primer. The finishing coat is a high-solid two pack paint.

Weight

See dimensional drawing.

Option

3312/715	Ex. proof version
3312/745	Ex. proof version
3312/775	Ex. proof version
3312/845	Ex. proof version
Leakage sensor in oil housing	CLS
Analogue temperature sensor in support bearing	Pt100
Analogue temperature sensors in stator	Pt100
Other cables	
Surface treatment	Epoxy treatment
Zinc anodes	

Accessories

Discharge connections, adapters, hose connections and other mechanical accessories.

Electrical accessories such as pump controller, control panels, starters, monitoring relays.

See separate booklet or www.flygt.com, for further information.

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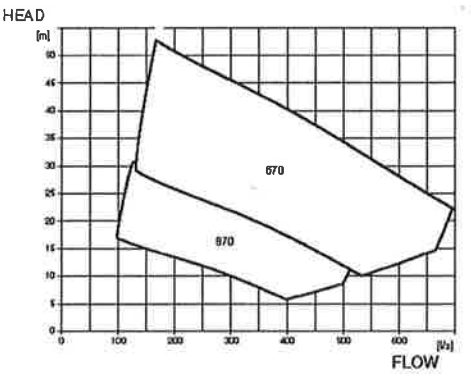
N 3312

Motor rating and performance curve

Curve/impeller No	Drive unit	Rated power, kW	Rated current, A	Starting current, A	Power factor cos φ	Impeller throughlet, mm	Ex proof version available	Installation P	S	T	Z
400 V, 50 Hz, 3 ~, 736 r/min											
870	705	55	107	505	0,82		•	•	•	•	•
870	705	90	182	775	0,79		•	•	•	•	•
870	735	125	245	1070	0,81						
400 V, 50 Hz, 3 ~, 985 r/min											
670	705	100	202	1150	0,78		•	•	•	•	•
670	735	140	268	1545	0,81		•	•	•	•	•
670	765	180	360	2215	0,77		•	•	•	•	•
670	835	250	465	2645	0,82		•	•	•	•	•



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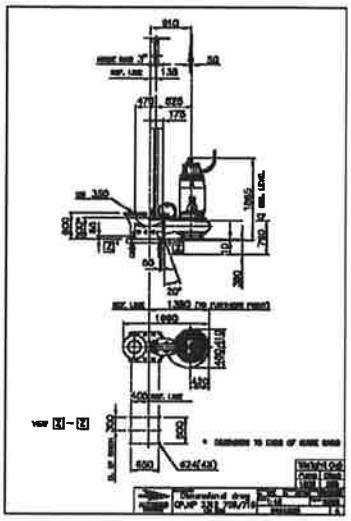
N 3312

Dimensional drawing

All drawings are available as Acrobat documents (.pdf) and AutoCad drawings (.dwg). Download the drawings from www.flygt.com or contact your ITT Flygt representative for more information.

All dimensions are in mm.

Drive unit 705/715, P-installation



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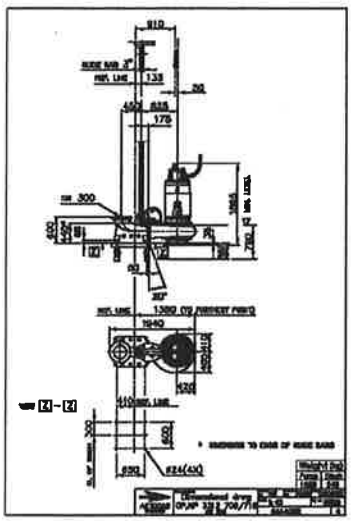

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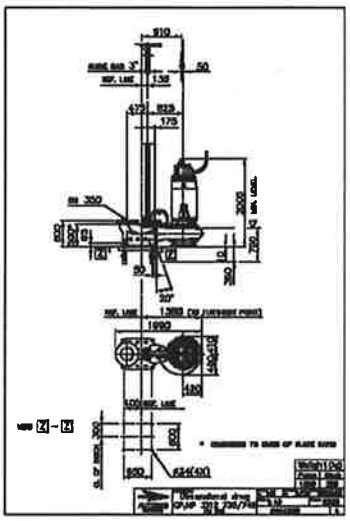
N 3312

Drive unit 735/745, P-installation



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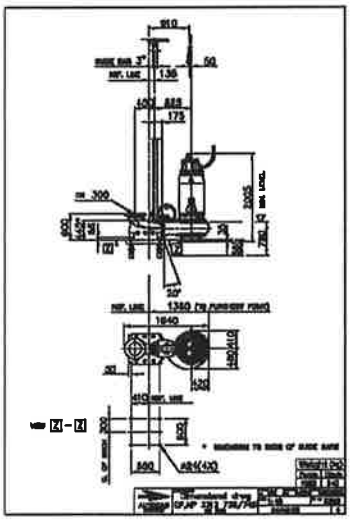

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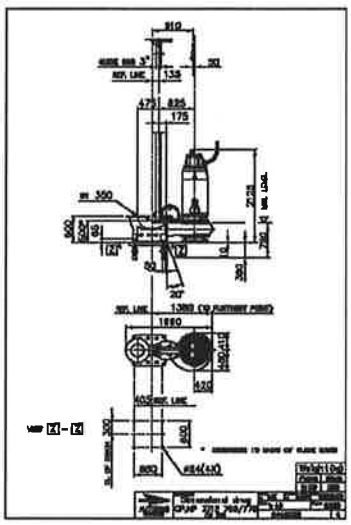

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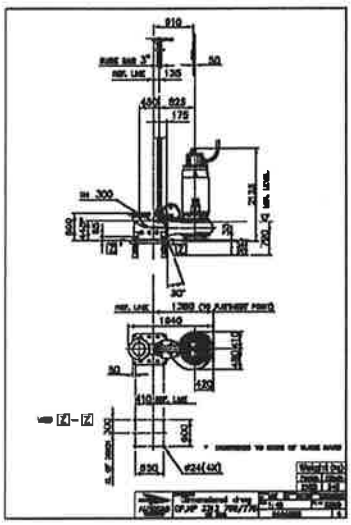

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N 3312

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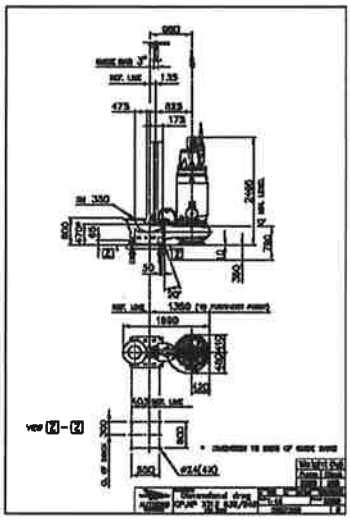

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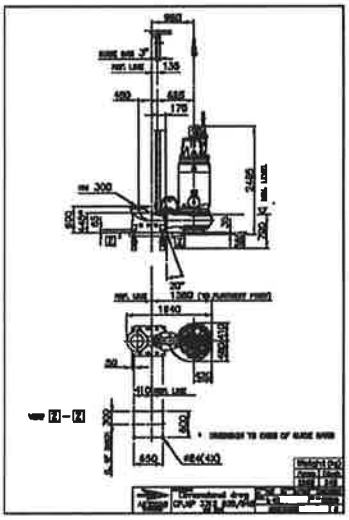
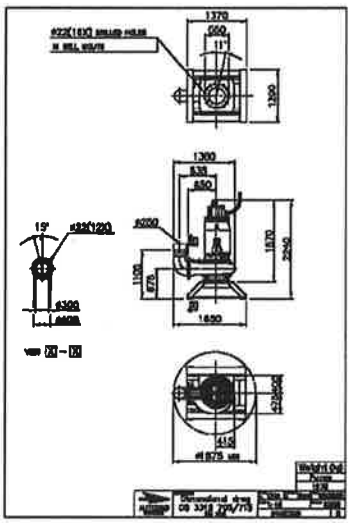


Drive unit 705/715, S-installation



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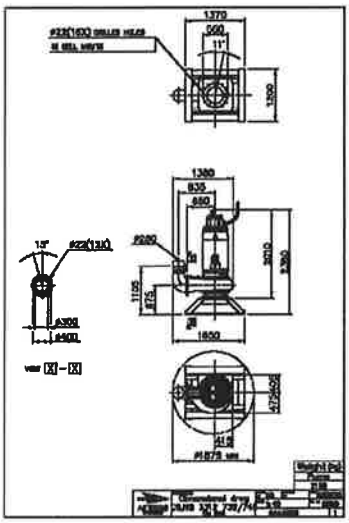

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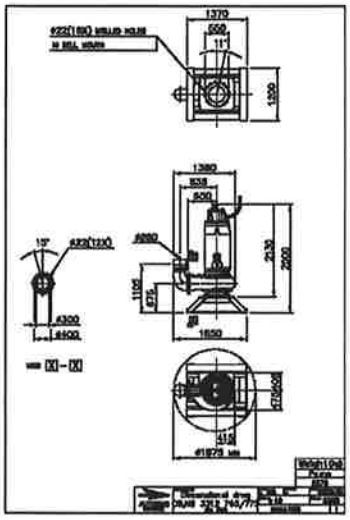
Drive unit 765/775, S-installation



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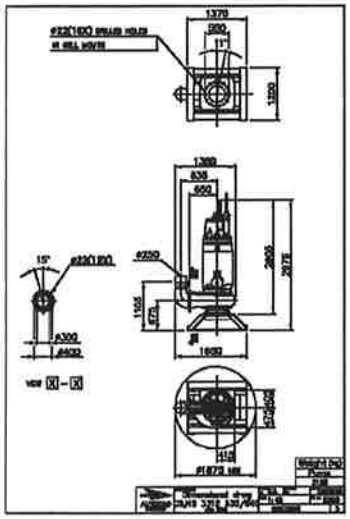

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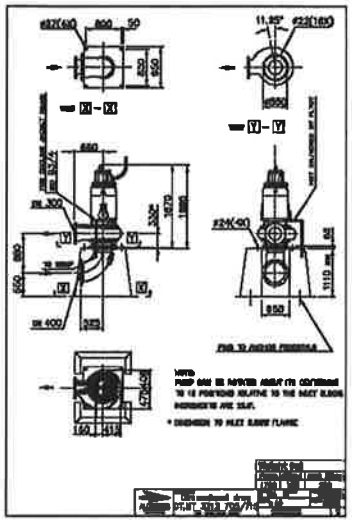

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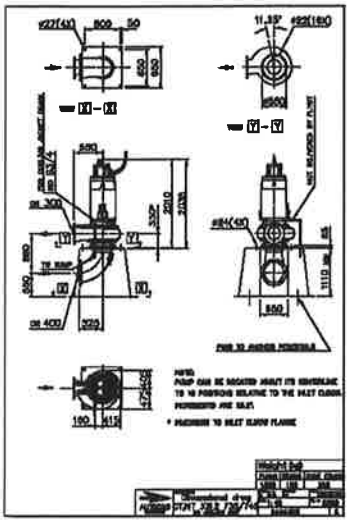

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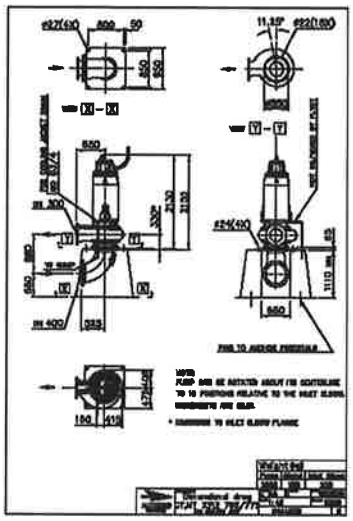

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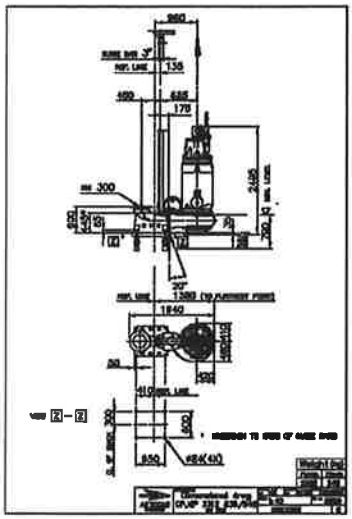
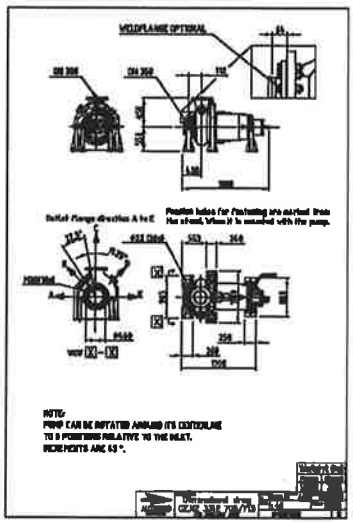


Drive unit 705/715, Z-installation



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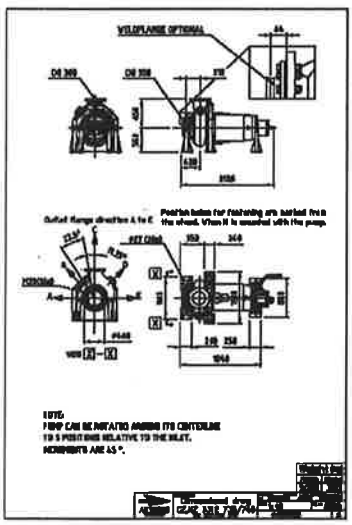

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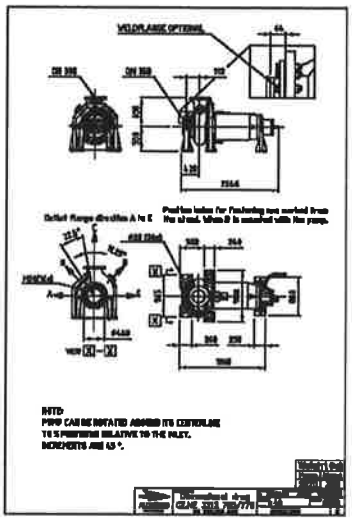
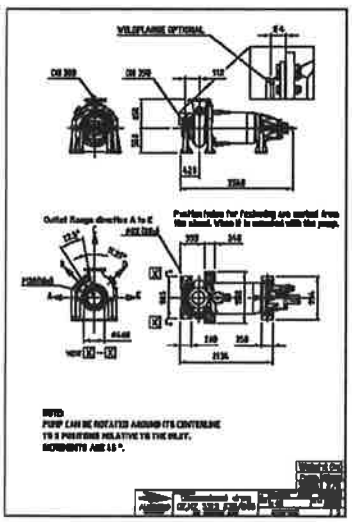


Drive unit 835/845, Z-installation



4.5 Pompe a disco oscillante

P

HOLLOW OSCILLATING DISK PUMPS
POMPE A DISCO CAVO OSCILLANTE

USES AND APPLICATION FIELDS
The P range of pumps has been designed for use on wide ranging applications within the marine, chemical, petrochemical, paper, food and paint industries. It can pump different fluids from viscous and lubricating to aqueous ones and therefore seizing liquids, slightly and medium abrasive products, aggressive fluids, etc..

USI E CAMPI DI APPLICAZIONE
La particolare realizzazione delle pompe P permette di impiegarle in vari settori come quello navale, chimico e petrolchimico, cartario, alimentare, vernici ecc., pompando i liquidi più diversi, da quelli viscosi e lubrificanti a quelli acquosi, fluidi parzialmente abrasivi, fluidi aggressivi, ecc.

SELF PRIMING
The P pumps are self priming by construction even with empty suction pipes and no suction valve. Priming capacity is strong related to suction pipe layout and pumped liquid.

AUTOADESCANTI
Le pompe P sono autoadescanti, cioè possono adescarsi automaticamente anche con tubazione aspirante vuota e senza valvola di fondo. La capacità di adescamento dipende da come viene realizzata la tubazione di aspirazione e dal liquido pompato.

REVERSIBLE
The P pumps are bi-rotational, that is to say they maintain their characteristics unchanged when they pump in both directions simply by reversing the direction of motor rotation.

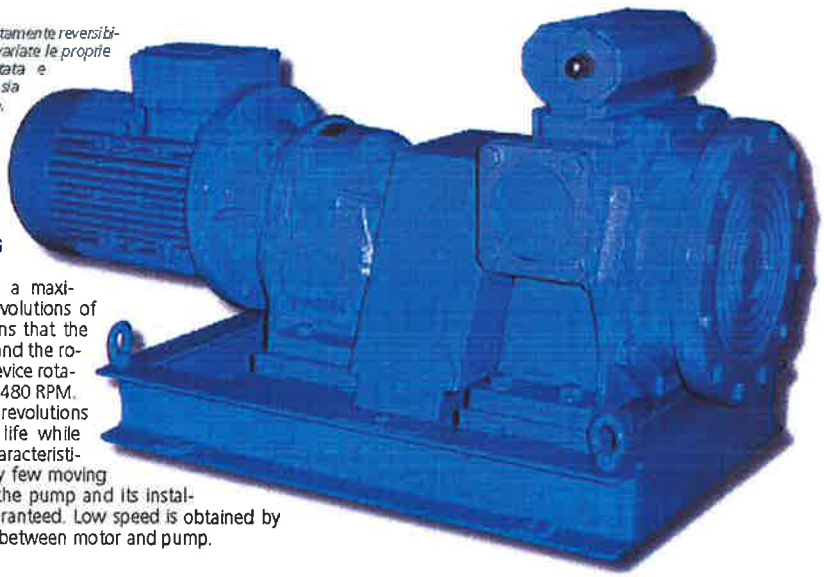
REVERSIBILI
Le pompe P sono perfettamente reversibili, cioè mantengono invariate le proprie caratteristiche di portata e prevalenza, pompando sia in un senso sia nell'altro, semplicemente invertendo il senso di rotazione del motore.

LOW NUMBER OF REVOLUTIONS OF THE PUMPING PART
The P pumps have a maximum number of revolutions of 480 RPM; this means that the shaft, the bearings and the rotor with its elastic device rotate at a maximum of 480 RPM. A low number of revolutions guarantees a long life while maintaining its characteristics. As there are very few moving parts, reliability of the pump and its installations are thus guaranteed. Low speed is obtained by means of a reducer between motor and pump.

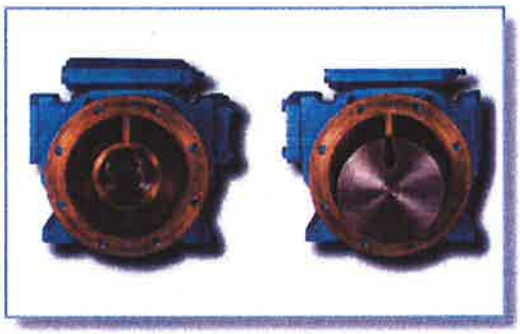
BASSO NUMERO DI GIRI
Le pompe P possono avere un numero di giri max. intorno ai 480 rpm, cioè l'albero della pompa, i suoi cuscinetti, la girante con il dispositivo elastico al massimo ruotano a 480 rpm. Il basso numero di giri e le pochissime parti in movimento garantiscono un lungo funzionamento con le stesse prestazioni e garanzie di affidabilità per la pompa ed il relativo impianto. La velocità ridotta è ottenuta tramite un riduttore montato tra pompa e motore.

ELASTIC ECCENTRICITY OF THE PUMPING PLATE
The pumping oscillating hollow disk is kept in contact with the pump body by an elastic device (spring + cap). This device allows the passage of considerable sized solid particles in suspension, as these particles remain in the available space and therefore do not damage seriously the body and the rotor. It also allows the recovery of play due to wear, at the same time maintaining the characteristics of capacity and head of the pump even with viscous, abrasive or chemical fluids.

ECCENTRICITA' ELASTICA DEL DISCO POMPANTE
Il disco cavo oscillante equilibrato è mantenuto a contatto del corpo pompa attraverso un dispositivo elastico (molla + scodellino). Tale dispositivo consente il passaggio di particelle solide, in sospensione nel fluido, di dimensioni anche notevoli, purchè sempre rientrando nello spazio a disposizione e purché non si tratti di particelle capaci di danneggiare profondamente il corpo e la girante. Consente inoltre di recuperare i giochi dovuti all'usura mantenendo costanti nel tempo le caratteristiche di portata e prevalenza della pompa anche con i fluidi pompati impegnativi sia per viscosità, aggressività ed anche abrasione.



GARBARINO



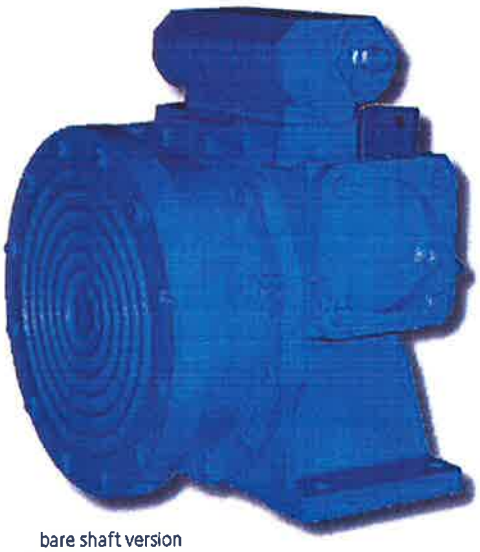
The hollow disk is pivoted eccentrically with regard to the pump shaft and is driven by a baffle-plate separating the suction orefice from the delivery one. The shaft rotation drags the hollow disk in an oscillating movement and keeps it always tangent to the outer and the inner cylindrical surfaces, thanks to two diametrically opposed generating lines, thus forming two movable hydraulic seals.

Il disco cavo è imperniato in modo eccentrico rispetto all'albero della pompa ed è guidato dal diaframma che separa la bocca di aspirazione da quella di mandata. La rotazione dell'albero trascina in un movimento oscillante il disco cavo, il quale si mantiene sempre tangente alle due superfici cilindriche, esterna ed interna, secondo due generatrici diametralmente opposte, formando così due tenute idrauliche mobili.

TYPE *TIPO*	NOZZLES *DIAMETRO BOCCHE* DN	CAPACITY *PORTATA m³/h* 1 bar	 5 bar	ABSORBED POWER *POTENZA ASSORBITA* KW 1 bar	 5 bar	MOTOR POWER *POTENZA INSTALLATA* KW
P 25	G 1"	1.4	1.2	0.1	0.3	0.37
P 35	35	3	2.6	0.2	0.7	0.75
P 50	50	6.4	5.7	0.4	1.6	1.5
P 60	60	13.4	11.5	0.75	3.2	4
P 80	80	21.5	18.5	1.2	5	5.5
P 100	100	37	32	2.3	8.8	11

Performances
Prestazioni

section of bare shaft version
versione ad asse nudo sezionata



bare shaft version
versione ad asse nudo

3

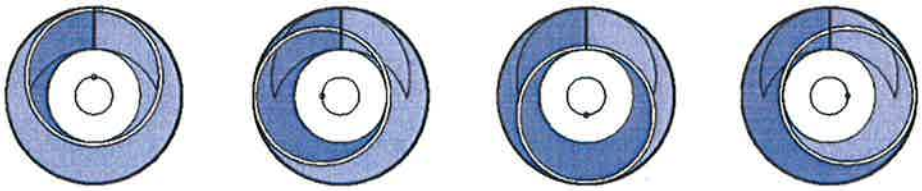


FIG. 1 A B C D

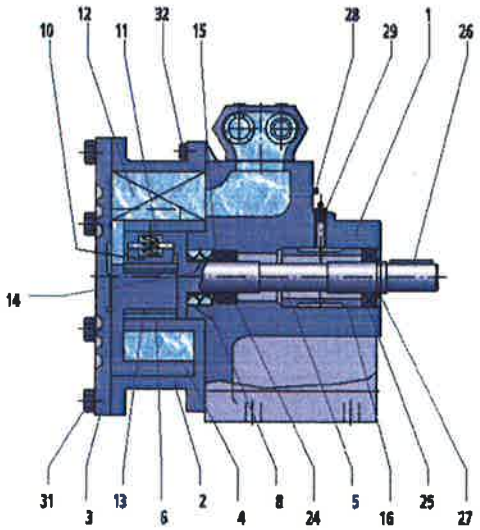
WORKING PRINCIPLE

Figure 1 shows the four positions of the hollow disk, how it shifts and how the volume varies progressively from intake to delivery, both internally and externally with respect to the pumping disk.
The picture also shows that both internal and external surfaces are always balanced with respect to the pressures.
An elastic device is inserted between the shaft and the pivot of the disk, thus allowing the free passage of suspended solid particles which dimension is limited by the size of the pump itself. Furthermore it permits to overcome eventual slacks caused by wearing and prevent the pump from being expanded by sudden temperature variations.
We can describe the working principle in details as follows:
The motion of the shaft causes the movement of the hollow oscillating disk which adheres to one of its generating lines and to the inner and peripheral surface of the pump casing. This movement creates a vacuum that forces the fluid into the pumps chamber and delivers the one already contained in the pump..
We can describe the working principle in details as follows:
The motion of the shaft causes the movement of the hollow oscillating disk which adheres to one of its generating lines and to the inner and peripheral surface of the pump casing. This movement creates a vacuum that forces the fluid into the pumps chamber and delivers the one already contained in the pump.
Refer back to figure 1 illustrating this condition.
A - The inner left side of the disk is filled with sucked liquid, while the inner right side and the whole external part of the disk is filled with discharge liquid.
B - The fluid outside the disk is conveyed to the outlet port while the pump is sucking the fluid through the inlet port, creating a vacuum that, under optimum rotational and suction conditions, can achieve a suction lift of 5 meters. During its rotational movement the impeller creates two volumes, one external and one internal.
C - While in the right end side the medium is delivered outside the disk, the left side of the casing and the disk are filled with sucked liquid.
D - Even the fluid contained inside the disk is conveyed to the discharge together with the residuals external to it. After such phases the disk returns back to its starting position.

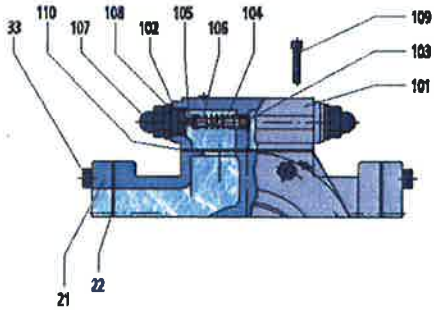
PRINCIPIO DI FUNZIONAMENTO

La fig. 1, che indica le quattro successive posizioni del disco cavo, mette in evidenza come vada spostandosi e come vari il volume progressivamente dall'aspirazione verso la mandata, e questo sia all'esterno sia all'interno del disco pompante. La figura evidenzia anche come, in ogni momento, le due superfici, interna ed esterna, di tenuta idraulica del disco risultano equilibrate rispetto alle pressioni.
Tra l'albero ed il perno del disco è inserito un dispositivo elastico che consente al disco stesso di superare senza inconvenienti il passaggio di particelle solide di dimensioni limitate dal tipo di pompa che eventualmente si trovassero in sospensione del fluido pompato; inoltre consente il recupero automatico di eventuali giochi causati dall'usura e rende la pompa scarsamente sensibile alle dilatazioni dovute a forti variazioni di temperatura.
Più dettagliatamente il principio di funzionamento può essere così spiegato:
L'asse, ruotando, fa rotolare il "pistone" denominato disco cavo oscillante che, aderendo lungo una sua generatrice alla superficie interna e periferica del corpo pompa fisso, crea una depressione in aspirazione richiamando il fluido dentro la pompa e spinge in mandata quello già contenuto nella pompa stessa. Vedasi fig. 1 nelle sue fasi di funzionamento mentre la pompa è piena di fluido ed inizia un giro.
A - La parte sinistra interna del disco è piena del fluido aspirato mentre nella parte destra interna ed in tutta la parte esterna del disco c'è il fluido di mandata.
B - Il fluido che si trova all'esterno del disco viene spinto attraverso la bocca di mandata mentre la pompa richiama fluido dalla bocca di aspirazione creando una depressione che può raggiungere, in condizioni ottimali di velocità di rotazione e di pressione in mandata, i 5 metri di colonna d'acqua. Da notare che quanto avviene nella zona esterna del disco avviene anche nella zona interna cava del disco stesso. In altre parole il disco durante la sua rotazione-oscillazione crea due volumi, uno esterno ed uno interno.
C - Mentre nella parte destra continua l'espulsione del fluido all'esterno del disco, la parte sinistra del corpo e tutto l'interno del disco sono piene di fluido aspirato.
D - Anche il fluido contenuto all'interno del disco viene spinto in mandata insieme agli ultimi residui del fluido all'esterno di esso.
Dopo queste fasi il disco ritorna nella posizione da cui è partito per dare inizio ad un nuovo ciclo.

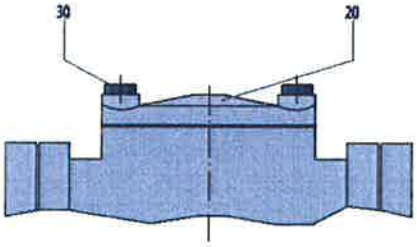
GARBARINO



LONGITUDINAL SECTION
SEZIONE LONGITUDINALE



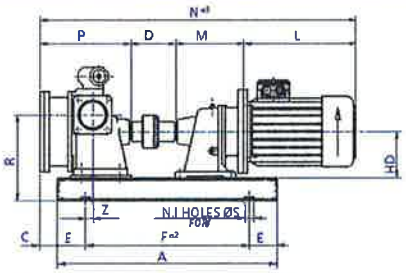
BY-PASS SECTION
SEZIONE BY-PASS

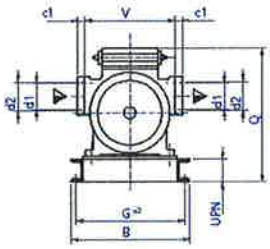


VERSION WITHOUT BY-PASS
VERSIONE SENZA BY-PASS

Pos	Description *Descrizione*
1	Base *Base*
2	Casing *Corpo*
3	Cover *Coperchio*
4	Impeller *Girante*
5	Shaft *Albero*
6	Shaft bushing *Bussola testa albero*
8	Sealing ring *Anelli tenuta*
10	Cap spring *Scodellino*
11	Spring *Molla*
12	Diaphragm *Diaframma*
13	Impeller bushing *Bussola gambo girante*
14	Slip ring *Anello strisciamento*
15	Spacer ring *Anello distanziatore*
16	Ball bearing spacer *Distanziale cuscinetto*
20	Plate *Piastrina*
21	Counterflange *Controflangia*
22	Gasket counterflange *Guarnizione controflangia*
24	Roller bearing *Cuscinetto anteriore*
25	Ball bearing *Cuscinetto posteriore*
26	Key *Chiavetta*
27	Circlip *Anello elastico*
28	Plug *Tappo*
29	Greaser *Ingrassatore*
30	Screw *Vite*
31	Screw *Vite T.E.*
32	Screw *Vite T.E.*
33	Screw *Vite T.E.*
101	By-pass casing *Corpo by-pass*
102	Plug *Tappo*
103	Head *Fungo*
104	Spring *Molla*
105	Control screw *Vite di regolazione*
106	Spring bush *Premimolla*
107	Nut *Dado*
108	Washer *Rosetta*
109	Clamping screw *Vite di fissaggio*
110	By-pass gasket *Guarnizione by-pass*

horizontal version
versione orizzontale





PUMP TYPE / TIPO POMPA	GEAR BOX TYPE / TIPO RIDUTTORE	MOTOR TYPE / TIPO MOTORE	BASE DIMENSIONS / DIMENSIONI DELLA BASE									WEIGHTS (KG) / PESI (Kg)				
			UPN	A	B	T	G	E	C	Z	I/S	PUMP	COUPLING	GEAR BOX	MOTOR	BASE
P 25	RT2/40	63	60	400	200	300	175	50	15	10	4/14	6	1	5	5	8
		71													6	
		80													10	
P 35	RT2/40	63	60	400	270	300	245	50	25	29	4/14	16	1	8	5	11
		71		450		350									6	
		80													10	
P 50	RT2/40	63	80	500	330	300	295	100	15	9	4/18	27	2	12	5	11
		71		550		350									6	
		80													10	12
P 50	RT2/50	63	80	500	330	300	295	100	15	9	4/18	27	2	12	5	11
		71		550		350									6	
		80													10	
		90 S													13	12
		90 L													15	
P 60	RT2/50	63	80	600	350	400	315	100	35	11	4/18	40	5	23	5	18
		71													6	
		80													10	
		90 S													13	
		90 L													15	
P 60	RT2/63	71	80	600	350	400	315	100	35	11	4/18	40	7	23	6	19
		80													10	
		90 S													13	
		90 L													15	
		100													25	
		112													31	
P 80	RT2/63	71	80	650	440	450	405	100	40	25	4/18	60	7	34	6	22
		80													10	
		90 S													13	
		90 L													15	
		100													25	
		112													31	
P 100	RT2/80	80	80	800	490	600	455	100	65	39	4/18	100	15	62	10	27
		90 S													13	
		90 L													15	
		100													25	
		112													31	
		132 S													42	
		132 M													55	

PUMP TYPE / TIPO POMPA	GEAR BOX TYPE / TIPO RIDUTTORE	MOTOR TYPE / TIPO MOTORE	PUMP DIMENSIONS / DIMENSIONI POMPA								FLANGES DIMENSIONS / DIMENSIONI FLANGE		
			P	D	M	L	N	V	R	HD	Q	c1	d1	d2
P 25	RT2/40	63	131	72	146	185	524	130	178	90	205	/	G1"	/
		71			151	210	564							
		80			169	230	598							
P 35	RT2/40	63	168	82	146	185	581	175	191	96	279	12	32	43
		71			151	210	620		201	106	289			
		80			169	230	643							
P 50	RT2/40	63	221	87	146	185	622	215	251	126	360	14	50	61
		71			151	210	659							
		80			169	230	681							
P 50	RT2/50	63	221	97	167	185	670	215	251	126	360	14	50	61
		71			172	210	707							
		80			184	230	732							
		90 S			194	270	782							
		90 L												
P 60	RT2/50	63	250	102	167	185	704	240	290	155	423	14	60	77
		71			172	210	724							
		80			184	230	766							
		90 S			194	270	816							
		90 L												
P 60	RT2/63	71	250	133	212	210	805	240	290	155	423	14	60	77
		80			213	230	828							
		90 S			223	270	876							
		90 L												
		100			239	340	956							
		112												
P 80	RT2/63	71	246	135	212	210	828	300	300	155	459	14	80	91
		80			213	230	874							
		90 S			223	270	874							
		90 L												
		100			239	340	954							
		112												
P 100	RT2/80	80	322	175	281	230	1008	350	390	245	585	16	100	115
		90 S												
		90 L			281	270	1048							
		100			281	340	1118							
		112												
		132 S			296	402	1195							
		132 M												

GARBARINO

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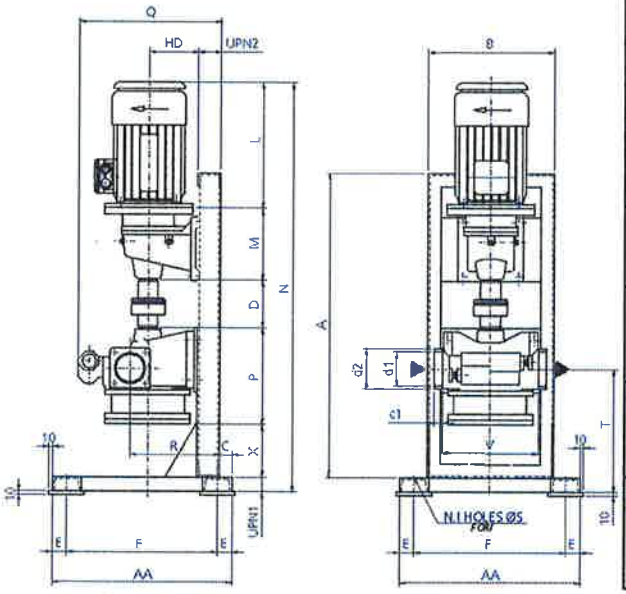
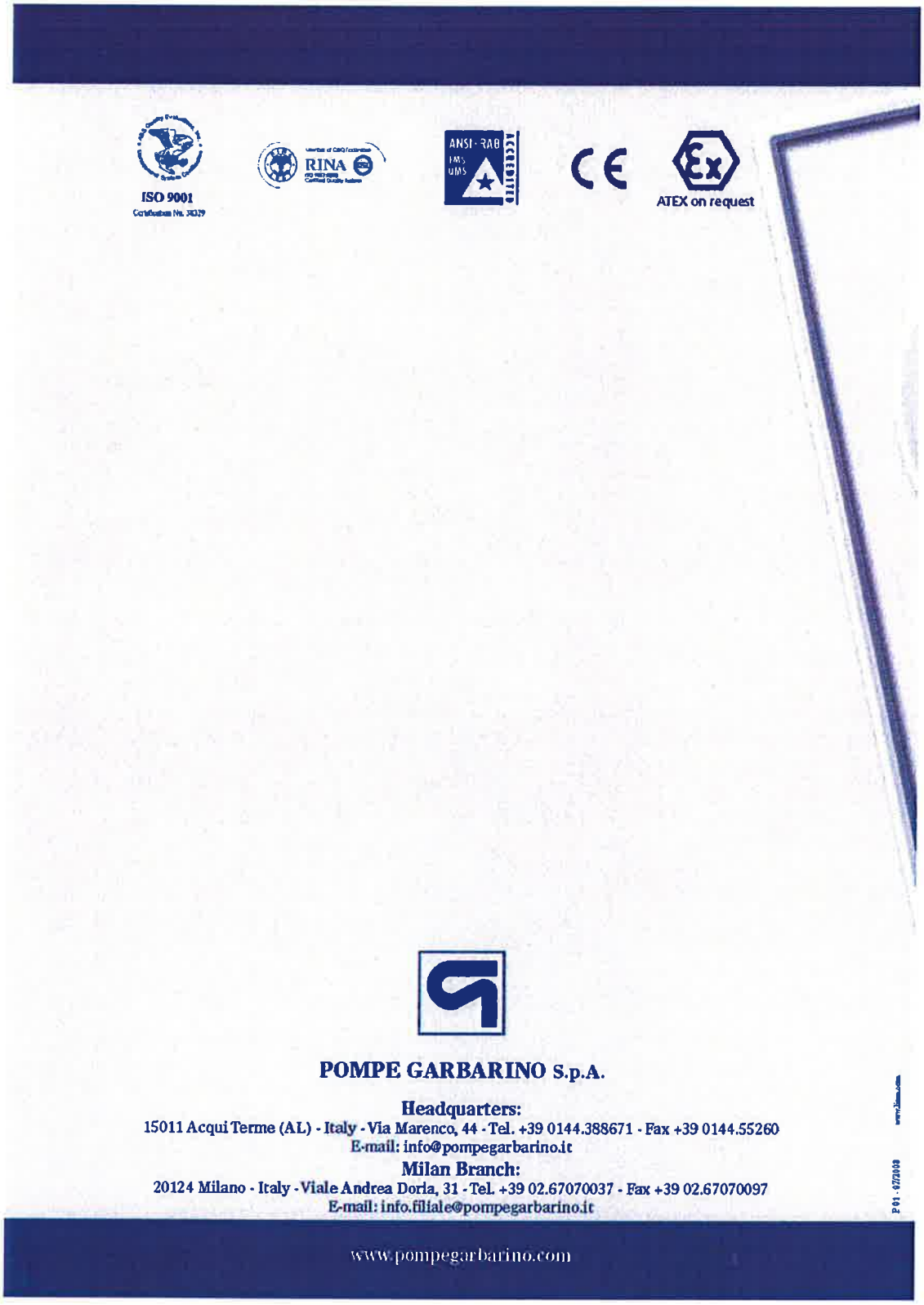


PUMP TYPE *TIPO POMPA*	GEAR BOX TYPE *TIPO RIDUTTORE*	MOTOR TYPE *TIPO MOTORE*	WEIGHTS (KG) *PESI (KG)* PUMP + GEAR BOX	MOTOR	BASE
P 25 V	RT2/40	63	11	5	22
		71		6	
		80		10	
P 35 V	RT2/40	63	24	5	25
		71		6	
		80		10	
P 50 V	RT2/40	63	39	5	44
		71		6	
		80		10	
P 50 V	RT2/50	63	39	5	44
		71		6	
		80		10	
		90 S		13	
		90 L		15	
P 60 V	RT2/50	63	63	5	47
		71		6	
		80		10	
		90 S		13	
		90 L		15	
P 60 V	RT2/63	71	63	6	49
		80		10	
		90 S		13	
		90 L		15	
		100		25	
		112		31	
P 80 V	RT2/63	71	94	8	53
		80		10	
		90 S		13	
		90 L		15	
		100		25	
		112		31	
P 100 V	RT2/80	80	162	10	56
		90 S		13	
		90 L		15	
		100		25	
		112		31	
		132 S		42	
		132 M		55	

PUMP TYPE *TIPO POMPA*	GEAR BOX TYPE *TIPO RIDUTTORE*	MOTOR TYPE *TIPO MOTORE*	PUMP DIMENSIONS *DIMENSIONI POMPA* P	D	M	L	N	V	R	HD	Q	BASE DIMENSIONS *DIMENSIONI DELLA BASE* UPN1/UPN2	A	AA	B	F	T	E	C	X	VS	FLANGES DIMENSIONS *DIMENSIONI FLANGE* c1	d1	d2
P 25 V	RT2/40	63	131	72	146	185	669	130	178	90	205	45	60	500	350	200	300	220	25	34	90	4/18	/	G1"	/
		71			151	210	699																		
		80			163	230	731																		
P 35 V	RT2/40	63	168	82	148	185	716	175	191	96	279	45	60	550	400	270	350	249	25	44	90	4/18	12	32	43
		71			151	210	746		201	106	289														
		80			163	230	778																		
P 50 V	RT2/40	63	221	87	148	185	779	215	251	126	360	50	80	650	500	330	400	274	50	44	90	4/18	14	50	61
		71			151	210	809																		
		80			163	230	841																		
P 50 V	RT2/50	63	221	97	167	185	810	215	251	126	360	50	80	850	500	330	400	274	50	44	90	4/18	14	50	61
		71			172	210	840																		
		80			184	230	872																		
		90 S			194	270	922																		
		90 L																							
P 60 V	RT2/50	63	250	102	167	185	844	240	290	155	423	50	80	750	550	350	450	296	50	40	90	4/18	14	60	77
		71			172	210	874																		
		80			184	230	906																		
		90 S			194	270	956																		
		90 L																							
P 60 V	RT2/63	71	250	133	212	210	945	240	290	155	423	50	80	750	550	350	450	296	50	40	90	4/18	14	60	77
		80			213	230	966																		
		90 S			223	270	1016																		
		90 L																							
		100			233	340	1096																		
		112																							
P 80 V	RT2/63	71	246	135	212	210	943	300	300	155	459	50	80	750	600	440	500	315	50	65	90	4/18	14	80	91
		80			213	230	964																		
		90 S			223	270	1014																		
		90 L																							
		100			233	340	1094																		
		112																							
P 100 V	RT2/80	80	322	175	281	230	1148	350	390	245	585	50	80	1000	650	490	550	354	50	70	90	4/18	16	100	115
		90 S			281	270	1188																		
		90 L																							
		100			281	340	1258																		
		112																							
		132 S			296	402	1335																		
		132 M																							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KRAL Screw Pumps – K Series.

KRAL

KRAL Screw Pumps – K Series

The universal KRAL pump with innovative design for long service life, even in harsh operating conditions.

Areas of application.

KRAL K Series are screw pumps for lubricating, non-abrasive and chemically inert fluids. They are used primarily in industrial applications, such as:

- ☐ Marine, as feed and circulation pumps for fuels and lubricants.
- ☐ Mechanical engineering, as lubricant and coolant pumps for gears, engines, turbines and hydraulic systems.
- ☐ Oil burner technology, as ring line and transfer pumps.
- ☐ Plastics processing, especially polyurethane applications.
- ☐ Filling pumps in tank installations, for example: fuel tank, PUR tank or ink tank installations.

How the K pump fits into the KRAL product program.

The KRAL K Series screw pump is designed for universal use. It is therefore the best-selling KRAL pump. The K Series has a delivery pressure of 16 bar, the casing is made of nodular cast iron and is approved for use on-board ship. It has a sealed, lifetime-lubricated external bearing. The external bearing is not exposed to the pumped medium and is maintenance-free. The K Series is available with DIN flanges in an inline configuration, and the KFT Series is available with DIN flanges at the top. Various installation methods are possible for flange-mounting, pedestal and base pumps.

Delivery rates K:	5 to 2.900 l/min.
Delivery rates KFT:	5 to 420 l/min.
Max. discharge pressure:	16 bar.
Temperature range:	-20 °C to 180 °C, magnetic coupling to 250 °C.
Casing:	EN-GJS-400.
Spindles:	Steel, nitration-hardened.
Accepted by:	ABS, BV, CCS, DNV, GL, LRS, MRS, NK, RINA.
ATEX:	Group II, Category 2 ⟨Ex⟩ II 2 GD b/c.
Heating:	Electric, media and steam heating.

Advantages of screw pumps.

Compared to other types of pumps, KRAL screw pumps offer high capacity without taking up much space. This applies in particular at high differential pressure. The pumps are self-priming, with low pulsation delivery and can be easily regulated. The single pumps, single stations and double stations are extremely compact. All K pumps have an internal safety valve.

Stop coupling damage.

With some liquids, residue can build up, which may cause the pump to fail.

A typical spot for residue to build up is at the mechanical seal. The residue damages the ball bearing, which runs hot, melts the elastomeric ring and damages the coupling.

With the K Series, there is a weep hole next to the mechanical seal, to prevent the fluid from collecting and building up as residue.

Different types of seal.

As standard the K Series is equipped with a mechanical seal. The optional high-quality SiC mechanical seal can be used at temperatures up to 180 °C. A small leakage flow is required to lubricate the friction faces properly.

If the pump is going to be operated at temperatures up to 250 °C or requires hermetic sealing, then the correct choice is the KRAL magnetic coupling. The fluid cannot escape or react by coming into contact with other materials.

Rotary shaft lip seals can be used for clean pumped media up to 6 bar.

Safety backup for dry running.

The startup phase of a pump is critical.

If the pump is not properly filled with fluid and vented, it may take some time for the mechanical seal to be immersed in the fluid. If the seal runs dry, it will not take long to reach temperatures in excess of 200 °C. The O-rings and the seal faces will become damaged, resulting in leakage.

KRAL provides high-quality SiC mechanical seals with graphite, which acts as a dry lubricant. The chemically stable O-rings have a high fluorine content and are suitable for use at higher temperatures. These high-quality components offer additional safety.

Low-viscosity media.

Low-viscosity media can damage the pump due to insufficient lubrication. Abrasive media and solid matter can lead to wear and blockages.

When required, KRAL can provide the pump casing with a special surface treatment. This will improve the frictional properties of the spindles in the casing. The increased hardness provided reduces wear.

This will allow fluids with viscosities as low as 2 mm²/s to be pumped. This also gives a greater safety margin should an unplanned increase in temperature reduce the viscosity.

Low-maintenance operation.

When operated correctly, the KRAL K Series pump is low-maintenance. The lifetime-lubricated external ball bearing is designed for a service life of 30.000 hours. There are two safeguards in place to protect the bearing:

- ☐ There is a weep hole just between the shaft seal and the bearing.
- ☐ The bearing is enclosed.

The ball bearing is not exposed to the fluid and therefore will not be damaged.

The mechanical seal is bathed by the fluid and is thus well lubricated and cooled. It is fitted in such a way that the frictional heat is guaranteed to be dissipated.

Innovative Solutions

Advanced surface treatment.

The option is available to have a special surface treatment applied to the pump casing. This treatment reduces wear and improves the frictional properties when pumping low-viscosity fluids.

Standard mechanical seals.

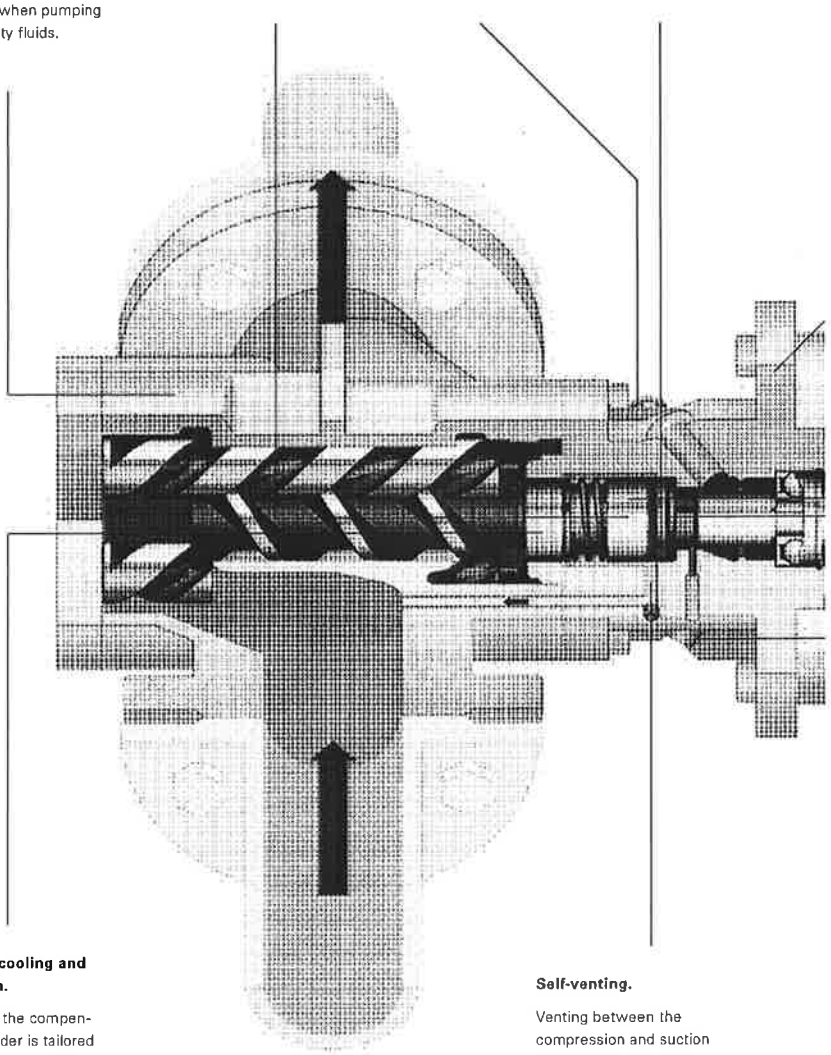
Depending on the operating requirements, there is a choice of mechanical seals in accordance with DIN 24960.

Venting the seal chamber.

The seal chamber has a separate vent hole. This allows the pump to be vented easily and correctly during startup.

State-of-the-art SiC quality.

The advanced SiC quality of the mechanical seal contains graphite as a dry lubricant. This reduces damaging friction when running dry.



Optimum cooling and lubrication.

The size of the compensating cylinder is tailored to the particular application, thus ensuring good cooling and lubrication of the sealing surfaces of the mechanical seal.

Self-venting.

Venting between the compression and suction sides starts directly at the mechanical seal. This ensures that even if the pump is mounted vertically, the air cushion will be displaced through the fluid into the vent line.

Optimized flange design.

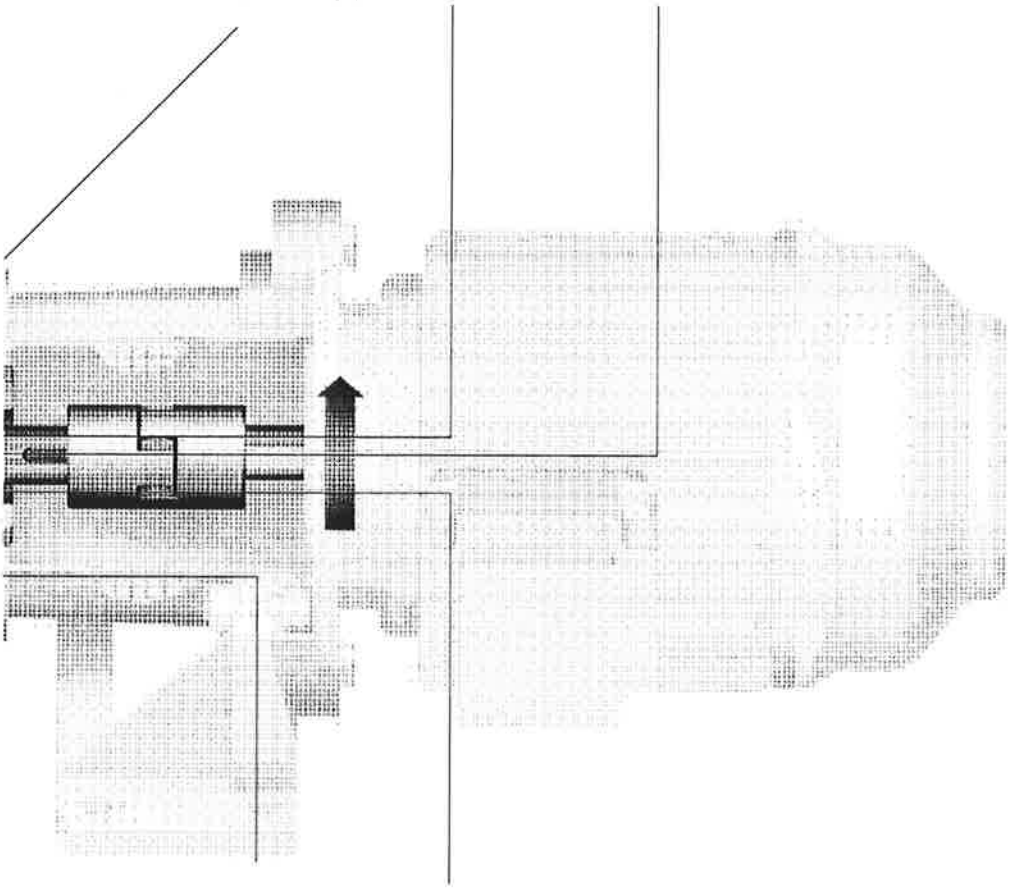
The flange is designed in accordance with ISO 3019. This means that the pump can be connected with normal, standard pump brackets. Thanks to this construction, minimal space is taken up by the magnetic coupling option.

Choice of shaft seals.

The standard fitting is a single mechanical seal in various material configurations. Available as options are a magnetic coupling, a rotary shaft lip seal or a mechanical seal with seal flushing.

Further improved O-rings.

The O-rings of the hard material mechanical seals have a high fluorine content. This material is chemically stable quality and can tolerate high temperatures without lasting deformation.



Residue does not collect.

Any leakage of the mechanical seal is drained through a weep hole immediately after the stationary seal face. Residue which could damage the ball bearing cannot collect unnoticed.

High-quality bearing.

In KRAL K Series pumps, lifetime-lubricated sealed standard bearings are used. This increases the service life and reduces maintenance costs.

Advantages.

Compared to other types of pump, KRAL screw pumps provide large flow rates in restricted spaces. KRAL pumps are quiet and deliver the fluid with low pulsation.

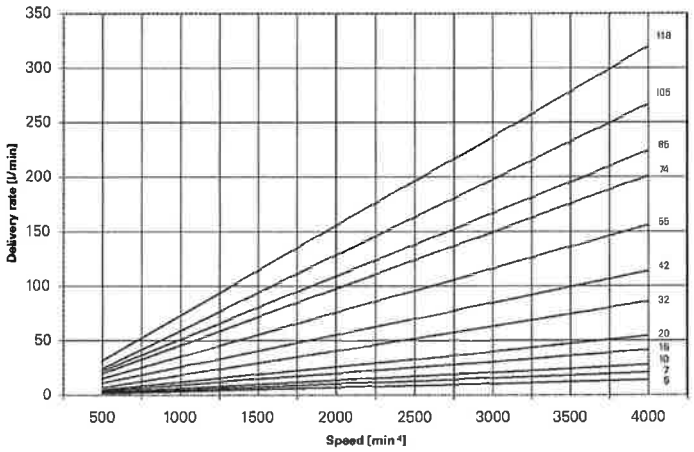
Short construction.

The K Series is known for its short construction. This compact pump is designed for delivery pressures up to 16 bar.

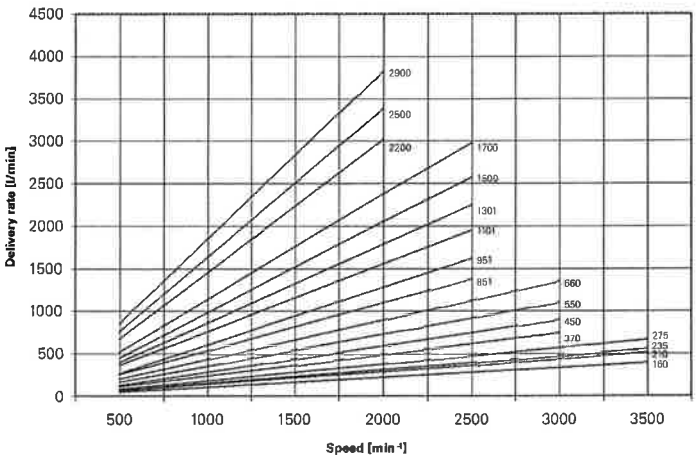
Benefits of KRAL Screw Pumps

Sizes rising in fine steps, and a linear delivery rate characteristic with fine adjustment.

Size 5 to 118.

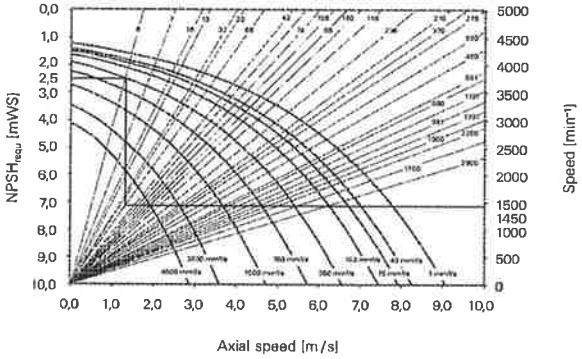


Size 160 to 2900.



KRAL screw pumps are self-priming.

The pump suction head for avoiding cavitation is an important practical consideration. The lower the pressure of the liquid, the earlier the onset of cavitation. The necessary pressure of the liquid rises as the axial speed and rotation speed increase.

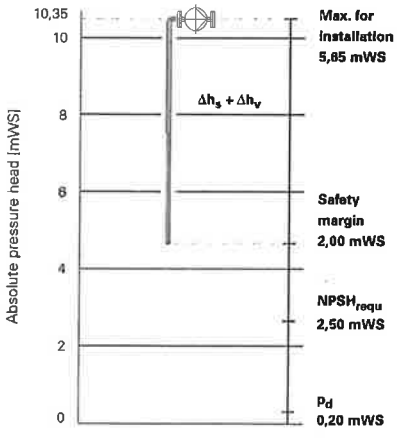


The NPSH-value (Net Positive Suction Head) indicates by how much the total pressure head at the pump inlet has to exceed the vapor pressure head p_d of the liquid to avoid cavitation. The available absolute pressure head is reduced by the suction head Δh_s, the pipe loss Δh_v and a safety margin of 2 mWS.

Example: On a ship, how high above the tank may the HFO 380 heavy oil pump K55 be installed?

Solution: From the nominal speed of 1.450 min^{-1} left, go to size 55. Then up to the 380 mm²/s curve and then left to the NPSH value, which gives 2.5 mWS.

In the diagram on the right, the vapor pressure head p_d and the safety margin at max. ambient pressure 1.013 mbar (10,35 mWS) give an installation height of 5.65 mWS.



Overview of models and sizes for the K Series.

Models.

	Pressure [bar]	Inline DIN flanges	DIN flanges at the top (Top-flanges)
K	up to 16	x	
KFT	up to 16		x

Size.
Q_{th} (1.450 min^{-1})

Q_{th} [l/min]	5,20	7,80	10,4	15,5	20,4	32,1	42,8
Size K	5	7	10	15	20	32	42
Size KFT	5	7	10	15	20	32	42

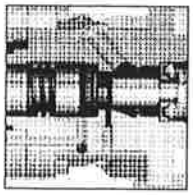
Q_{th} [l/min]	58,5	75,2	83,5	100	119	166	217
Size K	55	74	85	105	118	160	210
Size KFT	55	74	85	105	118	160	210

Q_{th} [l/min]	235	282	368	448	543	668	815
Size K	235	275	370	450	550	660	851

Q_{th} [l/min]	978	1.150	1.340	1.540	1.790	2.260	2.870
Size K	951	1101	1301	1500	1700	2200	2900

Seal Types

Seal qualities to meet every demand.

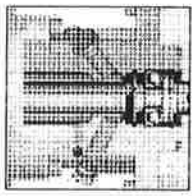


Mechanical seals.

- ☐ Standard: DIN24960, materials as requested, unidirectional, fluids without abrasive content, inlet pressure = 6 bar, T_{max} = 150 °C, viscosity < 500 mm²/s.
- ☐ Hard material, e.g. SiC, DIN 24960, materials as requested, bi-directional, fluids with abrasive content, inlet pressure = 6 bar, T_{max} = 180 °C, viscosity even above 500 mm²/s.
- ☐ Balanced: DIN24960, materials as requested, bi-directional, fluids with / without abrasive content, inlet pressure = 16 bar, T_{max} = 150 °C.

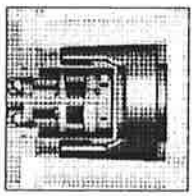
Mechanical seal with flushing (quench).

- ☐ DIN24960, materials and version as requested, fluids with a tendency to harden/reaction when in contact with surrounding air, inlet pressure = 6 bar, T_{max} = 150 °C.



Rotary shaft lip seals.

- ☐ Standard: Domsel type AC, NBR, fluids without abrasive content, inlet pressure = 6 bar, T_{max} = 80 °C.
- ☐ High temperature: Domsel type AC, FKM, fluids without abrasive content, inlet pressure = 6 bar, T_{max} = 150 °C.

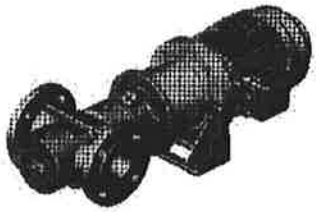


Magnetic coupling.

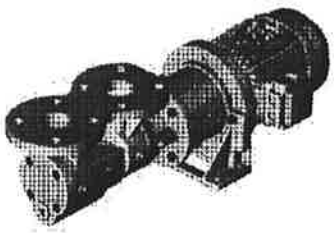
- ☐ Standard: containment can 1.4301, FKM secondary sealing, inlet pressure = 16 bar, T_{max} = 180 °C.
- ☐ High temperature: containment can 1.4301, secondary sealing on request, inlet pressure = 16 bar, T_{max} = 250 °C.

Models

Numerous installation methods are possible with different KRAL pump models.



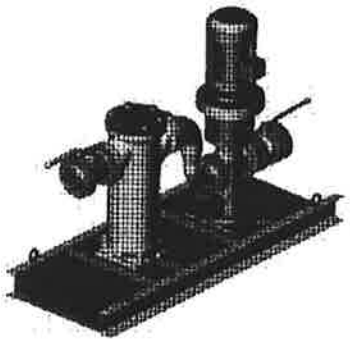
KF flange pump.
The KF flange pump is the universal pump for horizontal installation. Other mounting positions are also possible.



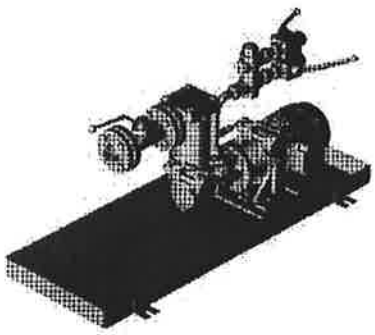
KFT pumps with DIN flanges at the top.
The pump with PN16 DIN flanges at the top for horizontal installation.

KV Pedestal pump.
The pedestal pump is the correct choice if there is minimal room at the installation location or if a large, heavy pump is required. Its compact design makes the KV ideally suited for station use.

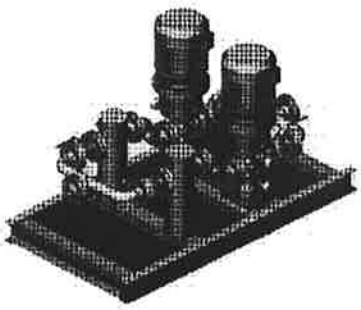
KVT pedestal pumps with DIN flanges at the top.
This space-saving, vertical installation pump is also available with top flanges.



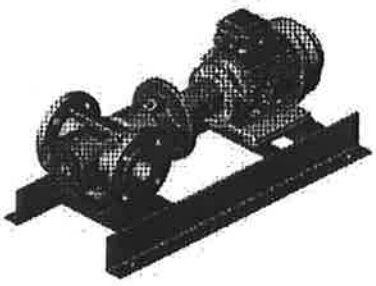
EKL, EKS single station.
KRAL takes on system responsibility with single and double stations. They define the function and the pipe-work connections. KRAL provides single stations for light and heavy oils.



EKL, EKS single station 11, 12, 13.
Oil burner pump station is available in the standards 11, 12 and 13. Version 11 is the basic module. Model 12 has an additional pressure regulator. Model 13 with an additional pressure regulator and a gas / air seperator with integrated commissioning filter.



DKL, DKS double station.
Double stations provide greater safety. The second pump is normally used as a back-up or capacity is split between the two pumps. Then, if one of the pumps is damaged, the system can still operate at half load.

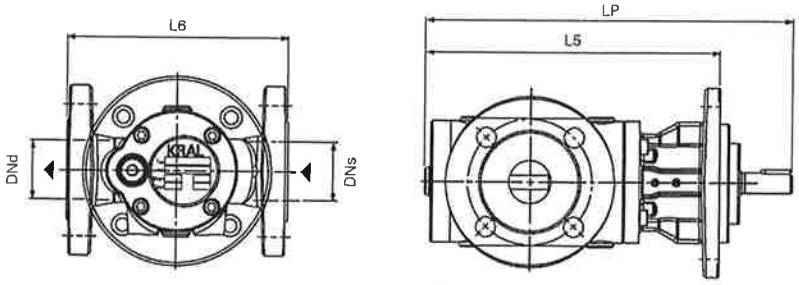


KH base pump.
We also deliver heavy pumps mounted horizontal on a base frame.

Technical Data, Dimensions and Weights

	5-42	55-118	160-275	370-450	550-660	851-1301	1500-1700	2200-2900
Q_{th} (1.450 min^{-1}, 0 bar) l/min	5-43	59-119	166-282	368-448	543-668	815-1340	1540-1790	2260-2870
Max. pressure at pressure flange bar								
K	16	16	16	16	16	16	16	16
KFT	16	16	16					
Temperature °C								
with NBR rotary lip seal	80	80	80	80	80	80	80	80
with FKM rotary lip seal	150	150	150	150	150	150	150	150
with standard mechanical seal	150	150	150	150	150	150	150	150
with SIC-SIC mechanical seal	180	180	180	180	180	180	180	180
with magnetic coupling	250	250	250	250	250	250	250	250
Viscosity mm²/s								
min.	2	2	2	2	2	2	2	2
max.	10.000	10.000	10.000	10.000	10.000	10.000	10.000	10.000
Max. pressure at suction flange bar								
with rotary lip seal	6	6	6	6	6	6	6	6
with standard mechanical seal	6	6	6	6	6	6	6	6
with SIC-SIC mechanical seal	6	6	6	6	6	6	6	6
with magnetic coupling	16	16	16	16	16	16	16	16

K-pump with inline flanges.

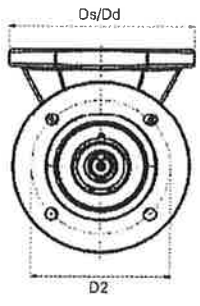


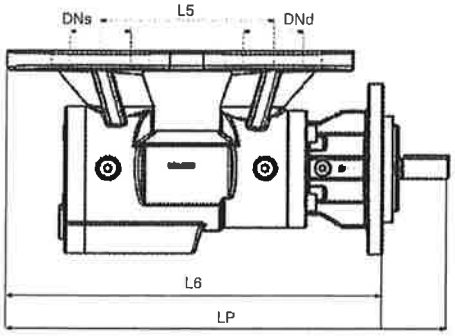
We will be happy to send you brochures about specialized applications on request.

	DNd/ PN 16	DNs/ PN 16	L6	L5	LP	kg
K 5-20	25	25	150	201	251	8
K 32-42	32	32	169	244	297	11
K 55-118	50	50	220	290	349	22
K 160-275	80	80	250	364	418	37
K 370-450	100	100	270	396	453	50
K 550-660	100	125	360	561	628	86
K 851-1301	125	150	450	681	795	154
K 1500-1700	150	200	520	867	1000	310
K 2200-2900	150	200	585	977	1110	430

	DNd/ PN 16	DNs/ PN 16	L6	L5	LP	kg
KFT 5-20	25	25	229	95	279	8
KFT 32-42	32	32	280	127	334	11
KFT 55-118	50	50	337	155	396	22
KFT 160-210	65	65	395	180	458	38

KFT-pump with flanges at the top.





13

Practical examples.

More safety for the Marine.

Medium:
Heavy fuel oil (HFO).
Delivery rate: 50 l/min.
Pressure: Up to 8 bar.
Temperature: Up to 190 °C.
Viscosity: 3 to 760 mm²/s.

Diesel engines are used on board of offshore ships as the power plant and auxiliary engine. KRAL pumps deliver the fuel in the booster-module, in this example heavy fuel oil.

Our customer, a large European ship owner with global establishments including the USA, has upgraded with the KRAL AG. For this upgrade pumps with mechanical seals have been changed to KRAL pumps with magnetic coupling. The reason for this upgrade was, to avoid the normal leakage of a mechanical seal. The leakage evident from lubricating the sealing faces can be a high fire risk. A magnetic coupling is hermetically sealed and leakage free.

Discharge and transfer pumps for PUR raw materials.

Pump: KF 20 bis KF 550.
Medium: Polyol, isocyanate.
Delivery rate: 282 l/min.
Speed: 750 min⁻¹.
Pressure: 10 bar.
Temperature: Ambient.
Viscosity: Polyol to 5.000 mm²/s, isocyanate to 1.500 mm²/s.
Seal: Magnetic coupling.

A storage tank depot for polyols and isocyanate is used to supply the raw materials for polyurethane production plants.

Transfer pumps for isocyanate are equipped with magnetic couplings. They prevent the isocyanate from coming into contact with the atmosphere and combining with the water to form abrasive urea crystals. Deposits of these solids can cause mechanical seal leakage.

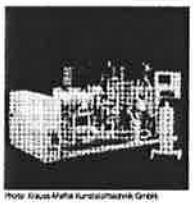
Lubricating pump series.

Pump: KF 951.
Medium: Lubricating oil ISO VG320.
Delivery rate: 950 l/min.
Pressure: 10 bar.
Temperature: 40 °C.
Viscosity: 320 mm²/s.
Seal: EAVGG mechanical seal.

A typical customer is a steel works manufacturer. In such an application KRAL pumps deliver the lubricating oil for the rolling contact bearings of the mill trains.

Because of the harsh operating conditions, it is absolutely essential for the pumps to be robust. KRAL KF pumps have a cast-metal casing. The pump is very compact, as it is designed for inline use. This means that the installation does not take up excessive room in the mill train.

Component producer.



Pump type: KF 118.DCA.
Delivery rate: 20 to 110 l/min.
Pressure: Up to 15 bar.
Temperature: up to 190 °C.
Viscosity: 300 to 5.000 mm²/s.

Mattresses and car seats are made from flexible PUR foams, refrigerator insulation and facade elements from rigid PUR foam. The preparation and precise batching of the liquid components are crucial criteria for component quality and process stability. In special applications, the polyol components can be highly viscous.

KRAL screw pumps work very precisely and reliably. For end-product customers, this means outstanding product quality and high plant availability, even if the materials used are highly viscous.

Engine room booster module and separator pumps on-board ship.

Pump: KF 74.
Medium: HFO, MDO.
Delivery rate: 20 to 74 l/min.
Pressure: 8 bar.
Temperature: 160 °C.
Viscosity: 2 to 1.000 mm²/s.
Seal: Magnetic coupling.

In large-scale diesel engines the pressure and the viscosity are set in the booster module. Heavy fuel oils are pre-heated up to 160 °C. This temperature can damage the mechanical seals. When the fuel comes into contact with the atmosphere, residue may form which could destroy the ball bearing. As a result, the pumps could fail and the diesel engine would cut out. The ship would be unable to maneuver.

The magnetic coupling is hermetically sealed and can be operated at up to 250 °C.

Oil pumping stations for motor-driven power plants.

Pump: 2 x K 660 in a double station.
Medium: HFO.
Speed: 1.750 min⁻¹.
Pressure: 5 bar.
Temperature: 50 °C.
Viscosity: 380 mm²/s.
Seal: SiC mechanical seal.

Power plant constructors and energy suppliers are under constant pressure to deliver the required energy supply. KRAL stations supply the booster modules in fixed or floating diesel-driven power plants with fuel for the motor.

KRAL stations pump heavy oil from the day tanks to the booster modules, where the fuel is conditioned before delivery to the motor's injection pump.

Transfer pumps on support ships.

Pump: KFT 32 - 74.
Medium: Fuel oil, lubricating oil, hydraulic oil.
Delivery rate: 70 l/min.
Speed: 3.400 min⁻¹.
Pressure: 2 bar.
Viscosity: 25 to 1.000 mm²/s.
Seal: Radial shaft lip seal.
Acceptance: DNV.

Support ships transport all the requisite materials to oil rigs and return with the waste. To run the support ship, the fuel and lubricants, as well as the hydraulic oil, are pumped from the storage tank to the day tank. KRAL transfer pumps provide the daily quantities of fuel, lubricating oil and hydraulic oil.

KRAL KFT pumps can be certified by the Acceptance Authorities.

Joint projects.

Our business partners are particularly appreciative of the cooperative collaboration with the KRAL AG. From the best possible support to the successful conclusion of the project, friendly business relations are always the order of the day. We take the time to talk to our customers and collaborate closely with them on technical matters. You can rely on KRAL.

[redacted]

KRAL

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Fax: +43/5577/88433, www.kral.at, e-mail:.kral@kral.at

4.7 Pompe mono vite

Mono®

Serie E
a supportazione
indipendente

Serie LF dosatrice

Mono

POMPE MONOVITE

La caratteristica principale di queste pompe è la loro semplicità costruttiva. Sono pompe volumetriche rotative a vite eccentrica (monovite) e sono autoadescanti.
La portata è direttamente proporzionale al numero dei giri delle pompe mentre la pressione è indipendente.
Le parti soggette ad usura sono due: il rotore metallico a vite eccentrica e lo statore in gomma vulcanizzata.
Le pompe MONO PUMPS sono dotate di un albero intermedio, denominato "Flexishaft", che collega la parte azionamento al rotore. Il Flexishaft, per la sua concezione costruttiva, non ha parti soggette ad usura, non necessita di manutenzione e di lubrificazione ed elimina qualsiasi possibilità di contaminazione del prodotto veicolato; è garantito cinque anni.

Serie P verticale

Serie C COMPACT
monoblocco

COSTRUZIONE

- **Diverse esecuzioni di materiali**, con corpo in ghisa, **acciaio inossidabile**, duplex stainless steel, polietilene
- **Modelli monoblocco** o a supportazione indipendente, **installazione verticale** od orizzontale.
- **Possibile esecuzione con tramoggia**, coclea o frangitore **rompiponte in prealimentazione**, per la veicolazione **di prodotti pastosi**, densi o viscosi fino a 1.000.000 cps ed elevato contenuto secco.
- **Parti rotanti**: in acciaio al carbonio, AISI 316, AISI 431, AISI 4140, AISI 803, Hastelloy, DSS – Duplex Stainless Steel, con o senza riporto di cromo a spessore (HCP), sono disponibili rivestimenti speciali in ossido di cromo o carburo di tungsteno (Duracoat 2000 o 3000).
- **Statori**: disponibili in vari tipi di materiali, compresa la gomma naturale NR, nitrilica NBR, EPDM, polietilene clorosulfonato CSM, poliuretano PUR, cloroprene CR, fluoroelastomero FKM.
- **Tenute**: sono installabili tenute del tipo a baderna o meccaniche singole o doppie secondo DIN 24960.

DATI TECNICI

• Portata:	2 l/h + 420 m³/h
• Pressione:	fino a 72 bar
• Temperatura:	fino a 150°C
• Viscosità:	fino a 1.000.000 cps

APPLICAZIONI

- Acque reflue
- Patinatura carta
- Biossido di titanio
- Carbonato di calcio
- Barbottina
- Lattici
- Adesivi
- Inchiostri
- Fanghi chimici
- Pitture/vernici
- Emulsioni viniliche ed acriliche
- Cosmetici

ACCESSORI

- Su richiesta è possibile fornire valvole di sicurezza, sistemi di rilevazione parametri del prodotto, sistemi ausiliari sulle tenute, unità di protezione contro la marcia a secco (TP 100).
- È possibile utilizzare un trituratore Muncher per migliorare l'efficienza e la durata delle pompe.

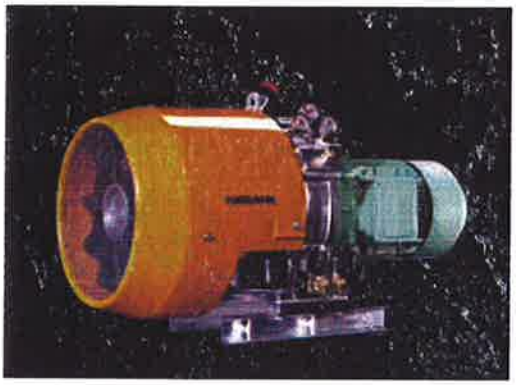
- LE POMPE MONO SONO CERTIFICATE ATEX

5. COMPRESSORE ARIA

HATLAPA

Compressor type

L50, L80II



Structural features:

L50: Two staged cylinders in W-arrangement with one-throw crankshaft, single acting trunk pistons

L80II: Two staged, opposed cylinder type with four-throw crankshaft, single acting trunk pistons

1st stage: 2 cylinders (L50), 3 cylinders (L80II)
2nd stage: 1 cylinder

Valves:

Combined suction and pressure valves in both stages

Air cooling:

By axial fan directly driven by the crankshaft

Intercooler and aftercooler:

Finned pipes

Force feed lubrication:

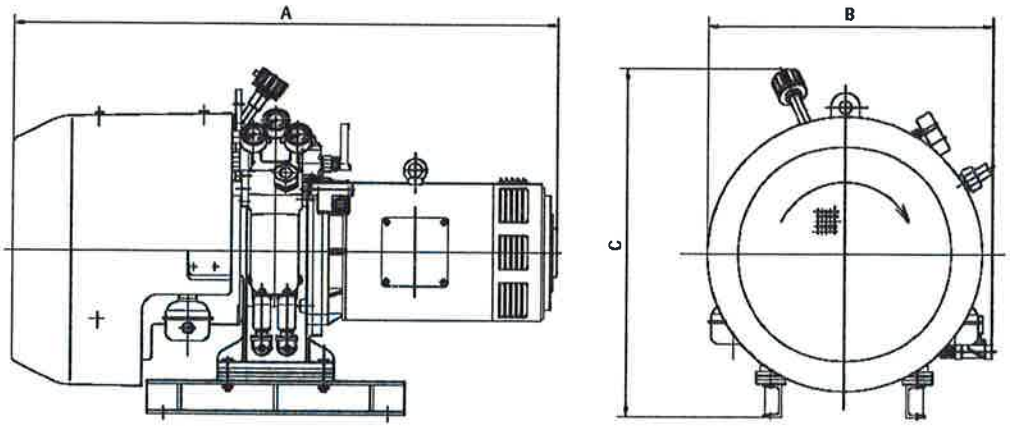
Gear pump driven by the crankshaft by means of gear wheel
Oil pressure control by means of pressure gauge and pressure switch
Oil level inspection glass
Crankcase venting from oil filler to air suction filter

Bearings:

Crankshaft: Slide bearings
Connecting rod: Slide bearings
Wrist pin 1st stage: Slide bearing
Wrist pin 2nd stage: Needle bearing

Compressor type
L50, L80II

HATLAPA

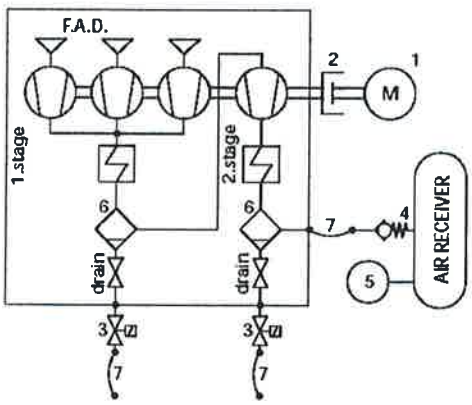


TYPE	Cylinders	Stages	Speed	F.A.D.	Power	Weight incl. e-motor	Dimensions		
			r.p.m.	m³/h	kW	approx. kg	A	B	C
L50	3	2	1150	37.5	8	310	1210	650	825
			1450	48.5	10.3	300	1210	650	825
			1750	59	12.5	300	1210	650	825
L80II	4	2	1150	57.5	12	330	1270	655	775
			1450	72.5	15.5	380	1300	655	775
			1750	85.5	19	380	1300	655	775

All data apply to a final pressure of 30 bar. The right for alteration of specification and data to incorporate improvements in design is reserved.

1. Motor
2. Flywheel and coupling
3. Solenoid valve for draining
4. Non-return valve
5. Pressure switch
6. Oil and water separator
7. Flexible hoses

Version 04/2000

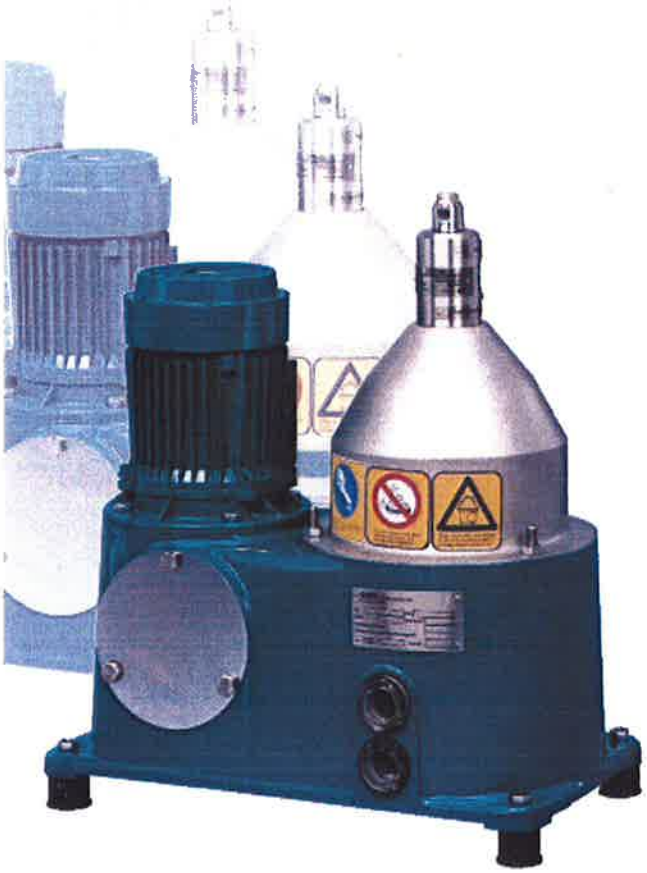


6. DEPURATORE

GEA
Mechanical Separation Division

Westfalia Separator Mineraloil Systems

Take the Best – Separate the Rest



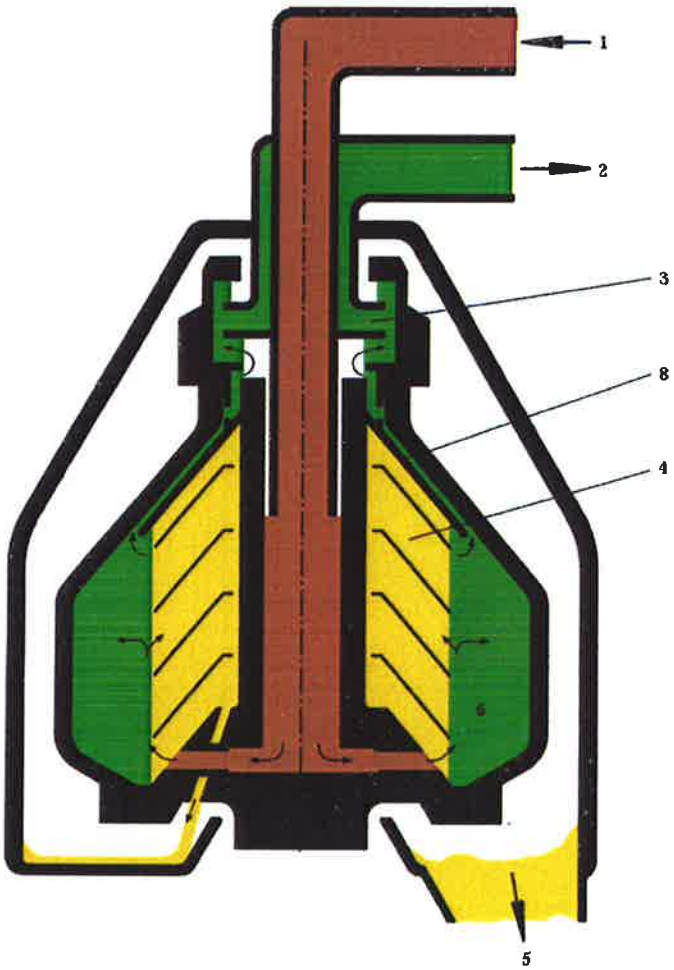
OTC 2
Mineral Oil Centrifuge

OTC 2-03-107

Function
Purification of cooling oil emulsions and wash water oil-water mixtures, etc.

Application
Automotive industry
engineering works
rolling mills
disposal plants

Operating principles and constructional features



1 Product feed
2 Discharge, heavy liquid phase
3 Centripetal pump
4 Disc stack
5 Discharge, light liquid phase
6 Solids holding space
8 Separating disc

This centrifuge is equipped with a solid-wall bowl for purification of liquid mixtures. The product enters the rotating bowl through the product feed (1) and is separated in disc stack (4). The separated and purified heavy phase flows outwards over the separating disc (8) and is pressure discharged by means of the centripetal pump (3). The light phase (5) discharges freely from the bowl. The separated solids collect in the solids holding space (6) and must be removed manually.

Frame, hood and drive

The separator of enclosed design is equipped with an oil level sight glass.
The hood is removable.
The machine is driven by a three-phase AC motor. Power is transferred to the bowl spindle via a flat belt. All bearings are splash-lubricated from a central oil bath.

Materials of construction

Frame:	grey cast-iron GG-25 silumin*
Hood:	stainless steel
Main bowl parts:	stainless steel
Gaskets:	Buna N

Features

- Standard motor
- Low- noise version
- Light weight
- Bowl of stainless steel
- Light phase discharged under pressure
- Easy conversion into clarifier

Benefits

- Easy installation
- Low maintenance
- Compact unit
- Easy and rapid dismantling of bowl for cleaning
- All product-contact parts are made of stainless steel

Standard equipment

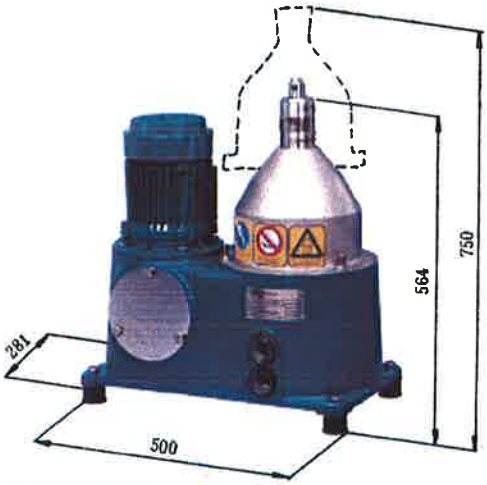
- Three-phase AC motor
- Rubber cushions
- Motor protection switch
- Set of tools
- Set of commissioning parts
- Technical documentation
- Set of regulating rings
- Set of hoses, 1000 mm long (for feed and discharge)
- Flow indicator
- Hood switch
- Filling water hopper

Additional equipment (at extra cost)

- Set of spare parts 8000 hours
- Set of spare parts 16000 hours
- Conversion set for clarifier
- Set of bowl inlay (sludge liner)
- For Operating voltage 230 V AC, 1phase
- For Operating voltage 110 V AC, 1phase
- For Operating voltage 24 V DC
- Flow detector
- Low-weight version (fraim of silumin)

* see "additional equipment"

Technical data



Dimensions in mm

Technical data

Bowl		
Speed	10 000	min^{-1}
Volume	1.2	l
Solids holding space	0.75	l
Three-phase AC motor		
Power	1.1	kW
Normal absorbed power	0.6	kW
Speed at 50 Hz	3000	min^{-1}
Speed at 60 Hz	3600	min^{-1}
Design	IM V1	
Enclosure	IP 55	
Centripetal pump		
Pressure head, HD of the light liquid phase	0.5	bar
Connections		
Feed	R ½ in	
Discharge heavy phase	R ¾ in	
Discharge light phase	R ½ in	
Max. separating temperature	100°C/212°F	

Weight and shipping data

Weight		
Separator complete (standard design)	60	kg
(low-weight version)	40	kg
Case dimensions (L x W x H)	640 x 640 x 710	mm
Shipping volume		

Capacity

Rated capacity	1400	l/h

For optimum capacities refer to the table of capacities

GEA Westfalia Separator Mineraloil Systems GmbH

Take the Best - Separate the Rest

A company of mg technologies group

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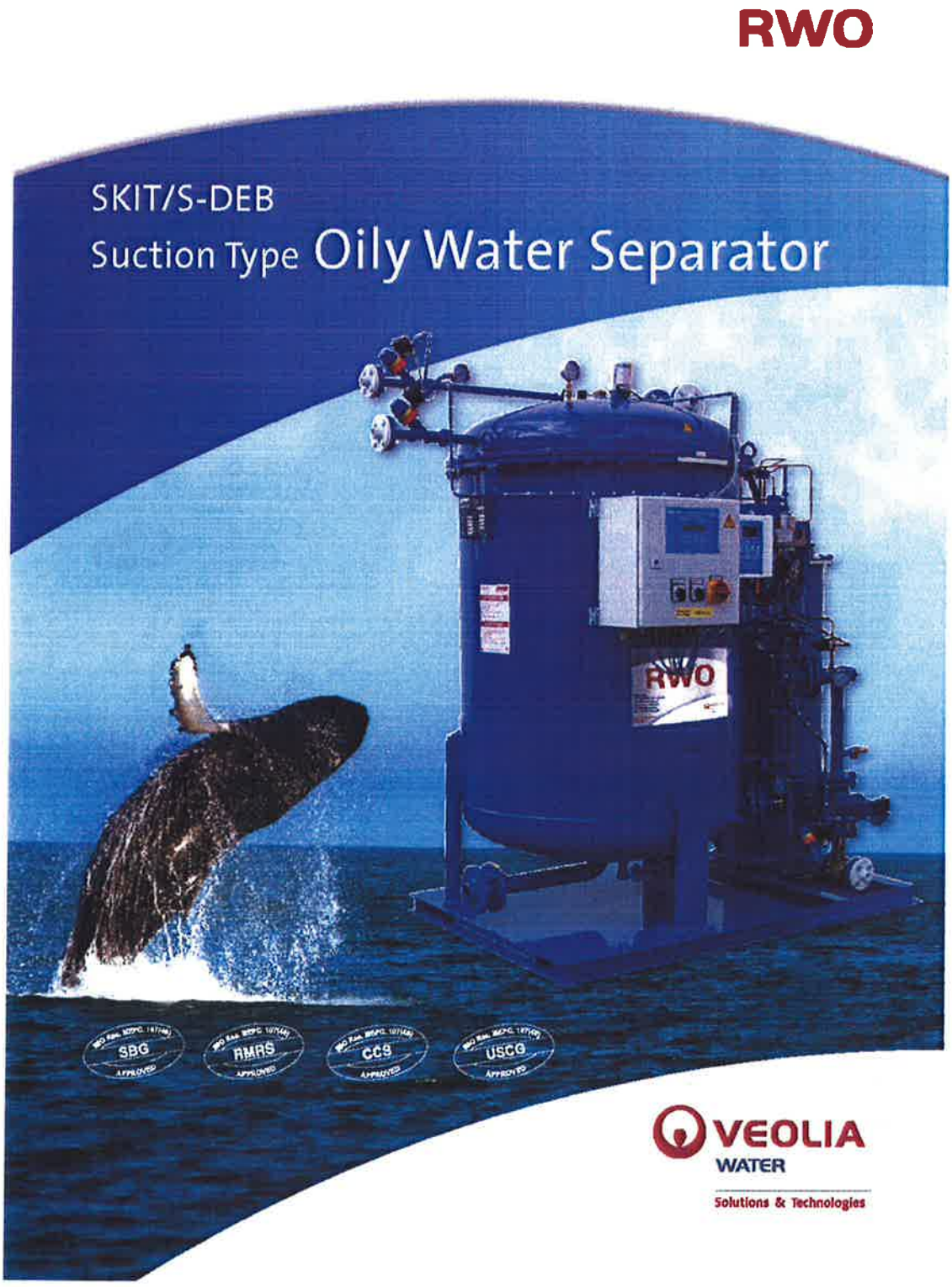
Subject to modification

Printed in Germany

7. SEPARATORE DI SENTINA



SKIT/S-DEB 0.5

Oil/Water Separation

The RWO oil/water separation system type SKIT/S-DEB complies with the actual IMO Resolution MEPC.107(49), using the combination of the well known SKIT/S highly effective open porous coalescer with automatic backflushing, together with a second stage newly developed emulsion breaking oil and hydrocarbon polisher.

The periodical backflushing keeps the coalescer surface clean and offers long lasting operation without attendance and lowest maintenance.

The excellent and long experience with the RWO coalescing type oily water separator guarantees a high performance standard. More than 10,000 ships have already been equipped with this efficient system.

SKIT/S-DEB 2.5

SKIT/S-DEB 5.0

The system comes as a complete package, skid mounted with all necessary accessories and controls and providing the following benefits:

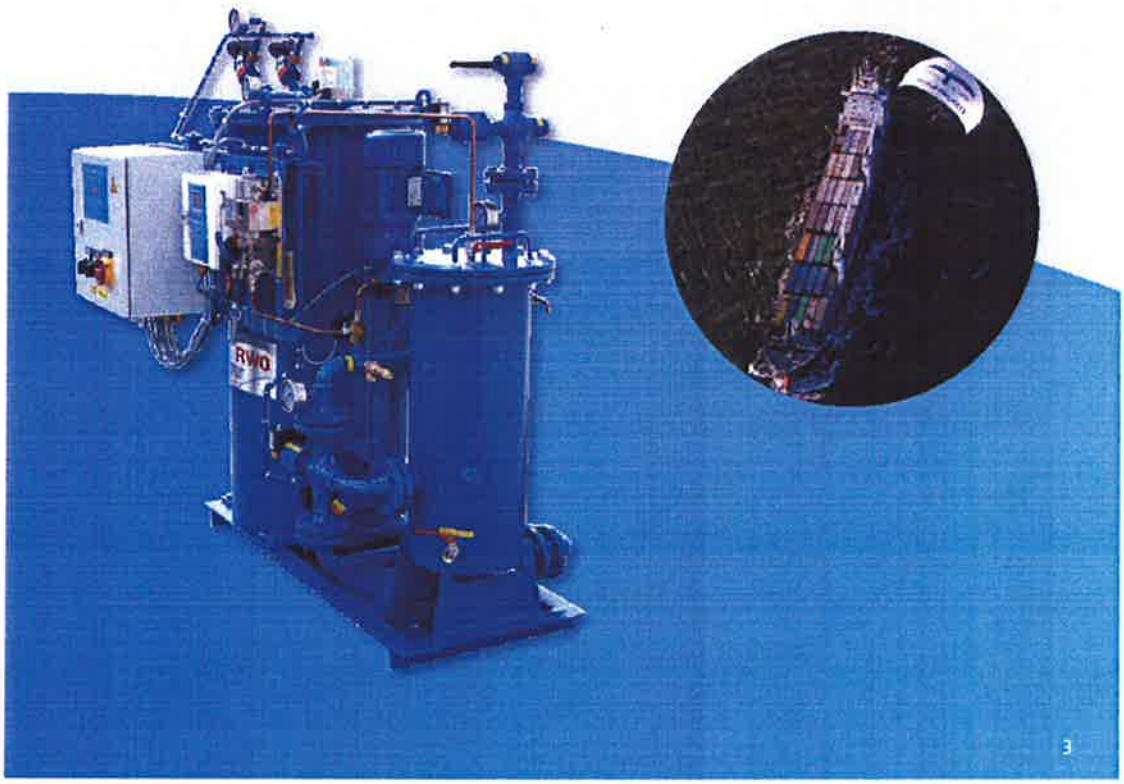
- exceptionally high purity levels < 1 ppm oil content in the effluent under IMO conditions
- USCG type approval certified
- EMV-Electromagnetic Compliance
- Class Notations "Clean Design" and Alaska Rules conformity
- Process Unit upgrade and retrofitting of RWO separators SKIT/S to comply with IMO-MEPC.107(49) possible
- easy to install and easy to handle
- worldwide service & support

Features

To extend the operating life of the demulsifier, an automatic bypass is fitted to the separating system. The 15ppm oil content measuring device periodically checks the water quality of the first stage separator and, if below 15ppm, the demulsifier is bypassed until the 15ppm alarm is activated. This process control causing a considerable life cycle prolongation.

15ppm oil content monitor

The RWO oily water separating system is equipped with the 15ppm oil content alarm device, type tested and approved in accordance with IMO Resolution MEPC.107(49).
The 3-way cock for flushing is fitted with a contact to ensure that during flushing of the alarm device, the 3-way diverting valve is in recirculation mode (automatic stopping device). According to IMO Resolution MEPC.107(49) an extra 3-way valve is installed downstream of the oily water separator in the overboard line to recirculate the water to the bilge whenever required during Port State Control.

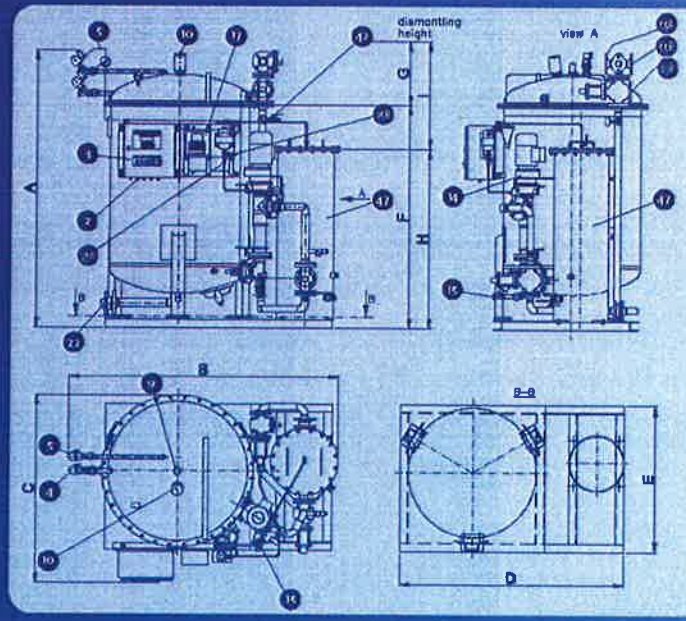


RWO

Technical Data SKIT/S-DEB

Type	Capacity (m^3/h)	A	B	C	D	E	F+G	H+I	Power kW	Empty weight kg
0.1	0.1	1100	715	650	–	–	610+260=870	500	0.5	86
0.25	0.25	1120	1075	770	822	380	750+300=1050	530+260=790	2.0	185
0.5	0.5	1170	1190	720	870	350	860+350=1210	780+510=1290	2.7	230
1.0	1.0	1280	1325	820	1040	450	1060+385=1445	780+510=1290	2.7	260
1.5	1.5	1545	1455	870	1185	500	1265+430=1695	1035+510=1545	2.7	340
2.5	2.5	1780	1515	1095	1225	750	1420+600=2020	780+510=1290	3.0	510
5.0	5.0	2000	1935	1350	1625	1050	1610+600=2210	1295+510=1805	4.0	850
10.0	10.0	2415	2410	1560	1880	1300	1895+600=2495	1315+510=1825	4.5	1200

- Data are subject to change without further notice -



- Power supply
- Control box
- Oil discharge
- Backwashing outlet
- Sensor electrode
- Electrical heating
- Mono pump
- Backwashing inlet
- 15ppm oil alarm monitor
- Bilge water inlet
- Recirculation to bilge tank
- Sample water inlet
- Flushing water inlet
- IMO-sample cock
- Polisher
- Discharge to overboard
- Recirculation to bilge tank

VEOLIA WATER
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8. EIETTORE

VILLA VALVOLE

SEZ. S
PAG. 3

EIETTORI A GETTO DI LIQUIDO

LIQUID JET EJECTOR

FIG. 2060
Eiettori a getto di liquido
Liquid jet enjector

FUNZIONAMENTO

Gli eiettori costruiscono sulla semplicità del proprio funzionamento la garanzia di un utilizzo con costi di esercizio veramenteconvenienti.
Il liquido di alimentazione arriva al corpo con una determinata pressione e, attraverso l'azione dell'ugello che ne convertel'energia statica di pressione in energia cinetica (con un aumento considerevole della velocità), crea la depressione necessaria all'aspirazione; il fluido aspirato, miscelandosi col liquido motore, ne assorbe parte dell'energia cinetica, ottenendo una velocità comune nella sezione maggiormente strozzata del diffusore.
Tale velocità si riconverte in pressione nel tratto divergente del diffusore.
L'apparecchio fornisce alla mandata una maggiore quantità di fluido (alimentazione + aspirazione) ad una pressione intermedia fra quella motrice e di aspirazione.

OPERATION

Thanks to their simple operation, the ejectors guarantee really reasonable working costo
The motive liquid reaches the body with precise pressure and through the nozzle action, which turns to the static pressure energy into kinetic energy (considerably increasing its speed), producesa depression necessary to the suction; the sucked fluid, mixing with the motive liquid, absorbs a part of kinetic energy obtaining a common speed in the mainly throttled section of the diffusero Such speed is turned again into pressure in the divergent length of the diffusero
The appliance slipplies a higher quantity of fluid (motive medium inlet + suction) to the delivery at an intermediate pressiire between motive and SIIC tion one.

IMPIEGHI

Gli eiettori GEJ trovano impiego in vari processi nel settore navale, alimentare, chimico, tessile, agricolo, antincendio etc.
Ne citiamo alcuni:
- Estinzione del carico di cisterne su petroliere.
- Svuotamento sentine
- Impianti di evaporazione per acqua di mare.
- Diluizione e trasporto di acidi e alcali.
- Aspirazione di fumi gas e vapori.
- Estrazione di aria dai condensatori.
- Ausilio per pompe per vuoto ad anello liquido.

La quantità e la pressione della miscela in mandata dipendono dalla quantità e pressione del liquido di alimentazione disponibile.
Funzionano correttamente sia immersi nel liquido da sollevare che al di sopradel livello del liquido stesso.
L'altezza di aspirazione è in stretta dipendenza con la temperatura dei liquidi, la pressione e la portata del fluido motore.
Nel caso di fluidi diversi dall'acqua, i dati caratteristici vanno determinati in funzione della viscosità, peso specifico e temperatura.

APPLICATIONS

GEJ ejectors have a wide range of applications in maval plants Plant depuration and water treatment, in sea, industry, in chemistry, agriculture, for firefighting equipment, etc. Some examples are listed below:
Clearing ship bilge.- Emergency stripping oftanks, on the ground or on oil tankers.- Evaporationplantsfor seawater.- Oxygenation, ventilation, drying in industrial processo - Dilution and freight of acids and alkalis. Suction ofsmokes, gases, steams.- Extraction ofthe condensatefrom vacuum condensers.- For the evacuation of the suction line of a centrifugal pump.- Help for liquid ring vacuum pumps.
The flow rate and pressure of the delivery fluid depend on the quantity and pressure of the available motive liquid
They correctly work both in the liquid to be lifted and above the level
The highest is the temperature ofthe liquid to be sucked, the lower is the allowable sucking height.
In case of other fluid than water, the characteristics are to bedetermined in relation to viscosity, specific weight and temperature

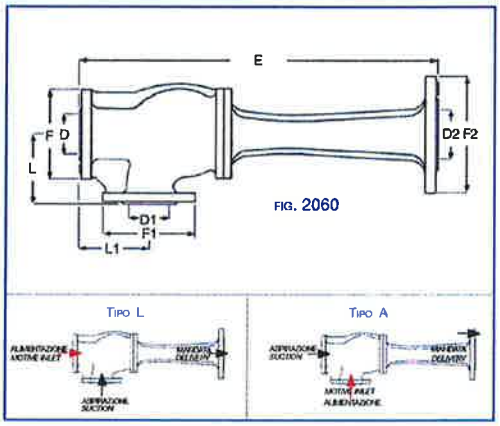


FIG. 2060

Dimensioni *Dimensions mm.*

Tipo	Portata mc/h	D	D1	D2	E	L	L1	F	F1	F2
L 32	3 ÷ 10	32	32	50	440	115	75	140	140	165
L 40	10 ÷ 20	40	40	65	460	120	80	150	150	185
L 50	20 ÷ 30	50	50	80	500	130	85	165	165	200
L 65	30 ÷ 50	65	65	100	550	150	95	185	185	220
L 80	50 ÷ 70	80	80	125	840	175	105	200	200	250
L100	70 ÷ 90	100	100	150	950	185	110	220	220	285

VALORI DEL COEFFICIENTE K = QI /Q PER EIETTORI A GETTO LIQUIDO IMMERSI IN ACQUA
COEFFICIENT VALUES K = QI / Q FOR LIQUID JET EJECTORS IMMERSED IN WATER

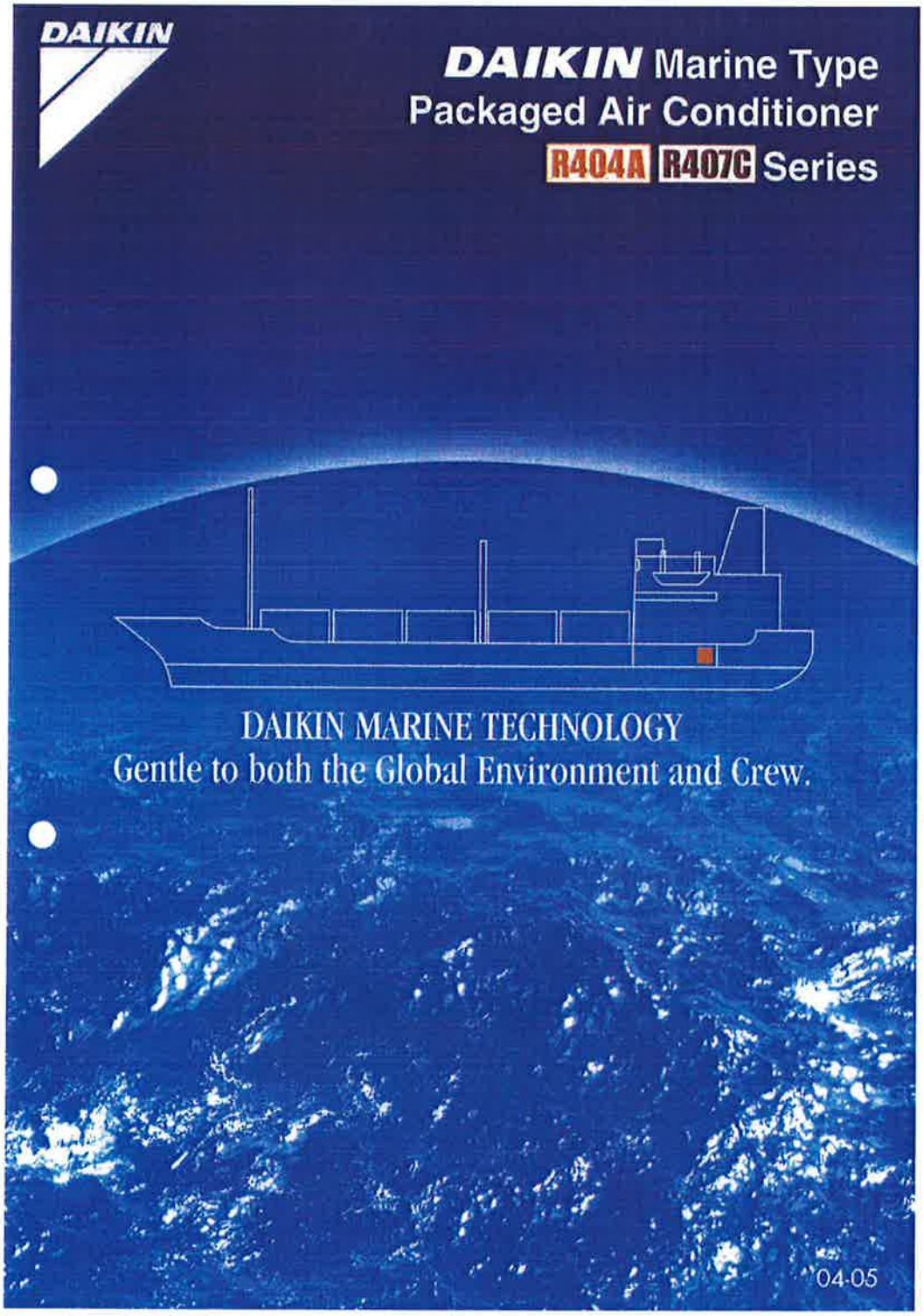
mt.	5	7,5	10	12,5	15	17,5	20	25	30
15	0,50								
20	0,75	0,42							
25	1	0,58	0,38						
30	1,25	0,75	0,50						
35	1,50	0,92	0,62	0,45					
40	1,75	1,08	0,75	0,55	0,41				
45	2	1,25	0,88	0,65	0,50	0,39			
50	2,25	1,42	1	0,75	0,58	0,47	0,37		
55	2,50	1,58	1,12	0,85	0,66	0,54	0,44		
60		1,75	1,25	0,95	0,75	0,61	0,50		
65		1,92	1,37	1,05	0,83	0,68	0,56	0,40	
70		2,08	1,50	1,15	0,92	0,75	0,62	0,45	
75		2,25	1,62	1,25	1	0,82	0,69	0,50	0,37
80		2,42	1,75	1,35	1,08	0,89	0,75	0,55	0,42

VALORI CALCOLATI CON TEMPERATURA DELL' ACQUA MOTRICE E ASPIRATA DI 18°C
VALUES MEASURES WITH MOTIVE AND SUCKED WATER AT 18°C

PHONE. +39 010 64 44 949 FAX +39 010 64 50 996 E-Mail villa@villavalvole.net

9. IMPIANTO CONDIZIONAMENTO

9.1 Condizionamento alloggi e locale quadri elettrici



For more comfortable voyage, Daikin Marine Type Packaged Air Conditioners are combined experienced marine engineering and advanced technology.

New Refrigerant with Ozone Depletion Potential "Zero"

Daikin has developed the new refrigerant which does not destroy an ozone layer. In addition to refrigerant R407C, refrigerant R404A is newly developed this time.
It is realized that reduction of the refrigerant volume with high efficiency, little problem for spare refrigerant and produced consideration of global environment and improvement in reliability.

Optionally Designed Compressor with Maintenance "Zero"

DAIKIN advanced technology creates the compressor with higher durability , allowing the crew to be free from the troublesome daily maintenance.
Adopting two compressors for USP15(R1)･USP20(R1) improves comfortability by two step temperature control.

Excellent Durability under Sever Conditions

Daikin's recognized design meets to ship motion as well as corrosion by sea water and salty air.
The reliability for unique ship motions as well as corrosion by sea water and salty air.

Varieties of Series Meet the Worldwide Power Sources

Wider range of cooling capacity from 8.7kW to 85.0kW (R404A units) enables to meet required capacity and applications.
Moreover, it satisfactorily corresponds to the power supply of a merchant vessel.

Compact and Compatible for R22 Series

The most compact units in the marine industries have also an equivalent performance to R22 units.
It thus enables to easily replace installed unit to new one.

Global Service Net Work

Repair and parts offer are possible in the world and domestic bases.
They smoothly cope with the even emergency service request.

Standard Specifications

R404A Series [Hermetically sealed scroll type]

	Model								
	Power source (50/60Hz)			3 phase 380,400,415V/400, 440V					
	Painting color			New light blue (7.5BG 7/2)					
★1	Cooling capacity (50/60Hz)		kW	8.7/9.7	14.6/16.6	21.7/24.3	29.1/32.5 ★2	43.6/48.5 ★2	58.2/65.0 ★2
			Btu/h	29800/33100	49700/56600	74200/82900	99200/111000	149000/166000	198700/221800
	Cooling water flow rate (50/60Hz)		ℓ/min	40/50	74/80	107/115	140/150	275/300	365/400
	Condenser head loss (50/60Hz)		kPa	14.5/17.6	18.6/21.8	14.0/17.7	16.0/20.0	18.0/19.0	19.0/21.0
★3	Rated power consumption (50/60Hz)		kW	2.78/3.58	4.24/5.19	6.48/8.60	9.21/12.1	12.3/15.0	18.4/24.2
Compressor	Type			Hermetically sealed scroll type					
	No.X Motor output		kW	1X3.0	1X3.75	1X5.5	1X7.5	2X5.5	2X7.5
	Starting method			Direct-on-line					
Condenser	Type			Water cooled shell and cross fin type					
	Material	Tube/Fin		Copper alloy seamless tubes (Aluminium-brass)/Aluminium fins					
		Water cover		Cast iron with sacrificial anode					
		Tube plate		Naval clad steel					
Evaporator	Type			Cross fin coil type					
	Material	Tube/Fin		Copper tubes/Aluminium fins with highly anti-corrosive treatment					
Fan	Type & drive			Dual suction multi blade fan, belt drive					
	Air flow rate (50/60Hz)		m³/min	22/27	42/50	50/60	67/80	100/120	135/160
	External static press (50/60Hz)		Pa	37.3/43.1	32.7/39.2	147/235	196/304	392/588	461/686
	Motor output X Poles		kWXP	0.4X4	0.4X4	0.75X4	2.2X4	3.7X4	5.5X4
	Air filter			Polyvinile chloride fiber (washable)					
	Refrigerant control			Thermostatic expansion valve					
	Temperature control			Thermostat					
	Capacity step		%	100-0				100-50-0	
	Protective devices			Over-current relay (comp.&fan motor), Reverse phase protector, High pressure switch, Low pressure switch, Comp. Motor protection thermostat					
	Thermal & sound isolator			Fusible plug					
				Glass fiber					
Piping Connection	Condenser water inlet/outlet			1B (flanges)	1 1/2B (flanges)		2B (flanges)	2 1/2B (flanges)	
	Upper/lower drain outle			3/4B (f. screw)	1B (f. screw)				
	Emergency gas			1/2R (flanges)					
Refrigerant	Kind			R404A					
	Charged		kg	2.2	3.5	5	5.9	10	11.8
Lubricant oil	Brand			DAPHNE FVC68D					
	Machine weight		kg	165	230	345	440	670	840
	Accessories			Spare parts			Fuses		

R407C Series [Hermetically sealed scroll type] *All others except the following items are identical to R404A Series.

	Model								
★1	Cooling capacity (50/60Hz)		kW	9.0/10.0	15.0/17.0	22.4/25.0	30.0/33.5 ★2	45.0/50.0 ★2	60.0/67.0 ★2
			Btu/h	30700/34100	51200/58000	76500/85400	102400/114400	153600/170700	204800/228700
★3	Rated power consumption (50/60Hz)		kW	2.78/3.58	4.24/5.19	6.48/8.60	9.21/12.1	12.3/15.0	18.4/24.2
Refrigerant	Kind			R407C					
Lubricant oil	Brand			DAPHNE FVC68D					

Note) ★1. is based on the following conditions. Inlet air temp. : 27℃D.B., 19.5℃W.B. and inlet water temp. : 32℃.
★2. Cooling capacity marked with ★2 is gross capacity which excludes a deduction for fan motor heat.
★3. shows in case of 380V 50Hz/440V 60Hz.

Secured High Reliability under Sever Environmental Condition on the Sea by DAIKIN Original Technology

Hermetically Sealed Scroll Compressor with Long Durability and High Efficiency

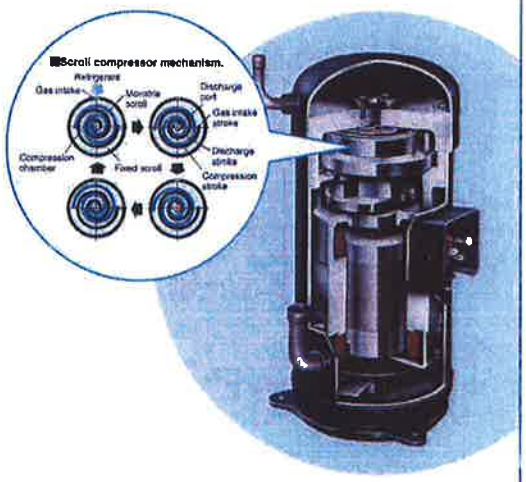
Developed R404A, R407C compressors, realizing 40,000h in designed life, are mounted in all new models.

Wider water temperature range

Easily operated with a wider range of water temperature of 10 to 38℃, the lowest sea water to the highest condition in the central cooling system.

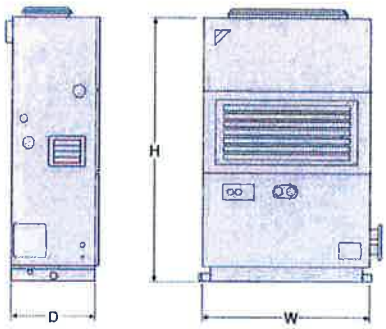
Succession to Recognized Various Technology of Marine Type Package Air Conditioner

- Condenser resistant to sea water
- Evaporator strong to salty air
- Grease-fed bearing with longer life
- One-side drain discharge system
- Corrosion resistance specifications in main construction.



Outside dimensions

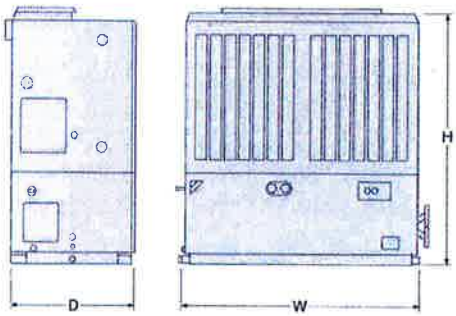
USP3~10HR1
USP3~10H



(mm)

	H	W	D
USP3HR1,USP3H	1450	800	410
USP5HR1,USP5H	1640	1050	550
USP8HR1,USP8H	1850	1350	600
USP10HR1,USP10H	1850	1350	750

USP15·20HR1
USP15·20H



(mm)

	H	W	D
USP15HR1,USP15H	1625	1600	850
USP20HR1,USP20H	1625	1600	850

■Optional specifications
*: Available

Model	USP3H USP3HR1	USP5H USP5HR1	USP8H USP8HR1	USP10H USP10HR1	USP15H USP15HR1	USP20H USP20HR1
Plenum chamber kit	*	*	*	–	–	–
Spare parts kit	Standard accessories			*	*	*
Electric heater	*	*	*	*	*	*
Steam heater	*	*	*	*	*	*
Hot water heater	*	*	*	*	*	–
Steam spray	*	*	*	*	*	*
Fresh air intake duct connection	*	*	*	*	–	–
Rear suction duct connection	–	*	*	*	–	–
Stage-up of fan motor	*	*	*	Standard	*	*
Alternation of motor pulley	*	*	*	*	*	*
Alternation of piping direction	*	*	*	*	*	*

Furthermore, Versatile Marine Air Conditioners and Refrigeration Units Commercially Available, with New Refrigerant Series.

Deck Unit

[USDP Series]

DAIKIN Technology for central air conditioning ensures the comfortable voyage life.

(R404A,R407C Type)

Small Size Marine Refrigeration Unit

[RKS/RHS Series]

Supports fresh and richful food life on board.

(R404A,R134a Type)

Refrigeration Unit for Marine Containers

[LXE-D Series]

DAIKIN advanced refrigeration technology ensures sea transportation of cargoes at high quality and low temperature.

(R134a Type)

• Please contact us for further detail.

The air conditioners manufactured by Daikin Industries have received ISO 9000 series certification for quality assurance.

Certificate Number.
(ISO9001) JMI-0167 (ISO9002) JQA-1458
JQA-0488

All Daikin Industries locations and subsidiaries in Japan have received environmental management system standard ISO 14001 certification.

Daikin Industries, Ltd.
Domestic Group
Certificate Number. EC99J2044

About ISO 14001

ISO 14001 is the standard defined by the International Organization for Standardization (ISO) relating to environmental management systems. Our group has been acknowledged by an internationally accredited compliance organisation as having an appropriate programme of environmental protection procedures and activities to meet the requirements of ISO 14001.

Notes for Safety (Applications of Marine Packaged Air Conditioners)

- Marine Packaged Air Conditioners contained in this catalog are air coolers exclusive for ships. Do not use those products for special applications such as foods, faunas and floras, precision devices and art works because deterioration of objects can take place.
- When using marine products in buildings on land, check if the specifications conform to each country's standard.

• The specifications, designs, and information in this brochure are subject to change without notice.

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e-mail:marine.aircon@daikin.co.jp

FR99-01A (04.05.003) SW:AD

10. VENTILATORI

Axialventilatoren ***Axial Flow Fans***

IGW-Axialventilator für ein Containerschiff. Größe 1000, 20.000 m³/h, 2.300 Pa, 90 kW.

IGW-Axial flow fan for a container vessel. Size 1000, 20.000 m³/h, 2.300 Pa, 90 kW.

IGW-Axialventilator mit Funkenstreifschutz und Keilriemenantrieb für Papierverarbeitung Größe 1000, 40.000 m³/h, 800 Pa.

IGW-Axial flow fan with sparklining andv-belt drive for paper mill. Size 1000, 40.000 m³/h, 800 Pa.

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WITT&SOHN
IGW Ventilatoren

Axial-Ventilatoren

Produktbeschreibung

Für die verschiedenen Laufräder werden eine große Anzahl von verschiedenen Einbaustellungen, Bauformen, Wandstärken und Materialien angeboten. Es folgt eine Beschreibung des Standard-Programmes. Wenn besondere Anforderungen bestehen, erlaubt eine sehr flexible Fertigung, auch diese zu befriedigen.

Axial-Ventilatoren

Baugröße	250 bis 3150 mm
Wandstärke	1,5 bis 16 mm
Laufradtypen	N, M, X, Y (verstellbare Schaufeln)
Motorbaugröße	63 bis 400
Antriebsart	Direkt-, Riemen- oder Kupplungsantrieb
Einbaustellung	A, AU, AD, B, BD, BU nach Eurovent
Schachtform	Kurz-/Lang-Schacht, ausschwenkbar mit/ohne Konus/Düse
Oberflächenbehandlung	Grundanstrich, Deckanstrich, Feuerverzinkung, nach Anforderung
Werkstoff	
- Laufrad	Seewasserbeständiger Aluminiumguß
- Gehäuse	Stahl, Aluminium, Sondermaterialien
Sonderausführung	Ex-Schutz, erhöhte Temperatur, schocksicher, nach Anforderung

Standardzubehör

- **Einströmdüse**
- **Brandschutzklappe**
- **Schutzgitter**
- **Pilzkopfhaube**
- **Füße für horizontalen/vertikalen Einbau**
- **Schwingungsdämpfer**
- **Düsenlüfter**
- **Flexibler Stutzen**
- **Gegenflansche**
- **Schalldämpfer**
- **Drallregler**

Axial Flow Fans

Product Description

A large selection of outlet positions, casing geometries, casing thicknesses and materials is available for the various impeller types. The following is a description of the standard product range; a very flexible production allows special requirements to be met as well.

Axial-Flow Fans

Inlet size	250 up to 3150 mm
Casing thickness	1,5 up to 16 mm
Impeller types	N, M, X, Y (adjustable pitch)
Motor frame size	63 up to 400
Drive type	Coupling-, belt- or direct drive
Position	A, AU, AD, B, BD, BU according to Eurovent
Casing form	Short/long casing, swing out with/without shaped inlet
Surface-treatment	Primer, finish, hot-dip galvanised, on request
Material	
- Impeller	Corrosion resistant cast aluminium
- Casing	Steel, aluminium, special alloys
Special design	Flame-proof, high temperature, shock proof, according to requirements

Standard Accessories

- **Shaped inlet**
- **Fire damper**
- **Protection grill**
- **Mushroom cowl**
- **Feet for horizontal/vertical position**
- **Vibration attenuator**
- **Jet cowl**
- **Flexible connection**
- **Counter flange**
- **Silencer**
- **Variable inlet vane**

Axial –Ventilatoren

Axial Flow Fans

Die Ausführung und Bauform eines Ventilators wird hauptsächlich durch die Anforderungen der einzubauenden Anlage bestimmt, wobei außer den physikalischen Bedingungen, wie z. B. Luftdruck, Volumenstrom und Temperatur, auch Betriebsart und Betriebsort ausschlaggebend sind. Außerdem ist die Gehäusestellung von Bedeutung (siehe DIN 24 163 für eine komplette Beschreibung der Vorgabedaten für einen Ventilator). Die eigentlichen Ventilatormaße werden jedoch zum größten Teil von den eingebauten Elektromotoren und Zubehörteilen bestimmt.

Unser Axial-Ventilatoren-Programm zeichnet sich durch eine sehr große Anzahl von Bauformen und Ausführungen aus. Mit unseren verschiedenen Laufradtypen ist es uns möglich, einen sehr weiten Bereich von Fördermenge und Druck in den verschiedensten Anlagen zu befriedigen.

Die Schnellselektionstabelle/Nomogrammblätter und Maßblätter geben eine Übersicht über unsere gängigsten Axial-Ventilatoren. Außer den hier vorgestellten Ventilatoren, stellen wir auch eine große Anzahl verschiedener Sonderausführungen her, wie z. B. explosionsgeschützte Pumpenraum-Ventilatoren, Brandgasventilatoren, schock- und rüttelsichere Ventilatoren, Impulsventilatoren usw. Bei Bedarf für Spezial-Axial-Ventilatoren fragen Sie bitte bei uns an.

Die Typenselektionsgraphiken ermöglichen eine schnelle Vorauswahl, über die bei 50 Hz normal verwendeten Axialventilatoren, inc. Typ, Polzahl, Größe, Wellenleistung und Schallleistung.

Auf den folgenden Seiten finden Sie eine Kurzbeschreibung unseres Axial-Ventilator-Gehäuse-Programmes.

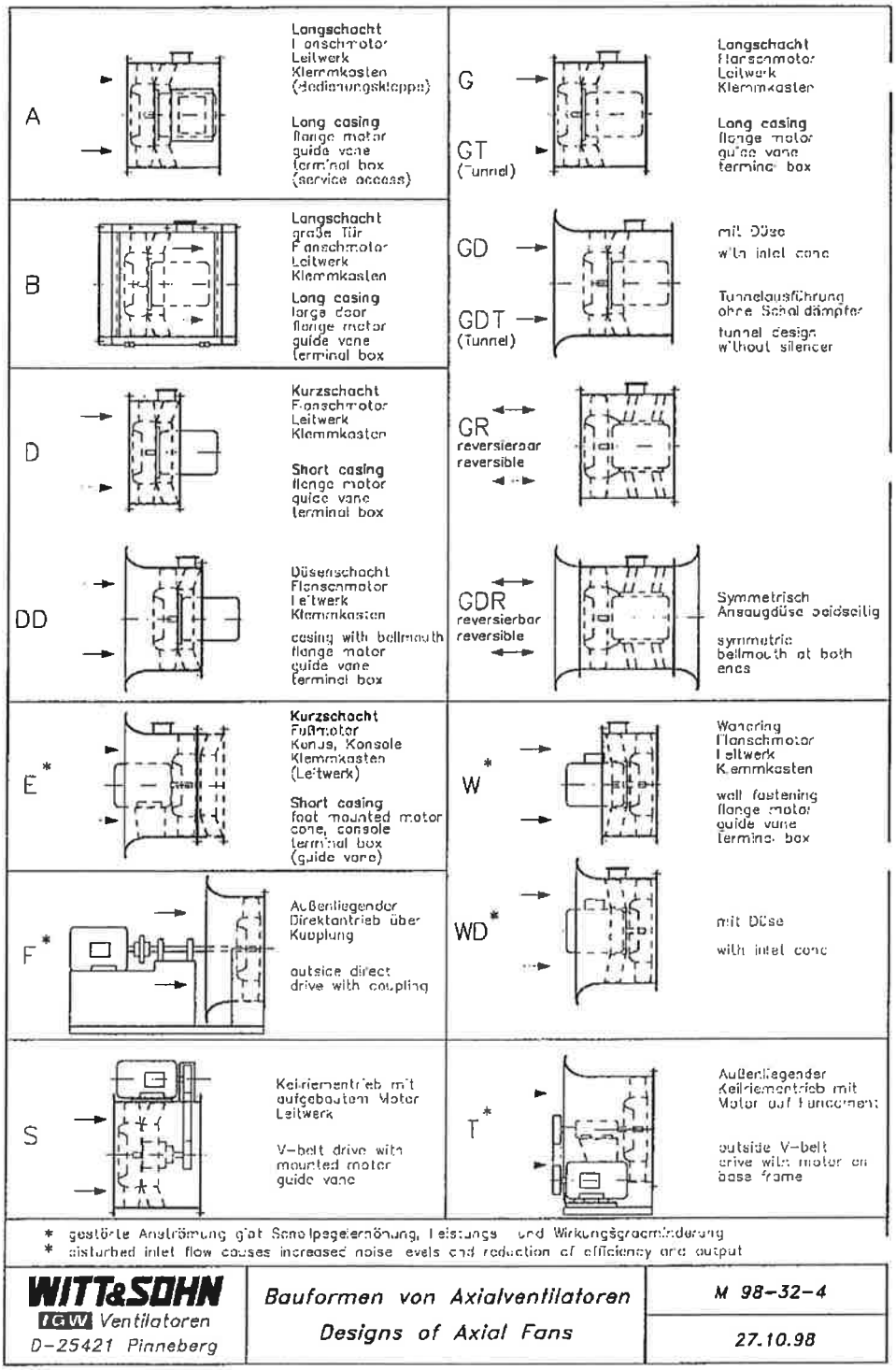
The specific design of a fan is mainly determined by the installation in which it will be used. Beside the physical properties such as pressure, volume flow rate and temperature, the operating conditions and the installation location are of major importance (Reference DIN 24 163 for a complete description of the input parameters for a fan specification). The actual fan dimensions are mainly determined by the motors and accessories used.

Our axial flow fan range is distinguished by a large number of different standard designs. The different impeller hub-diameter rations enable us to satisfy a very large range of volume flow rate/pressure combinations for most types of installations.

The quick selection charts/nomogramm sheets and our dimension sheets give an overview over the most commonly used axial flow fans. In addition to the shown standard fans, we also manufacture a large number of special designs, e. g. explosions proof, pump room fans, shock proof fans, smoke extract fans, jet fans etc. In case of demand for special fans please inquire.

The fan selection graphs make allow a quick selection of the axial flow fans normally used at 50 Hz. They provide the fan type, the size, number of poles of the motor, the shaft power and the sound power.

The following gives a brief description of our axial flow fan casing designs.


A
Langschacht
Flanschmotor
Leitwerk
Klemmkasten
(Bedienungsklappe)
Long casing
flange motor
guide vane
terminal box
(service access)
B
Langschacht
große Tür
Flanschmotor
Leitwerk
Klemmkasten
Long casing
large door
flange motor
guide vane
terminal box
D
Kurzschacht
Flanschmotor
Leitwerk
Klemmkasten
Short casing
flange motor
guide vane
terminal box
DD
Düsenschacht
Flanschmotor
Leitwerk
Klemmkasten
casing with bellmouth
flange motor
guide vane
terminal box
E*
Kurzschacht
Fußmotor
Konus, Konsole
Klemmkasten
(Leitwerk)
Short casing
foot mounted motor
cone, console
terminal box
(guide vane)
F*
Außenliegender
Direktantrieb über
Kupplung
outside direct
drive with coupling
S
Keilriementrieb mit
aufgebautem Motor
Leitwerk
V-belt drive with
mounted motor
guide vane
G
GT
(Tunnel)
Langschacht
Flanschmotor
Leitwerk
Klemmkasten
Long casing
flange motor
guide vane
terminal box
GD
GDT
(Tunnel)
mit Düse
with inlet cone
Tunnelausführung
ohne Schalldämpfer
tunnel design
without silencer
GR
reversierbar
reversible
GDR
reversierbar
reversible
Symmetrisch
Ansaugdüse beidseitig
symmetric
bellmouth at both
ends
W*
Wandring
Flanschmotor
Leitwerk
Klemmkasten
wall fastening
flange motor
guide vane
terminal box
WD*
mit Düse
with inlet cone
T*
Außenliegender
Keilriementrieb mit
Motor auf Fundament
outside V-belt
drive with motor on
base frame
* gestörte Anströmung gibt Schallpegelerhöhung, Leistungs- und Wirkungsgradminderung
* disturbed inlet flow causes increased noise levels and reduction of efficiency and output
WITT&SOHN
IGW Ventilatoren
D-25421 Pinneberg
Bauformen von Axialventilatoren
Designs of Axial Fans
M 98-32-4
27.10.98

Axial-Ventilatoren
Bauformen

ie auform eines ial- entilators wird durch die Schachtl nge, den ad- urchmesser, die Schachtform, Geh usewandst rke, Motor/- lemmkasten- usführung und dem ubehör bestimmt lle unsere ial- entilatoren können standardm ßig mit 1,5 bis 10 mm andst rke und on 250 bis 3150 mm urchmesser gebaut werden

er insatzort bestimmt die t pischen andst rken um eispiel 2 bis 4 mm bei normalen ndustrieanlagen, 3 bis 6 mm bei nterdeckaufstellung auf Seeschiffen und 8 bis 10 mm für berdeckaufstellung bei Seeschiffen oder ndustrieanlagen mit besonders harten etriebsbedingungen

n and der nforderungen der nlage wird die genaue auform bestimmt m folgenden einige inweise

Normalausführung (Langschacht)

ür iele Lüftungsanlagen (ndustrieanlagen oder Schiffbau) werden die auformen **A** und **G** (**GT** bei mpuls entilatoren) eingesetzt eide haben Langsch chte, die den Motor oll umschließen, mit einem ußeren lemmenkasten ie auform **A** hat zus tzlich eine edienungsklappe, um kleinere artungsarbeiten ornehmen zu können

in Sondert p der auform **G** (**GT** bei mpuls entilatoren) ist die auform **GD** (**GDT**), die eine üse anstatt lansches am nsaugende hat

Axial Flow Fans
Design

he design of an a ial flow fan is described b the casing length, the impeller diameter, casing shape, casing thickness, motor/terminal bo design and the accessories ll our a ial flow fans can be supplied as a standard with 1,5 to 10 mm casing gadge and a diameter from 250 mm to 3150 mm

he application and the location of the fan determine the gadge or e ample 2 to 4 mm is used in normal industrial installations, 3 to 6 mm below deck on ships and 8 to 10 mm abo e deck or in hea dut industrial applications

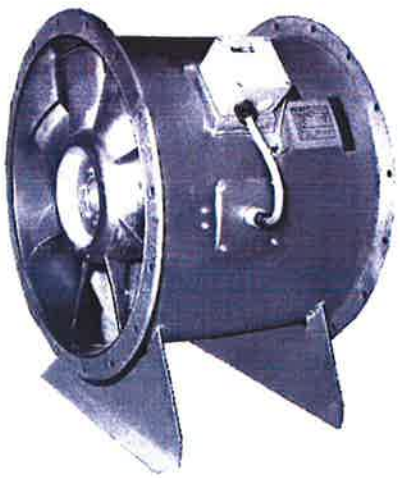
he specifications of the installation determine the design he following gi es some guidelines

Normal design (long casing)

or man applications (industrial or ship building) the designs **A** and **G** (**GT** for et fans) are used he designs ha e a long casing that full encloses the motor, with an e ternal terminal bo he design **A** has furthermore a ser ice access to allow minor ser icing

special ersion of design **G** (**GT** for et fans) is the design **GD** (**GDT**), which has an inlet bellmouth instead of a flange at the inlet end

Axial Ventilator Bauform A / Axial fan design A



Axial Ventilator Bauform GD/Axial fan design GD

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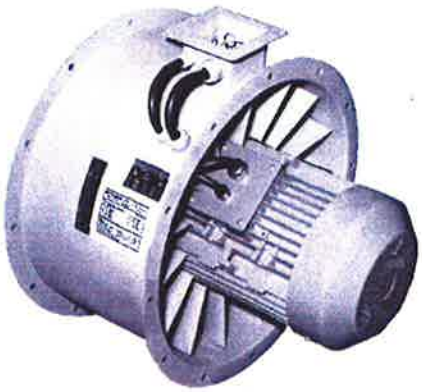
Axial-Ventilatoren
Bauformen

Axial Flow Fans
Design

Axial Ventilator Bauform D / Axial fan design D



Normalausführung (Kurzschacht)
Für viele Lüftungsanlagen, wo ein kleiner Ventilator in den Luftkanal eingebaut werden soll, verwendet man oft die Bauformen **D** und **W** (bzw. **DD** und **WD** mit Düse statt Flansch-Abschluß). Sie haben einen kleinen Schacht, wo der Motor in den Lüftungsschacht hineinragt.

Vorsicht:
Anströmung über den Motor, Bauform W und WD, führt zu schlechter Laufradan- und abströmung. Dieses führt zu schwer vorhersagbaren Schallpegelerhöhungen sowie Leistungs- und Wirkungsgradverminderungen.

Normal design (short casing)
For many ventilation applications a small fan is mounted in a duct system. The designs **D** and **W** (**DD** and **WD** with inlet cone for free inlet) are used for that. They have a short fan casing with the motor partly outside the casing.

Attention:
If the motor is mounted in the inlet, Design W and WD, the upstream and downstream impeller flow is disturbed. This leads to increased noise, reduced aerodynamic power and efficiency, which can not be predicted accurately.

Axial Ventilator Bauform B / Axial fan design B

Wartungsleichte Ausführung
In einigen Anlagen ist es häufig wesentlich, an den Motor bzw. an das Laufrad gelangen zu können, ohne die Anlage demontieren zu müssen. Für solche Zwecke empfiehlt sich die Bauform **B**. Mit Hilfe einer Tür im Schacht können alle anfallenden Arbeiten einfach durchgeführt werden. Oft ist der Motor/das Laufrad an der Tür befestigt, so daß das gesamte Gebilde ausschwenkbar ist.

Ease of Service Access
In some installations it is important to be able to have access to the impeller or the motor without disassembling the whole system. For this kind of applications we recommend our design **B**. By having the impeller /motor mounted on a swing out access door, all kinds of service and maintenance work can easily be done.

Axial-Ventilatoren
Bauformen

Axial Flow Fans
Design

Axial Ventilator Bf. GDR / Axial Fan design GDR

Reversible Ventilatoren
m rinzip sind alle entilatoren re ersibel, bei stark erminderten Leistungsdaten

entilatoren mit einem **R** in der penbezeichnung (z **GDR**) erreichen zu ann hernd 100 die gleiche Leistung in beiden ichtungen durch u erwendung on re ersiblen Laufr dern

Reversible Fans
n principle all fans can be re ersed, but with much reduced performance data

ans with an **R** in the t pe (f i **GDR**) ha e to nearl 100 the same performance data in both directions b using re ersible impellers and other special features

Axial Ventilator Bf. S/Axial Fan design S

Außenliegender Motor
ür nlagen, wo der Motor nicht in dem Luftstrom plaziert sein soll, bieten wir die auformen **S** und **T** an sie werden z bei nwendungen mit hohen emperaturen oder bei Materialtransport eingesetzt as Laufrad wird über einen eilriemenantrieb angetrieben, wobei der Motor entweder auf dem Schacht aufgebaut ist (**S**) oder auf einem undament (**T**)
ie auform **F** mit einem upplungsantrieb wird nur selten erwendet

External Motor
or installations where the motor can not be in the airflow, we offer the designs **S** or **T** he are for e ample used for applications with high temperatures or for material transport fans oth designs use a -belt dri e n design **S** the motor is mounted on the fan casing itself, while in design **T** the motor is on a separate base frame he design **F** with a coupling dri e is onl seldom used

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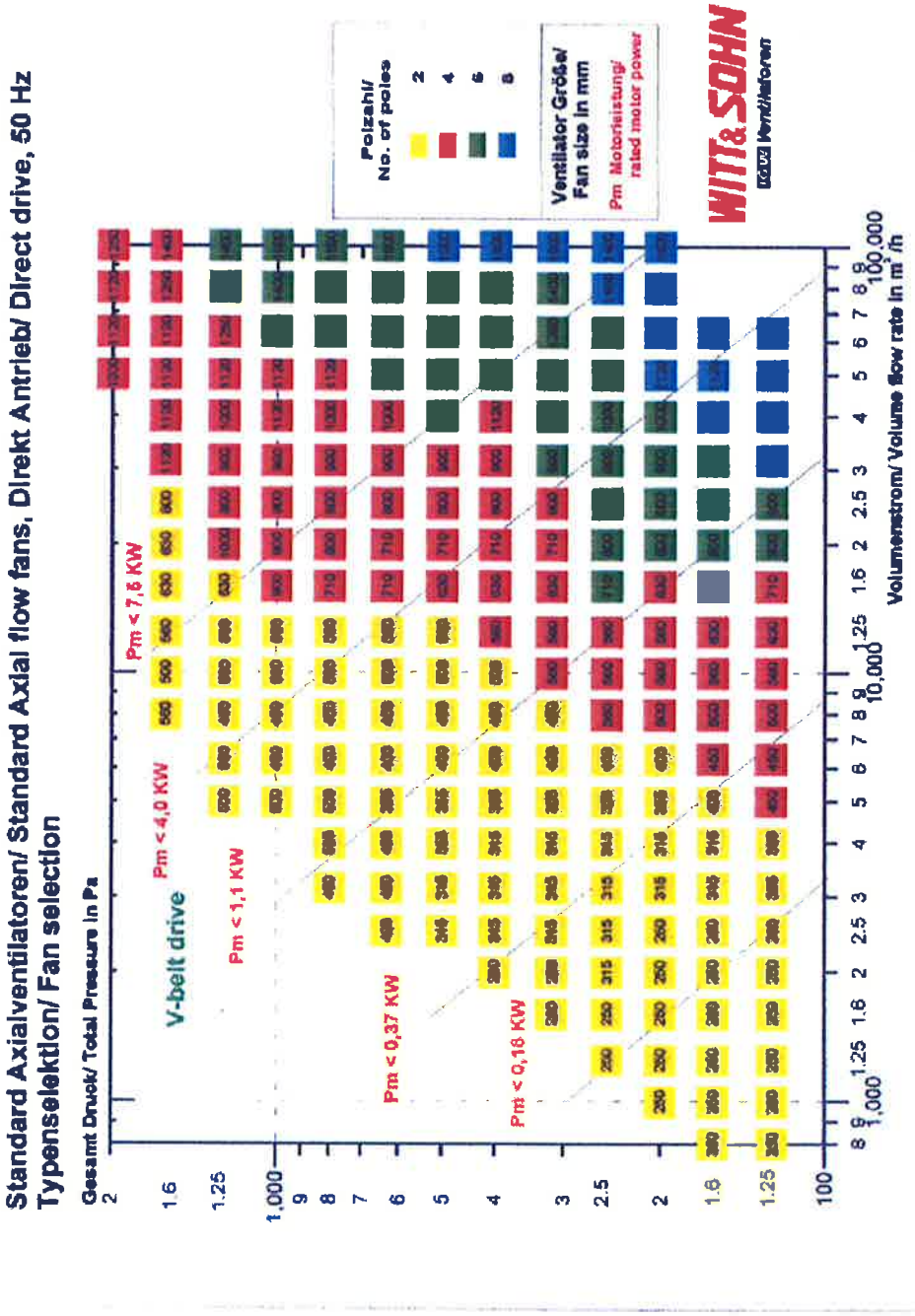
WITT&SOHN
KKW Ventilatoren


Standard Axialventilatoren/ Standard Axial flow fans, Direkt Antrieb/ Direct drive, 50 Hz
Typenselektion/ Fan selection
Gesamt Druck/ Total Pressure in Pa
V-belt drive
Pm < 7,5 KW
Pm < 4,0 KW
Pm < 1,1 KW
Pm < 0,37 KW
Pm < 0,18 KW
Polzahl/ No. of poles
2
4
6
8
Ventilator Größe/ Fan size in mm
Pm Motorleistung/ rated motor power
WITT&SOHN
Volumenstrom/ Volume flow rate in m³/h

Axial-Ventilatoren
Laufradtypen

Axial Flow Fans
Impeller programme

Unsere Laufräder haben alle profilierte Schaufeln mit hohen Wirkungsgraden und günstigem Geräuschverhalten. Selbstverständlich sind die Elektromotoren normal am Leitwerk aufgehängt, ohne störende Motorfüße.

Our impellers have all aerofoil blades with high efficiencies and favourable noise ratings. Of course electric motors are normally supported by the guide vanes, without feet disturbing the flow.

Die Schaufelwinkel sind im Stillstand verstellbar, welches häufig ein großer Vorteil bei Änderungen im Kanalsystem ist.

The blade angle can be adjusted at standstill, a big advantage when for example the duct system is modified.

Das profilierte Laufrad, aus korrosionsbeständigem Aluminiumguß, zeichnet sich außerdem durch ein niedriges Gewicht aus und ist deshalb sehr günstig für die Lebenserwartung der Kugellager.

The aerodynamically shaped impellers are made of corrosions resistant cast aluminium alloy. It's low weight gives good life expectancy for the motor bearings.

An Hand der Schnellselektionstabelle/Nomogramme kann das für Sie günstigste Laufrad ausgewählt werden.

The quick selection tables/nomogramme is an aid for quickly selecting the most suitable impeller.

Typenübersicht einstufige Laufräder

Das Standard-Laufradprogramm hat vier Haupttypen **N, M, X** und **Y** mit wahlweise je 6, 8 bzw. 12 Schaufeln. Durch die Verwendung von Leitwerken mit 5 oder 15 Schaufeln wird ein hoher Wirkungsgrad bei hoher Druckziffer erreicht.

Description of single stage impellers

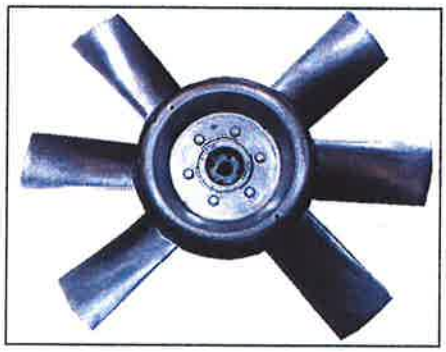
The standard impeller programme has four main types, **N, M, X** and **Y** which each may have 6, 8 or 12 blades. By using guide vanes with 5 or 15 blades a high efficiency at high pressure is obtained.

1. Niederdruck Laufradtypen N6 und N8

Dieser Typ mit 6 oder 8 profilierten Schaufeln zeichnet sich durch hohe Wirkungsgrade (bis 85 %) und ein sehr gutes Geräuschverhalten aus. Die blaue (bzw. rote mit Leitwerk) Kurvenschar auf dem transparenten Nomogrammblatt zeigt den normal für diesen Typ am besten geeigneten Leistungsbereich.

1. Low pressure impeller N6 and N8

This type with 6 or 8 blades has high efficiencies (up to 85 %) and good noise rating. The blue (red with guide vane) fan curves on the nomogramme sheets or quick selection chart show the normally most advantageous performance area.



Niederdruck Laufradtyp N6

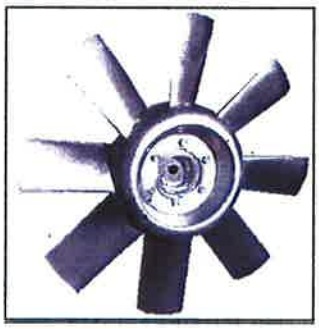
Laufraddurchmesser	315 - 3550 mm
Druckbereich	100 Pa - 700 Pa
Volumenstrombereich	500 m³/h - 200.000 m³/h
Nabenverhältnis	45 %

Low pressure impeller type N6

Impeller diameter	315 - 3550 mm
Pressure range	100 Pa - 700 Pa
Volume flow rate range	500 m³/h - 200.000 m³/h
Hub ratio	45 %

Axial-Ventilatoren
Laufradtypen

Axial Flow Fans
Impeller programme



Niederdruck Laufradtyp N8

Laufraddurchmesser	315 - 3550 mm
Druckbereich	100 Pa - 1700 Pa
Volumenstrombereich	500 m³/h - 1.000.000 m³/h
Nabenverhältnis	45 %

Low pressure impeller type N8

Impeller diameter	315 - 3550 mm
Pressure range	100 Pa - 1700 Pa
Volume flow rate range	500 m³/h - 1.000.000 m³/h
Hub ratio	45 %

2. Mitteldruck Laufradtypen M8 und X8

Um bei größeren Luftmengen und höheren Drücken trotzdem gute Wirkungsgrade (bis zu 80%) zu erzielen, setzen wir oft die Laufräder **M8** oder **X8** ein. (Schwarze bzw. blaue Kurvenschar auf den Nomogrammdeckblättern.)

2. Medium pressure impellers M8 and X8

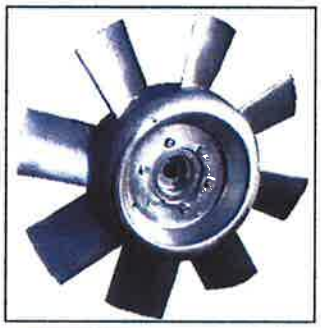
To achieve higher pressure and volume flow rates with good efficiencies (up to 80 %) we normally use the impeller types M8 and X8 (black and blue curves on the nomogramme sheets/quick selection chart).

Mitteldruck Laufradtyp M8

Laufraddurchmesser	280 - 3150 mm
Druckbereich	100 Pa - 2000 Pa
Volumenstrombereich	500 m³/h - 500.0.00 m³/h
Nabenverhältnis	50 %

Medium pressure impeller type M8

Impeller diameter	280 - 3150 mm
Pressure range	100 Pa - 2000 Pa
Volume flow rate range	500 m³/h - 500.000 m³/h
Hub ratio	50 %



Mitteldruck Laufradtyp X8

Laufraddurchmesser	250 - 2800 mm
Druckbereich	100 Pa - 2500 Pa
Volumenstrombereich	500 m³/h - 400.000 m³/h
Nabenverhältnis	56 %

Medium pressure impeller type X8

Impeller diameter	250 - 2800 mm
Pressure range	100 Pa - 2500 Pa
Volume flow rate range	500 m³/h - 400.000 m³/h
Hub ratio	56 %

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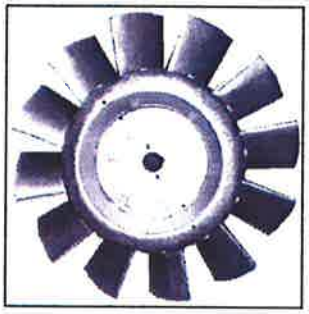
WITT&SOHN
Ventilatoren

Axial-Ventilatoren
Laufradtypen

Axial Flow Fans
Impeller programme

3. Hochdruck Laufradtypen Y8 und Y12

Diese Laufradtypen erlauben es, mit 15 Leitschaufeln für Axialventilatoren sehr hohe Drücke bei trotzdem guten Wirkungsgraden zu erreichen.



3. High pressure impellers Y8 and Y12

These impellers combined with 15 bladed guide vanes provide very high pressures for axial flow fans while still maintaining good overall efficiencies.

Hochdruck Laufradtyp Y12

Laufraddurchmesser	250 - 2500 mm
Druckbereich	100 Pa - 3500 Pa
Volumenstrombereich	500 m³/h - 300.000 m³/h
Nabenverhältnis	63 %

High pressure impeller type Y12

Impeller diameter	250 - 2500 mm
Pressure range	100 Pa - 3500 Pa
Volume flow rate range	500 m³/h - 300.000 m³/h
Hub ratio	63 %

4. Reversierbarer Laufrädertyp NR8 und MR8

Diese Laufrädertypen erlauben eine fast 100 %ige Reversierbarkeit des Luftstromes ohne zu großen Leistungsverlust.

4. Reversible impellers NR8 and MR8

These impeller types allow an almost 100 % reversibility of the air flow without too much loss in performance.

Reversierbarer Laufradtyp NR8/MR8

Laufraddurchmesser	400 - 2240 mm	
Druckbereich	NR8	100 - 1500 Pa
	MR8	100 - 1700 Pa
Volumenstrombereich	NR8	500 - 1.000.000 m³/h
	MR8	500 - 500.000 m³/h
Nabenverhältnis	NR8	45 %
	MR8	50 %

Reversible impeller type NR8/MR8

Impeller diameter	400 - 2240 mm	
Pressure range	NR8	100 - 1500 Pa
	MR8	100 - 1700 Pa
Volume flow rate range	NR8	500 - 1.000.000 m³/h
	MR8	500 - 500.000 m³/h
Hub ratio	NR8	45 %
	MR8	50 %

Zusätzlich zu den beschriebenen Standard-Laufrädern ist ein begrenztes Programm an Stahl-Laufrädern oder alten Laufradtypen verfügbar.

In additon to the above standard types a limited range of steel impellers or elder types of axial flow impellers are available.

Axial-Ventilatoren
Laufradtypen

Axial Flow Fans
Impeller Programme

Mehrstufige Axial-Ventilatoren

Axial-Ventilatoren können auch mehrstufig betrieben werden, um den Gesamtdruck grundsätzlich zu erhöhen. Unsere verschiedenen Laufräder mit Leitwerk können auch in Hintereinanderschaltung verwendet werden. Die Ventilatoren werden mit Motoren mit zweitem Wellenende oder mit zwei getrennten Antriebsmotoren ausgeführt. Die Drücke der Einzelstufen können addiert werden nach Abzug von ca. 15% Druckminderung in der zweiten Stufe.

Da die Zahl der möglichen Kurven sehr groß ist, sind diese im Katalog nicht aufgenommen. Wir bitten bei Bedarf um Ihre Anfrage.

Definition des Schaufelwinkels

Der Anstellwinkel der verstellbaren Schaufeln ist als der Abstand der Abströmkante der Schaufel vom Nabenende definiert. Dieser wird in Prozent des Laufraddurchmessers angegeben. Dabei zeigt der Buchstabe "V" an, daß die Schaufelabströmkante vorsteht. Der Buchstabe "Z" gibt an, daß die Schaufelkante zurückspringt. Bei der Angabe "O" liegen Schaufelkante und Nabenabströmkante in einer Ebene, d. h. ihr Abstand ist null.

Beispiel:
Laufradtyp: N8/V1,0/800

Bei diesem Laufrad mit dem Durchmesser 800 mm steht die Schaufelabströmkante 1,0% von 800 mm = 8 mm über die Nabenkante vor.

Multistage axial flow fans

Axial flow fans can also be build in multistage versions to increase to total pressure achieved. Our various impellers with guide vanes can be installed in series. The fans are made by using motors with two shaft ends or two separate motors. The pressures can be added with a subtraction of approximately 15 % for the second stage.

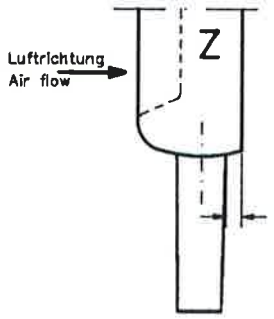
The number of possible curves is so waste that they have not been included in this catalogue. If the need arises please send us an inquiry.

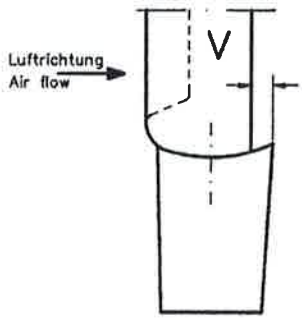
Definition of Pitch

The pitch of the adjustable blades is defined as the distance of the trailing edge of the blade from the rim of the hub. This distance is specified in percent of the impeller diameter. Furthermore the letter "V" indicates that the trailing edge of the blades is prominent. The letter "Z" indicates that the trailing edge stands back. The indication "O" means that the distance between the trailing edge of the blade and the rim of the hub is zero, i. e. they lie in the same plane.

Example:
Impeller type: N8/V1,0/800

On this impeller having the diameter 800 mm, the trailing edge of the blade stands 1,0% of 800 mm = 8 mm out over the rim of the hub.





Axial-Ventilatoren
Bestellangaben

Axial Flow Fans
Order Specification

Um die Fertigung termingerecht ausführen zu können, benötigen wir folgende Angaben gemäß DIN 24 166:

- Luftmenge
- Gesamtdruck oder den statischen Druck
- Eventuell bevorzugte Größe
- Spannung und Frequenz
- Eventuell von VDE 0530 abweichende Motorvorschriften
- Bauform
- Besondere Betriebsverhältnisse oder Umweltforderungen, wenn vorhanden. Hierzu gehört z. B. die Angabe besonderer Korrosionsbelastungen oder die Aufstellung an Oberdeck eines Seeschiffes.
- Einbaustellung
- Angabe eventueller Zubehörteile
- Eventueller Explosionsschutz
- Staub- oder Schmutzbelastung
- Gewünschte Sondermaterialien
- Gewünschte Oberflächenbehandlung

In Order to prevent unnecessary delays, we need the following informations according DIN 24 166:

- Capacity
- Total or static pressure
- Desired size, if any.
- Voltage and frequency
- Special rules concerning the motor if different from VDI 0530
- Design
- Special service conditions or requirements if any. For example special corrosion hazards or installation on deck of a seagoing vessel should be mentioned.
- Installation position
- Information concerning accessories
- Explosion hazards if any
- Dust- or dirt hazards
- Special materials, if desired.
- Special surface treatment, if desired.

Technische Daten
entnehmen sie bitte unseren "DATENBLÄTTERN".

Technical Data
please see our "DATA SHEETS".

Typenschlüssel

S - M8 L5 / V1,0 / 800 / A / 6

- S - Standard / A-Angepaßt / P-Spezial
- M8 - Axial-Laufrad-Typ M mit 8 Schaufeln
- L5 - Leitwerk mit 5 Schaufeln / T5 - Tragwerk
- V1,0 - Schaufelstellung
- 800 - Raddurchmesser in mm
- A - Bauform
- 6 - Wandstärke in mm

Fan Code

S - M8 L5 / V1,0 / 800 / A / 6

- S - Standard / A-Adapted / P-Special
- M8 - Axial impeller type M with 8 blades
- L5 - Guiding vane with 5 blades / T5 - Supports
- V1,0 - Blade pitch
- 800 - Impeller diameter in mm
- A - Design
- 6 - Casing thickness in mm

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WITT&SOHN
BWV Ventilatoren

Axial-Ventilatoren
Technische Richtlinien

Axial Flow Fans
Technical Guidelines

Material und Oberflächenbehandlung

In Normalausführung sind die Ventilatorgehäuse aus kräftigen, zunderarmen fett- und ölfreien Blechen und Profilen gefertigt und mit hochwertigem, umweltfreundlichem Grundanstrich versehen. Alle Schrauben und Muttern sind verzinkt. Im Schiffbau sind die Verschraubungen der Bedienungsöffnungen aus Edelstahl oder Messing.

Auf Wunsch können die Gehäuse feuerverzinkt werden oder einen besonderen Farbanstrich erhalten.

Die eingebauten Motoren sind normalerweise für einen Temperatur-Bereich von minus 25 Grad bis plus 40 Grad Celsius ausgelegt gemäss VDE 0530.

Die Laufräder sind aus GAlSi10Mg gegossen und die eingebauten Leitwerke sind aus Stahlblech geschweißt.

Die Laufräder können für Temperaturen bis zu 250°C in einer Stunde gebaut werden. Normaltemperaturbereich ist bis zu 100°C.

Materials and Surface Treatments

The fan casings are normally made of heavy gauge plates and structural steel, free from grease and oil and with negligable surface oxidation. They are painted with an epoxy resin iron oxide ground coat. All screws and nuts are galvanised. For seagoing vessels the screw-connections of the service access are made of stainless steel or brass.

On request, the casings can be hot dip galvanised or receive a special coating.

The installed motors are usually designed for a temperature range of minus 25 to plus 40 degrees Celsius according to the rules VDE 0530.

Impellers are cast of GAlSi10Mg and guiding vanes are welded of rolled steel.

The impellers can withstand temperatures up to 250°C, one hour. The normal temperature range is up to 100°C.

Explosionsschutz

Bei explosionsgeschützter Ausführung ist der Schacht im Laufradbereich mit einem Streifschutz aus Sonder-Messing versehen, so daß in der Verbindung mit dem Aluminiumlaufrad keine Reib- oder Schlagfunken entstehen können. Der Motor entspricht selbstverständlich den einschlägigen Vorschriften.

Explosion Proof

The casing of our explosion proof designs is lined with a spark protection plate of naval brass, which will cause no sparking due to friction or impact with the aluminium impeller. The motor will of course comply with pertinent rules.

Aufstellungsrichtlinien

Axialventilatoren sind sehr empfindlich gegen eine ungleiche Beaufschlagung des Strömungsquerschnittes. Wenn in parallelen Strömungsfäden unterschiedliche Geschwindigkeiten vorliegen, kommt es im Laufradbereich leicht zu Wirbeln mit bedeutenden Leistungsverlusten zur Folge. Krümmer sollten möglichst nicht kurz vor oder hinter dem Laufrad angeordnet werden.

Um Ablösung im Laufradbereich zu vermeiden, sollten frei aus dem Raum saugende Ventilatoren immer eine Ansaugdüse haben. Bei Querschnittsänderungen vor dem Ventilator sollte ebenfalls darauf geachtet werden, daß es zu keinen Ablösungen kommen kann.

Die Ventilatorleistung wird ebenfalls durch Verminderung des Rohrquerschnittes hinter dem Flügelrad stark gemindert. Dieses gilt besonders bei Ventilatoren mit starkem Drall, d. h. ohne Leitwerk.

Wirbelerzeugende Einbauten vor Axialventilatoren sollten vermieden werden, da die erzeugten Wirbel zu wesentlichen Schallpegelerhöhungen führen können.

Installation Guidelines

Axial fans are quite sensitive against lopsided air supply to the impeller. When different velocities reign in parallel pathes of flow, turbulencies may occur close to the impeller with important output losses as a consequence. Sharp bends at a short distance from the impeller should be avoided.

In order to avoid a contraction of the air flow with turbulencies near the duct wall, fans should have a conical inlet or a bellmouth whenever they have no duct system on their inlet side. Changes in the cross section of ducts shortly before the fan should, if possible, be carried out in such a way that no flow separations occur.

The fan output may be seriously diminished by cross section reductions shortly after the impeller. This is especially the case for axial fans with an important swirl in absence of guiding vanes.

Upstream flow obstacles should be avoided, as they may create turbulencies that lead to an important noise level increase.

Axial-Ventilatoren
Technische Richtlinien

Axial Flow Fans
Technical Guidelines

Anlaufzeiten

Die Anlaufzeiten werden teils durch das Beschleunigungsmoment bestimmt, definiert als Differenz von Motormoment und Lastmoment, teils vom Trägheitsmoment des Laufrades. Der Verlauf der Motormomentkurven ist von Fall zu Fall recht unterschiedlich, trotz einengender Vorschriften. So muß das angegebene Anzugsmoment z. B. nach VDE 0530 in den Toleranzgrenzen -15% bis +25% liegen.

Bei Motoren der Läuferklasse 16 ist die Anlaufzeit etwa:

$$t = \frac{0{,}7 \cdot M \cdot D^2 \cdot n^2}{10^6 \cdot N} [\text{sec}]$$

wobei n die Ventilatordrehzahl im Upm, N die Motorleistung in kW, M die Laufradmasse in kg und D der Raddurchmesser in m ist.

Bei keilriemengetriebenen Ventilatoren ist

n^2 durch $n_{vent} \cdot n_{mot}$

zu ersetzen, dem Produkt der Ventilator- und Motordrehzahlen.

Bei Einsatz von Motoren mit niedriger Läuferklasse ist die ermittelte Zeit mit 1,2 zu multiplizieren bei Läuferklasse 13 und mit 1,9 bei Klasse 10.

Bei Axialventilatoren, deren Drehzahl durch Keilriementrieb niedriger ist als die Motordrehzahl, sollte man stets mit Schweranlauf rechnen und entsprechende Vorkehrungen treffen. Auch in anderen Fällen kann der Einbau von Relais für Schweranlauf notwendig sein.

Instabilitätsbereich

Die Kennlinien der Axialventilatoren haben einen mehr oder weniger ausgeprägten Instabilitätsbereich, wegen seiner Form auch oft Sattel genannt. Im Kennlinienbereich B-C [Fig. 1.6] ergibt eine geringfügige Erhöhung des Widerstandsbeiwertes eine bedeutende Verminderung der Fördermenge bei gleichzeitigem Abfall des vom Ventilator erzeugten Druckes. Der Arbeitspunkt eines Axialventilators sollte möglichst in den normalen Arbeitsbereich A-B, wo der Ventilator seinen höchsten Wirkungsgrad hat, gelegt werden.

Die Wirkung des Sattels sei an Hand von Fig. 1.6 illustriert, welche drei verschiedene Arbeitspunkte eines Ventilators zeigt. Diese sind als Schnittpunkte der Ventilatorkennlinie mit drei verschiedenen Anlagen-Widerstandskurven bestimmt. Diese folgen häufig dem Gesetz

$$\Delta p_g = C_{1,2,3} \cdot \dot{V}^2$$

wo C_1, C_2, C_3 die Widerstandsbeiwerte sind. Der notwendige Druck in einem System steigt mit dem Quadrat der Durchflußmenge.

Starting Times

The starting time is determined by both the accelerating torque, being equal to the difference between the motor torque and counter torque of the load and by the inertia of the impeller. The motor torque curve may vary considerably from case to case, in spite of existing rules. For the guaranteed starting torque, for instance, VDE 0530 rules allow a tolerance form -15 % to +25 %.

For motors having the rotor class 16 the starting time is roughly:

$$t = \frac{0{,}7 \cdot M \cdot D^2 \cdot n^2}{10^6 \cdot N} [\text{sec}]$$

where n is the fan speed in rpm, N the rated motor power in kW, M die mass of the fan in kg and D the impeller diameter.

For belt drive fans

n^2 is to be substituted by $n_{vent} \cdot n_{mot}$

the product of the blower and motor speeds. If motor with lower starting torque's are employed, the calculated time is to be multiplied by 1,2 for rotor class 13 and 1,9 for class 10, where n is the number of fan rotations per minute, N the motor power in kW, M the impeller mass in kg and D the impeller diameter in m.

Long starting times should be expected for all axial fans having a lower speed than that of the motor, f. e. by means of a belt drive. In this and also in other cases the installation of relays for extrea heavy start may be necessary.

Instability range

The performance curves of axial fans have a more or less pronounced instability range, because of its shape often called saddle. In the range B - C (Fig. 1.6) a small increase of the flow resistance coefficient will cause a considerable decrease of the flow combined with a simultaneous decrease of the pressure produced by the fan. The working point of a fan should, if possible, be placed in its normal working range A - B, where it has the highest efficiency.

The effect of the saddle may be illustrated by means of Fig. 1.6 showing three working points of a fan. They are determined as intersection points of its performance curve with three different air flow resistance curves. These often follow the rule:

$$\Delta p_t = C_{1,2,3} \cdot \dot{V}^2$$

where C_1, C_2, C_3 are the flow resistance coefficients. The necessary pressure increases with the square of the flow through a system.

Axial-Ventilatoren
Technische Richtlinien

Axial Flow Fans
Technical Guidelines

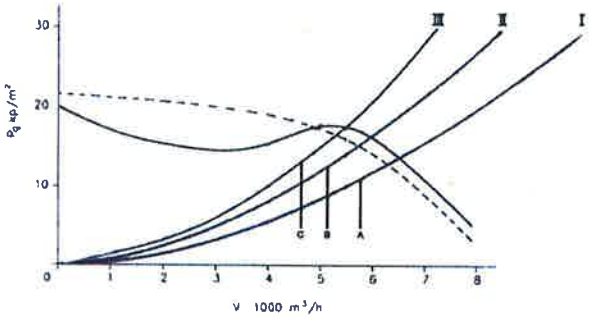

Fig. 1.6 **Bestimmung des Arbeitspunktes eines Axialventilators als Schnittpunkt zwischen Ventilatorenkennlinie und Widerstandsparabel der Anlage (I, II, III)**

Fig. 1.6 **Determination of the working point of an axial fan is intersection of its characteristic with three different resistance parables.**

Geht man von Kurve I aus und erhöht den Widerstandskoeffizienten um 20%, erhält man Kurve II. Die Ventilatorleistung im neuen Arbeitspunkt, definiert als Produkt von Fördermenge und Gesamtdruck, ist 10% niedriger als zuvor. Erhöht man den Widerstandsbeiwert abermals um 20%, erhält man Kurve III. Der Arbeitspunkt fällt jetzt in den Sattel und die Leistungsminderung beträgt in diesem Fall 37%.

If we start from curve I and increase the coefficient by 20 %, we obtain curve II. The output in the new working point, defined as product of flow and total pressure, is 10 % lower than before. If the coefficient is increased once more by 20 %, we obtain curve III. The working point now falls into the saddle and the reduction of output is in the example shown 37 %.

Wenn Ventilatoren links vom Punkt B arbeiten, kann der Strömungsabriß an den Schaufeln diese in heftige Schwingungen versetzen, die zu Ermüdungsbrüchen führen können. Besonders bei Betrieb zwischen den Arbeitspunkten B und C kann es zum sogenannten Pumpen kommen, wobei der Arbeitspunkt auf der Kurve ständig hin und her fährt. Hierbei können die Abrißschwingungen verstärkt werden.

Whenever fans work to the left of point B flow separation on the blades may cause these to vibrate considerably, eventually leading to fatigue. Especially for fans working between the points B and C the so called pumping may occur, where the working point on the curve is subject o travel continuously along the curve. This may aggravate the vibrations.

Um den Strömungsabriß und Pumpen zu verhindern, können unsere Ventilatoren auf Wunsch mit Antistallringen nach Prof. Eck ausgerüstet werden. Die Leistungskurve wird dadurch stabilisiert, so daß man die gestrichelte Kurve erhält, mit stark verminderten Schwingwerten zur Folge.

In order to prevent flow separation and pumping, our fans can on request be fitted with antistall rings according to Prof. Eck. The fan curve will be stabilised to the dotted line with much reduced vibration levels.

Leistungsregelung/Drallregler

In den meisten Fällen ist der Einsatz von zwei oder dreifach polumschaltbaren Ventilatoren ausreichend, eventuell in Verbindung mit einer Regelklappe. Beachtet werden muß, daß die Eigenfrequenz des Ventilators (besonders bei stufenloser Frequenzregelung) vermieden wird.

Output Control/Vane controls

In most cases the use of two- or three speed motors is sufficient, sometimes in connection with a damper. It is important that the eigenfrequencies of fan (especially when using frequency control) is avoided.

Ab Größe 400 stellen wir Drallregler her, die eine stufenlose wirtschaftliche Regelung ermöglichen. Diese sind jedoch nicht im Abrißgebiet einsetzbar. Bitte fragen Sie diese bei uns an.

We also produce Inlet vane controls from size 400 and upwards, allowing an economical control. Vane control may however not be used in the stall region. Please ask for details.

Axial-Ventilatoren
Technische Richtlinien

Axial Flow Fans
Technical Guidelines

Frequenzumformerbetrieb

Wenn ein Axialventilator über Frequenzumformer angesteuert wird, ist darauf zu achten, daß der Ventilator nicht in einer seiner Resonanzfrequenzen für längere Zeit betrieben wird. Die Schwingungsamplitude muß am Motor selbst - nicht außen am Gehäuse - gemessen werden. Die Resonanzfrequenzen müssen blockiert werden, so daß sie schnell durchfahren werden.

Bei niedrigen Drehzahlen, d. h. geringem Motormoment ist zu beachten, daß der Motor nicht durch Gegenstrom zum annähernden Stillstand kommen kann. Der Motor läuft sonst Gefahr überhitzt zu werden.

Elektrische Stromstöße

Besonders durch plötzliche Reversierung der Drehrichtung wie auch beim Einschalten von Axialventilatoren, die im Luftstrom in Gegenrichtung rotieren, können große Stromstöße entstehen. Diese können zu Netzstörungen führen und sehr hohen Verschleiß der Kontakte verursachen. Die sehr hohen mechanischen Momente können auch Laufräder und Motoren beschädigen.

Vor dem Reversieren muß ein ausreichendes Auslaufintervall eingelegt werden. Der Mitlauf des Rades kann so kräftig werden, daß sich der Einbau einer Mitlaufbremse empfiehlt, die erst im Einschaltaugenblick freigegeben wird.

Bei Stern-Dreieck-Anlauf ist darauf zu achten, daß die Umschaltung nicht zu früh erfolgt, um größere Stromstöße zu vermeiden.

Schalldämpfer

Axialventilatoren haben einen relativ hohen Schall-Leistungspegel. Falls der Ventilator frei ansaugend oder frei ausblasend eingebaut werden soll, müssen oft Schalldämpfer eingesetzt werden. Für die Auswahl der passenden Schalldämpfer siehe das Kapitel "Schalldämmung/Schalldämpfer" oder auch das Selektionsprogramm.

Frequency converter control

When an axial fan is controlled by a frequency converter care has to be taken, that the fan is not for any length of time in one of it's resonance frequencies. The vibration amplitude must be measured on the motor itself and not on the casing. The resonance frequencies must be blocked, so that they are passed quickly.

At low rotational speeds, i. e. at low motor torque care must be taken, that the fan can not be stopped by a reverse air current, otherwise the motor may be overheated.

Electric current pulses

Especially sudden reversion of the direction of rotation as well as wind milling of axial impellers may cause large current pulses. This may cause disturbances in the electric supply net and unacceptable wear of the electric contacts. The high torque pulses may also harm impellers and electric motors.

Before the direction of rotation is reversed a sufficient run-out period must be allowed for. Wind milling may become so pronounced, that the installation of a motor brake may be recommendable, which only is released briefly before the motor is energised.

When star-delta start is employed the switching over must not be done too early in order to avoid large current pulses.

Silencers

Axial flow fans have a relatively high sound power level. If the fans are to be used with free inlet or outlet, silencers are often necessary. For the selection of the silencers refer to the chapter Sound reduction/Silencers and/or the fan selection programme.

Witt & Sohn Parkgaragen-Lüfter Ø 400 mm mit beidseitigen Schalldämpfern
Witt & Sohn parking garage fan Ø 400 mm with inlet and outlet silencers

Axial-Ventilatoren Technische Richtlinien

Axial Flow Fans Technical Guidelines

Toleranzen
Auslegungs-, Berechnungs- und Fertigungstoleranzen sind unvermeidbar. Deshalb sind diese für Ventilatoren in der DIN 24 166 als Bautoleranzen zusammengefaßt[*]. Für Normalventilatoren gilt die Genauigkeitsklasse 2, sofern nicht besondere Vereinbarungen getroffen werden.

Für Sonderventilatoren (z. B. gummierte Ausführungen, Sonderlaufräder, gasdichte Ausführungen, explosionsgeschützte usw.) gilt die Klasse 3. In Zweifelsfällen empfiehlt sich, einen unserer Verkaufsingenieure zu konsultieren.

Störungen in der Zu- und Abströmung sind nicht enthalten und müssen zusätzlich berücksichtigt werden.

Von der DIN abweichende Toleranzen (z. B. nur Plus-Toleranzen) müssen gesondert schriftlich vereinbart werden.

Tolerances
Selection, prediction and manufacturing tolerances cannot be avoided. The tolerances for fans are summarised in the DIN 24 166[*]. For fans the tolerance class 2 is normally applicable unless otherwise specifically agreed upon.

For special fans (e. g. rubber coated fans, special one-off impellers, gastight design, explosion proof fans etc.) the tolerance class 3 is applicable. In case of doubt please consult one of our sales engineers.

Inlet/outlet disturbances are not included and have to be included separately.

Other tolerance levels than those given in DIN 24 166 must be agreed upon separately in writing.

Toleranzen in Abhängigkeit von der Genauigkeitsklasse
Tolerances for various tolerances classes

Genauigkeitsklasse nach DIN 24 166 Tolerance class acc. to DIN 24 166	1	2	3
Volumenstrom $\dot{V}$ Volume flow rate	± 2,5 %	± 5 %	± 10 %
Total-druckerhöhung Δp_t Total pressure increase	± 2,5 %	± 5 %	± 10 %
Wellenleistung P_w Shaft power	± 3 %	± 8 %	± 16 %
Wirkungsgrad Efficiency	- 2 %	- 5 %	—
Schallwerte L_w, $\overline{L_p}$ Sound values	+ 3 dB	+ 4 dB	+ 6 dB

Betriebszustand
Die Toleranzen gelten nur für den Auslegungspunkt des Ventilators der hinsichtlich Drehzahl, Volumenstrom, Druck, Dichte und Fördermedium festgelegt ist.

Operating conditions
The tolerances are only valid in the specified working point which is defined by the fan speed, volume flow rate, pressure increase, density and gas composition.

Bautoleranzen
Die zulässigen Abweichungen von Maßen ohne Toleranzangabe in den Maßskizzenblättern entsprechen EN ISO 13920:1996

Manufacturing tolerances
The allowable tolerances of dimensions without given tolerance values on all drawings are according to EN ISO 13920:1996

gem./acc. to EN ISO 13920 Grenzabmaße für Tolerance on	Nennmaß / Rated dimension (mm)	2≤ ≤10	30< ≤120	120< ≤400	400< ≤1000	1000≤ ≤2000	2000< ≤4000	4000< ≤8000
Längenmaße Linear dimensions Tabelle / Table 1	Toleranzklasse C Tolerance class C	± 1 mm	± 3 mm	± 4 mm	± 6 mm	± 8 mm	± 11 mm	± 14 mm
Winkelmaße Angular dimensions Tabelle / Table 2	Toleranzklasse C Tolerance class C	± 1°			± 45'	± 30'		
Geradheitstoleranzen Tolerance on straightness Tabelle / Table 3	Toleranzklasse G Tolerance class G	± 1,5 mm		± 3 mm	± 5,5 mm	± 9 mm	± 11 mm	± 16 mm

[*] ISO/CD13348

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WITT&SOHN Ventilatoren

Axial-Ventilatoren
Typenauswahltabellen

Axial Flow Fans
Fan Selection Tables

Direktantrieb /Direct Drive 50 Hz

Gesamtdruck /Total pressure 125 Pa							
Volumen-strom	Ventilator-größe	Dreh-zahl	Wellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
Volume flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
800	250	2730	0,1	0,18	14-1 m	73	13
900	250	2730	0,1	0,18	16-1 m	74	13
1000	250	2730	0,1	0,18	17-1 m	74	13
1120	250	2730	0,1	0,18	18-1 m	75	13
1250	250	2730	0,1	0,18	18-1 m	75	13
1400	250	2730	0,1	0,18	19-1 m	77	13
1600	250	2730	0,1	0,18	19-1 m	78	13
1800	250	2730	0,1	0,18	24-1 m	79	13
2000	250	2730	0,1	0,18	29-1 m	79	13
2240	280	2730	0,1	0,18	28-1 m	79	18
2500	280	2730	0,2	0,18	27-1 m	79	18
2800	315	2730	0,2	0,25	28-1 m	80	21
3150	355	2730	0,2	0,25	28-1 m	80	17
3550	355	2730	0,2	0,25	29-1 m	81	17
4000	355	2751	0,2	0,37	29-1 m	81	17
4500	400	2751	0,2	0,37	27-1 m	79	18
5000	450	1379	0,2	0,37	24-1 m	76	24
5600	450	1379	0,3	0,37	25-1 m	77	24
6300	4500	1379	0,3	0,55	25-1 m	78	26
7100	500	1379	0,4	0,55	26-1 m	79	32
8000	500	1397	0,4	0,55	27-1 m	79	32
9000	500	1397	0,4	0,55	30-1 m	81	32
10000	560	1399	0,5	0,75	32-1 m	82	39
11200	560	1399	0,6	0,75	33-1 m	83	39
12500	630	1399	0,7	1,1	33-1 m	83	49
14000	630	1399	0,8	1,1	33-1 m	83	49
16000	710	1405	1,0	1,1	33-1 m	83	58
18000	710	1405	1,0	1,1	33-1 m	82	58
20000	900	936	1,0	1,5	33-1 m	82	145
22400	900	936	1,1	1,5	34-1 m	82	145
25000	900	936	1,3	1,5	35-1 m	83	145
28000	1000	697	1,4	1,5	35-1 m	83	191
31500	1000	706	1,6	2,2	35-1 m	83	210
35500	1000	708	2,0	2,2	37-1 m	85	210
40000	1000	708	2,3	3,0	38-1 m	86	223
45000	1120	708	2,6	3,0	37-1 m	86	317
50000	1120	708	2,8	4,0	37-1 m	85	352
55000	1250	719	3,3	4,0	38-1 m	86	426
63000	1250	719	3,7	5,5	39-1 m	87	430

Gesamtdruck /Total pressure 160 Pa							
Volumen-strom	Ventilator-größe	Dreh-zahl	Wellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
Volume-flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
800	250	2730	0,1	0,18	21-1 m	74	13
900	250	2730	0,1	0,18	22-1 m	75	13
1000	250	2730	0,1	0,18	22-1 m	75	13
1120	250	2730	0,1	0,18	23-1 m	76	13
1250	250	2730	0,1	0,18	24-1 m	77	13
1400	250	2730	0,1	0,18	25-1 m	78	13
1600	250	2730	0,1	0,18	26-1 m	78	13
1800	250	2730	0,1	0,18	27-1 m	79	13
2000	250	2730	0,1	0,18	28-1 m	79	13
2240	250	2730	0,2	0,25	29-1 m	81	14
2500	250	2730	0,3	0,37	29-1 m	82	14
2800	280	2730	0,3	0,37	30-1 m	82	19
3150	315	2751	0,2	0,37	30-1 m	82	21
3550	315	2751	0,3	0,37	31-1 m	83	21
4000	315	2788	0,3	0,37	32-1 m	84	21
4500	315	2786	0,3	0,55	32-1 m	84	23
5000	400	2788	0,4	0,55	31-1 m	83	20
5600	400	2788	0,4	0,55	30-1 m	82	20
6300	450	1397	0,5	0,55	29-1 m	81	26
7100	450	1397	0,5	0,75	29-1 m	81	27
8000	500	1399	0,5	0,75	29-1 m	80	33
9000	500	1399	0,6	0,75	30-1 m	82	33
10000	560	1399	0,6	0,75	31-1 m	83	39
11200	560	1399	0,7	1,1	32-1 m	83	42
12500	630	1405	0,8	1,1	33-1 m	83	49
14000	630	1405	0,9	1,1	33-1 m	83	49
16000	710	936	0,9	1,1	32-1 m	82	62
18000	710	936	1,0	1,5	34-1 m	83	44
20000	800	936	1,1	1,5	35-1 m	83	115
22400	800	936	1,4	2,2	36-1 m	84	132
25000	800	941	1,7	2,2	37-1 m	85	132
28000	900	941	1,8	2,2	37-1 m	86	162
31500	900	953	2,0	3,0	37-1 m	87	183
35500	1000	953	2,1	3,0	37-1 m	86	210
40000	1120	708	2,3	3,0	37-1 m	85	317
45000	1120	708	2,8	4,0	38-1 m	87	352
50000	1120	719	3,4	4,0	38-1 m	88	352
55000	1120	719	3,7	5,5	39-1 m	89	430
63000	1250	720	4,1	5,5	39-1 m	89	430

Bezugsdaten: Dichte= 1,2 kg/m³

Reference: Density = 1,2 kg/m³

Umrechnungsfaktoren/Conversion factors

Druck/Pressure: 1 Pa=0.01 mbar=0.102 mm=1.4504 x 10^{-4} Psi=9.869 x 10^{-6} atm=4.02 x 10^{-3} in WG

Volumenstrom/Volume flow rate: 1 m^3/h=2.777 x 10^{-4} m^3/s=0.588 cfm=4.4029 gpm

Kraftbedarf/Power: 1 kW=1.341 HP=1.360 PS=1000 Nm/s=0.24 kcal/s

Bemerkungen:

1.) Die hier getroffene Auswahl ist nur ein kleiner Teil der möglichen Ventilatoren. Andere Drehzahlen, niedrigerer Schalldruck oder besserer Wirkungsgrad kann in den meisten Fällen realisiert werden.

2.) Gestörte Anströmungs- und Austrittverhältnisse sind nicht berücksichtigt.

3.) Eine endgültige Auswahl sollte mit einem unserer Verkeufsingenieure abgestimmt werden.

Remarks:

1.) The shown selection only represents a small part of the possible fans for each working point. Other fan speeds, lower sound pressure or better efficiency can in most cases be selected.

2.) Disturbed inlet and outlet conditions have not been considered.

3.) A final selection should be discussed with one of our sales engineers.

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WITT&SOHN Ventilatoren

Axial-Ventilatoren
Typenauswahltabellen

Axial Flow Fans
Fan Selection Tables

Direktantrieb /Direct Drive 50 Hz

Gesamtdruck /Total pressure 200 Pa

Volumenstrom	Ventilatorgröße	Drehzahl	Wellenleistung	Motorleistung	Schalldruck	Schallpegel	Gesamtmasse
Volume flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m³/h	DN	min⁻¹	kW	kW	dB(A)	dB(A)	kg
1000	250	2730	0,1	0,18	25-1 m	78	13
1120	250	2730	0,1	0,18	25-1 m	78	13
1250	250	2730	0,1	0,18	25-1 m	78	13
1400	250	2730	0,1	0,18	26-1 m	79	13
1600	250	2730	0,1	0,18	27-1 m	80	13
1800	250	2730	0,2	,18	28-1 m	81	13
2000	250	2730	0,2	0,25	28-1 m	81	14
2240	250	2730	0,2	0,25	29-1 m	82	14
2500	250	2751	0,3	0,37	29-1 m	82	14
2800	280	2751	0,3	0,37	29-1 m	82	19
3150	315	2788	0,3	0,37	28-1 m	81	21
3550	315	2788	0,3	0,37	30-1 m	83	21
4000	315	2788	0,4	0,55	32-1 m	85	23
4500	355	2788	0,4	0,55	33-1 m	86	19
5000	355	2798	0,4	0,55	34-1 m	86	19
5600	400	2798	0,5	0,75	35-1 m	87	22
6300	400	2826	0,6	0,75	36-1 m	88	22
7100	450	2826	0,6	0,75	36-1 m	88	26
8000	500	1386	0,6	0,75	30-1 m	87	33
9000	500	1386	0,7	1,1	34-1 m	85	36
10000	560	1405	0,8	1,1	33-1 m	83	42
11200	560	1405	0,9	1,1	34-1 m	84	42
12500	560	1409	1,0	1,5	34-1 m	84	46
14000	630	1409	1,1	1,5	35-1 m	86	53
16000	630	1409	1,3	1,5	35-1 m	87	53
18000	710	1409	1,4	2,2	36-1 m	86	68
20000	800	941	1,6	2,2	36-1 m	85	132
22400	800	941	1,8	2,2	38-1 m	86	132
25000	800	953	2,0	3,0	39-1 m	87	153
28000	900	953	2,2	3,0	38-1 m	88	183
31500	900	953	2,4	3,0	37-1 m	88	183
35500	1000	953	2,8	4,0	38-1 m	89	218
40000	1000	954	3,1	4,0	38-1 m	89	218
45000	1120	954	3,6	4,0	39-1 m	89	312
50000	1120	720	4,2	5,5	40-1 m	88	356
55000	1250	720	4,7	5,5	42-1 m	90	430
63000	1250	720	5,3	7,5	43-1 m	91	451
71000	1400	720	5,9	7,5	44-1 m	92	548
80000	1400	720	6,6	11,0	44-1 m	92	588
90000	1400	720	8,2	11,0	45-1 m	92	588
100000	1600	724	10,7	15,0	45-1 m	93	812

Gesamtdruck /Total pressure 250 Pa

Volumenstrom	Ventilatorgröße	Drehzahl	Wellenleistung	Motorleistung	Schalldruck	Schallpegel	Gesamtmasse
Volume-flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m³/h	DN	min⁻¹	kW	kW	dB(A)	dB(A)	kg
1000							
1120							
1250	250	2730	0,1	0,18	27-1 m	80	13
1400	250	2730	0,2	0,25	28-1 m	81	14
1600	250	2730	0,2	0,25	28-1 m	81	14
1800	280	2730	0,2	0,37	29-1 m	82	19
2000	315	2751	0,2	0,37	30-1 m	82	21
2240	315	2751	0,3	0,37	30-1 m	82	21
2500	315	2788	0,3	0,37	30-1 m	82	21
2800	315	2788	0,3	0,55	31-1m	83	23
3150	315	2788	0,3	0,55	31-1 m	82	23
3550	315	2788	0,4	0,55	32-1 m	84	23
4000	315	2798	0,4	0,55	32-1 m	84	23
4500	355	2798	0,5	0,75	34-1 m	86	21
5000	355	2826	0,6	0,75	36-1 m	88	21
5600	400	2826	0,6	0,75	36-1 m	88	22
6300	400	2826	0,7	1,1	35-1 m	87	23
7100	450	2826	0,7	1,1	35-1 m	86	27
8000	560	1405	0,8	1,1	34-1 m	84	42
9000	560	1405	0,8	1,1	35-1 m	85	42
10000	560	1409	0,9	1,1	36-1 m	86	42
11200	560	1409	1,1	1,5	37-1 m	87	46
12500	560	1409	1,2	1,5	38-1 m	88	46
14000	630	1409	1,3	2,2	37-1 m	87	59
16000	710	941	1,5	2,2	36-1 m	85	85
18000	710	941	1,6	2,2	37-1 m	86	85
20000	800	953	1,8	2,2	37-1 m	86	132
22400	800	953	2,2	3,0	39-1 m	87	153
25000	800	953	2,6	3,0	40-1 m	88	153
28000	900	953	2,7	4,0	41-1 m	89	191
31500	900	954	2,9	4,0	41-1 m	89	191
35500	1000	954	3,2	4,0	42-1 m	90	218
40000	1000	949	3,5	5,5	43-1 m	91	223
45000	1120	949	4,2	5,5	44-1 m	92	317
50000	1120	965	4,9	7,5	44-1 m	92	356
55000	1250	965	5,7	7,5	45-1 m	93	430
63000	1250	965	6,5	7,5	45-1 m	93	430
71000	1400	965	7,0	11,0	45-1 m	93	548
80000	1400	724	7,5	11,0	44-1 m	92	588
90000	1400	726	9,0	15,0	45-1 m	93	669
100000	1400	726	10,4	15,0	47-1 m	95	669

Bezugsdaten: Dichte= 1.2 kg/m³ **Reference:** Density = 1.2 kg/m³

Umrechnungsfaktoren/Conversion factors

Druck/Pressure: 1 Pa=0.01 mbar=0.102 mm=1.4504 x 10^{-4} Psi=9.869 x 10^{-6} atm=4.02 x 10^{-3} in WG

Volumenstrom/Volume flow rate: 1 m³/h=2.777 x 10^{-4} m³/s=0.588 cfm=4.4029 gpm

Kraftbedarf/Power: 1 kW=1.341 HP=1.360 PS=1000 Nm/s=0.24 kcal/s

Bemerkungen:

1.) Die hier getroffene Auswahl ist nur ein kleiner Teil der möglichen Ventilatoren. Andere Drehzahlen, niedrigerer Schalldruck oder besserer Wirkungsgrad kann in den meisten Fällen realisiert werden.

2.) Gestörte Anströmungs- und Austrittsverhältnisse sind nicht berücksichtigt.

3.) Eine endgültige Auswahl sollte mit einem unserer Verkaufsingenieure abgestimmt werden.

Remarks:

1.) The shown selection only represents a small part of the possible fans for each working point. Other fan speeds, lower sound pressure or better efficiency can in most cases be selected.

2.) Disturbed inlet and outlet conditions have not been considered.

3.) A final selection should be discussed with one of our sales engineers.

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WITT&SOHN Ventilatoren

Axial-Ventilatoren
Typenauswahltabellen

Axial Flow Fans
Fan Selection Tables

Direktantrieb /Direct Drive 50 Hz

Gesamtdruck /Total pressure 316 Pa							
Volumen-strom	Ventilator-größe	Dreh-zahl	Wellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
Volume flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
1600	280	2751	0,2	0,37	32-1 m	84	19
1800	280	3751	0,3	0,37	32-1 m	84	19
2000	280	2788	0,3	0,37	32-1 m	84	19
2240	315	2788	0,3	0,37	33-1 m	85	21
2500	315	2788	0,3	0,37	33-1 m	85	21
2800	315	2788	0,4	0,55	34-1 m	86	23
3150	315	2798	0,4	0,55	34-1 m	86	23
3550	315	2798	0,5	0,55	35-1 m	87	23
4000	315	2826	0,5	0,75	35-1 m	87	25
4500	355	2826	0,6	0,75	35-1 m	87	21
5000	3355	2826	0,6	0,75	35-1 m	87	21
5600	400	2826	0,7	1,1	36-1 m	88	23
6300	400	2827	0,8	1,1	36-1 m	88	23
7100	450	2827	0,9	1,1	37-1 m	89	27
8000	450	2838	1,1	1,5	38-1 m	90	30
9000	500	2838	1,2	1,5	39-1 m	91	36
10000	560	2838	1,3	1,5	40-1 m	92	42
11200	560	2838	1,5	2,2	41-1 m	92	46
12500	560	2842	1,7	2,2	42-1 m	92	46
14000	630	2842	1,9	2,2	41-1 m	91	53
16000	630	1413	2,0	3,0	39-1 m	89	60
18000	710	1413	2,1	3,0	40-1 m	90	69
20000	710	1413	2,2	3,0	41-1 m	91	69
22400	800	1413	2,7	3,0	43-1 m	91	116
25000	900	1424	3,1	4,0	45-1 m	93	169
28000	900	1424	3,4	4,0	44-1 m	92	169
31500	900	949	3,6	5,5	42-1 m	90	196
35500	1000	949	4,4	5,5	45-1 m	93	223
40000	1000	965	4,5	5,5	47-1 m	95	223
45000	1120	965	5,2	7,5	48-1 m	96	356
50000	1120	965	5,9	7,5	49-1 m	97	356
55000	1250	965	7,6	11,0	48-1 m	96	450
63000	1250	965	7,8	11,0	47-1 m	95	451
71000	1400	965	9,0	11,0	48-1 m	96	548
80000	1400	970	10,2	15,0	48-1 m	96	588
90000	1600	726	11,0	15,0	47-1 m	95	812
10000	1600	726	11,8	15,0	47-1 m	95	812

Gesamtdruck /Total pressure 400 Pa							
Volumen-strom	Ventilator-größe	Dreh-zahl	Wellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
Volume-flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
1600							
1800							
2000	280	2788	0,4	0,55	34-1 m	86	21
2240	280	2788	0,4	0,55	35-1 m	87	21
2500	315	2798	0,4	0,55	36-1 m	88	23
2800	315	2798	0,5	0,55	36-1 m	88	23
3150	315	2826	0,6	0,75	36-1 m	88	25
3550	315	2826	0,6	0,75	37-1 m	89	25
4000	315	2826	0,7	1,1	37-1 m	89	26
4500	355	2826	0,7	1,1	37-1 m	89	22
5000	355	2827	0,8	1,1	36-1 m	88	22
5600	400	2827	0,9	1,1	37-1 m	89	23
6300	400	2838	0,9	1,1	38-1 m	90	23
7100	450	2838	1,1	1,5	40-1 m	92	30
8000	450	2838	1,3	1,5	41-1 m	93	30
9000	450	2838	1,4	2,2	41-1 m	93	34
10000	500	2842	1,6	2,2	40-1 m	92	40
11200	500	2842	1,8	2,2	41-1 m	92	40
12500	560	1413	1,9	3,0	41-1 m	91	53
14000	560	1413	2,2	3,0	42-1 m	92	53
16000	630	1413	2,5	3,0	42-1 m	92	60
18000	630	1413	2,9	4,0	43-1 m	93	83
20000	710	1424	3,3	4,0	43-1 m	93	92
22400	710	1424	3,4	4,0	44-1 m	93	92
25000	800	1438	3,4	4,0	45-1 m	93	139
28000	800	1438	4,0	5,5	46-1 m	94	147
31500	900	1441	4,7	5,5	47-1 m	95	177
35500	1000	1441	5,5	7,5	50-1 m	96	220
40000	1120	1441	6,4	7,5	52-1 m	97	314
45000	1120	1441	6,7	7,5	50-1 m	96	314
50000	1120	965	7,0	11,0	47-1 m	95	377
55000	1250	965	8,4	11,0	48-1 m	96	451
63000	1250	970	9,8	15,0	49-1 m	97	491
71000	1400	970	10,9	15,0	50-1 m	98	588
80000	1400	970	12,0	15,0	50-1 m	98	588
90000	1600	729	13,1	15,0	49-1 m	97	812
100000	1600	729	14,5	22,0	49-1 m	97	916

Bezugsdaten: Dichte= 1.2 kg/m³
Umrechnungsfaktoren/Conversion factors
Druck/Pressure: 1 Pa=0.01 mbar=0.102 mm=1.4504 x 10^{-4} Psi=9.869 x 10^{-6} atm=4.02 x 10^{-3} In WG
Volumenstrom/Volume flow rate: 1 m^3/h=2.777 x 10^{-4} m^3/s=0.588 cfm=4.4028 gpm
Kraftbedarf/Power: 1 kW=1.341 HP=1.360 PS=1000 Nm/s=0.24 kcal/s

Reference: Density = 1.2 kg/m³

Bemerkungen:
1.) Die hier getroffene Auswahl ist nur ein kleiner Teil der möglichen Ventilatoren. Andere Drehzahlen, niedrigerer Schalldruck oder besserer Wirkungsgrad kann in den meisten Fällen realisiert werden.
2.) Gestörte Anströmungs- und Austrittsverhältnisse sind nicht berücksichtigt.
3.) Eine endgültige Auswahl sollte mit einem unserer Verkaufsingenieure abgestimmt werden.

Remarks:
1.) The shown selection only represents a small part of the possible fans for each working point. Other fan speeds, lower sound pressure or better efficiency can in most cases be selected.
2.) Disturbed inlet and outlet conditions have not been considered.
3.) A final selection should be discussed with one of our sales engineers.

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WITT&SOHN Ventilatoren

Axial-Ventilatoren
Typenauswahltabellen

Axial Flow Fans
Fan Selection Tables

Direktantrieb /Direct Drive 50 Hz

Gesamtdruck /Total pressure 500 Pa							
Volumen-strom	Ventilator-größe	Dreh-zahl	Wellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
Volume flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
2500	315	2826	0,6	0,75	37-1 m	89	25
2800	315	2826	0,6	0,75	38-1 m	90	25
3150	315	2826	0,7	1,1	38-1 m	90	26
3550	355	2826	0,8	1,1	39-1 m	91	22
4000	355	2827	0,8	1,1	39-1 m	91	22
4500	355	2827	0,9	1,1	40-1 m	92	22
5000	355	2838	1,0	1,5	40-1 m	92	25
5600	400	2838	1,1	1,5	41-1 m	93	26
6300	400	2838	1,2	1,5	41-1 m	93	26
7100	450	2838	1,4	1,5	41-1 m	93	30
8000	450	2842	1,6	2,2	41-1 m	93	34
9000	500	2842	1,8	2,2	42-1 m	94	40
10000	500	2863	2,0	3,0	43-1 m	95	46
11200	560	2863	2,2	3,0	45-1 m	96	52
12500	560	2863	2,5	3,0	46-1 m	96	52
14000	630	2863	2,7	4,0	45-1 m	95	76
16000	630	1424	3,0	4,0	43-1 m	94	83
18000	710	1424	3,5	4,0	44-1 m	95	92
20000	710	1438	4,1	5,5	45-1 m	95	100
22400	800	1438	4,3	5,5	46-1 m	95	147
25000	800	1441	4,4	5,5	47-1 m	95	147
28000	900	1441	5,0	5,5	48-1 m	96	177
31500	900	1441	5,5	7,5	48-1 m	96	193
35500	1000	1441	6,3	7,5	49-1 m	97	220
40000	1000	965	7,2	11,0	45-1 m	96	283
45000	1120	970	8,4	11,0	47-1 m	97	377
50000	1120	970	9,1	11,0	49-1 m	97	377
55000	1250	970	10,5	15,0	51-1 m	98	491
63000	1250	970	11,2	15,0	50-1 m	98	491
71000	1400	970	13,3	15,0	51-1 m	99	588
80000	1400	973	15,5	18,5	52-1 m	100	673
90000	1600	973	17,0	22,0	52-1 m	100	836
100000	1600	733	18,6	22,0	51-1 m	99	836

Gesamtdruck /Total pressure 600 Pa							
Volumen-strom	Ventilator-größe	Dreh-zahl	Wellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
Volume-flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
2500							
2800							
3150	315	2827	1,0	1,5	49-1 m	101	28
3550	315	2827	1,0	1,5	48-1 m	100	28
4000	355	2838	1,1	1,5	47-1 m	99	25
4500	355	2838	1,2	1,5	45-1 m	97	25
5000	355	2838	1,3	1,5	42-1 m	94	25
5600	400	2838	1,4	2,2	43-1 m	95	30
6300	400	2842	1,5	2,2	43-1 m	95	30
7100	400	2842	1,7	2,2	44-1 m	96	30
8000	450	2863	1,8	2,2	44-1 m	96	34
9000	500	2863	2,1	3,0	44-1 m	96	46
10000	500	2863	2,3	3,0	44-1 m	96	46
11200	560	2863	2,7	40	46-1 m	97	69
12500	560	2871	3,1	4,0	47-1 m	97	69
14000	630	2871	3,3	4,0	47-1 m	97	76
16000	710	1438	3,5	4,0	46-1 m	98	92
18000	710	1436	4,2	7,5	471 m	97	116
20000	710	1441	4,9	7,5	47-1 m	97	116
22400	800	1441	5,3	75	47-1 m	98	163
25000	800	1441	5,7	7,5	47-1 m	98	163
28000	800	1441	6,6	7,5	49-1 m	99	163
31500	900	1458	7,4	11,0	51-1 m	99	235
35500	900	1458	8,0	11,0	51-1 m	99	235
40000	1000	1459	8,6	11,0	51-1 m	99	262
45000	1000	1459	10,6	15,0	51-1 m	99	283
50000	1120	970	12,6	15,0	51-1 m	99	417
55000	1120	970	13,3	15,0	52-1 m	100	417
63000	1250	973	14,1	18,5	52-1 m	100	576
71000	1400	973	16,3	18,5	53-1 m	101	673
80000	1400	977	18,4	22,0	53-1 m	101	693
90000	1600	977	20,8	30,0	54-1 m	102	906
100000	1600	977	23,1	30,0	54-1 m	102	906

Bezugsdaten: Dichte= 1.2 kg/m³
Umrechnungsfaktoren/Conversion factors
Druck/Pressure: 1 Pa=0.01 mbar=0,102 mm=1.4504 x 10^{-4} Psi=9.868 x 10^{-6} atm=4.02 x 10^{-3} in WG
Volumenstrom/Volume flow rate: 1 m^3/h=2.777 x 10^{-4} m^3/s=0.588 cfm=4.4029 gpm
Kraftbedarf/Power: 1 kW=1.341 HP=1.360 PS=1000 Nm/s=0.24 kcal/s

Bemerkungen:
1.) Die hier getroffene Auswahl ist nur ein kleiner Teil der möglichen Ventilatoren. Andere Drehzahlen, niedrigerer Schalldruck oder besserer Widungsgrad kann in den meisten Fällen realisiert werden.
2.) Gestörte Anströmungs- und Austrittsverhältnisse sind nicht berücksichtigt.
3.) Eine endgültige Auswahl sollte mit einem unserer Verkaufsingenieure abgestimmt werden.

Reference: Density = 1.2 kg/m³

Remarks:
1.) The shown selection only represents a small part of the possible fans for each working point. Other fan speeds, lower sound pressure or better efficiency can in most cases be selected.
2.) Disturbed inlet and outlet conditions have not been considered.
3.) A final selection should be discussed with one of our sales engineers.

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WITT&SOHN IGW Ventilatoren

Axial-Ventilatoren
Typenauswahltabellen

Axial Flow Fans
Fan Selection Tables

Direktantrieb /Direct Drive 50 Hz

Gesamtdruck /Total pressure 900 Pa

Volumenstrom	Ventilatorgröße	Drehzahl	Wellenleistung	Motorleistung	Schalldruck	Schallpegel	Gesamtmasse
Volume flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
4000	500	2838	1,5	2,3	51-1 m	103	40
4500	500	2838	1,7	2,2	51-1 m	104	40
5000	500	2842	1,8	2,2	52-1 m	104	40
5600	450	2842	1,9	2,2	49-1 m	101	34
6300	400	2863	2,1	3,0	45-1 m	97	36
7100	450	2883	2,3	3,0	46-1 m	98	40
8000	450	2863	2,5	3,0	46-1 m	98	40
9000	500	2863	2,8	4,0	46-1 m	98	63
10000	500	2871	3,0	4,0	46-1 m	98	63
11200	560	2871	3,4	4,0	48-1 m	99	69
12500	560	2892	3,7	5,5	50-1 m	100	84
14000	630	2892	4,7	5,5	50-1 m	100	91
16000	710	1441	5,7	7,5	49-1 m	99	116
18000	710	1441	6,1	7,5	51-1 m	100	116
20000	800	1441	6,4	7,5	52-1 m	100	163
22400	800	1441	7,1	11,0	51-1 m	100	205
25000	800	1458	7,8	11,0	49-1 m	100	205
28000	900	1458	8,3	11,0	50-1 m	101	235
31500	900	1459	8,7	11,0	50-1 m	101	235
35500	1000	1459	10,0	15,0	52-1 m	101	283
40000	1000	1459	11,4	15,0	53-1 m	101	283
45000	1120	1459	13,4	15,0	54-1 m	102	377
50000	1120	1464	15,5	18,5	55-1 m	103	397
55000	1250	1464	16,9	18,5	55-1 m	103	471
63000	1250	977	18,3	22,0	54-1 m	102	596
71000	1400	977	20,4	30,0	54-0 m	102	763
80000	1400	977	22,8	30,0	54-1 m	102	763
90000	1600	977	25,1	30,0	55-1 m	103	906
100000	1600	979	27,6	37,0	56-1 m	104	1001

Gesamtdruck /Total pressure 1000 Pa

Volumenstrom	Ventilatorgröße	Drehzahl	Wellenleistung	Motorleistung	Schalldruck	Schallpegel	Gesamtmasse
Volume-flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
4000							
4500							
5000	500	2863	2,4	3,0	54-1 m	106	46
5600	500	2863	2,4	3,0	51-1 m	103	46
6300	450	2863	2,5	3,0	47-1 m	99	40
7100	450	2863	2,9	4,0	48-1 m	100	57
8000	450	2871	3,3	4,0	48-1 m	100	57
9000	450	2871	3,5	4,0	49-1 m	101	57
10000	500	2892	3,6	5,5	49-1 m	101	78
11200	560	2892	4,0	5,5	51-1 m	102	84
12500	560	2900	4,3	5,5	52-1 m	102	84
14000	630	2900	5,5	7,5	56-1 m	105	94
16000	710	1441	6,7	11,0	59-1 m	107	158
18000	710	1441	7,6	11,0	55-1 m	104	158
20000	800	1458	8,6	11,0	50-1 m	101	205
22400	800	1458	8,7	11,0	51-1 m	102	205
25000	900	1459	8,8	11,0	51-1 m	102	235
28000	900	1459	10,5	15,0	53-1 m	103	256
31500	900	1459	12,1	15,0	55-1 m	103	256
35500	1000	1459	13,4	18,5	56-1 m	104	303
40000	1120	1464	14,7	18,5	56-1 m	104	397
45000	1120	1464	16,3	18,5	56-1 m	104	397
50000	1120	1469	18,0	22,0	56-1 m	104	417
55000	1250	1469	21,1	30,0	56-1 m	104	568
63000	1250	977	24,3	30,0	56-1 m	104	666
71000	1400	977	26,5	30,0	57-1 m	105	763
80000	1400	979	28,7	37,0	57-1 m	105	858
90000	1600	979	32,4	37,0	58-1 m	106	1001
100000	1600	981	36,0	45	58-1 m	106	1216

Bezugsdaten: Dichte= 1.2 kg/m³
Umrechnungsfaktoren/Conversion factors
Druck/Pressure: 1 Pa=0.01 mbar=0.102 mm=1.4504 x 10^{-4} Psi=9.869 x 10^{-6} atm=4.02 x 10^{-3} in WG
Volumenstrom/Volume flow rate: 1 m^3/h=2.777 x 10^{-4} m^3/s=0.588 cfm=4.4029 gpm
Kraftbedarf/Power: 1 kW=1.341 HP=1.360 PS=1000 Nm/s=0.24 kcal/s

Reference: Density = 1.2 kg/m³

Bemerkungen:
1.) Die hier getroffene Auswahl ist nur ein kleiner Teil der möglichen Ventilatoren. Andere Drehzahlen, niedrigerer Schalldruck oder besserer Wirkungsgrad kann in den meisten Fällen realisiert werden.
2.) Gestörte Anströmungs- und Austrittsverhältnisse sind nicht berücksichtigt.
3.) Eine endgültige Auswahl sollte mit einem unserer Verkaufsingenieure abgestimmt werden.

Remarks:
1.) The shown selection only represents a small part of the possible fans for each working point. Other fan speeds, lower sound pressure or better efficiency can in most cases be selected.
2.) Disturbed inlet and outlet conditions have not been considered.
3.) A final selection should be discussed with one of our sales engineers.

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WITT&SOHN
Witt Ventilatoren

Axial-Ventilatoren
Typenauswahltabellen

Axial Flow Fans
Fan Selection Tables

Direktantrieb /Direct Drive 50 Hz

Gesamtdruck /Total pressure 1200 Pa							
Volumen-strom	Ventilator-größe	Dreh-zahl	Wellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
Volume flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
5000	500	2863	3,8	5,5	58-1 m	107	78
5600	560	2863	4,2	5,5	56-1 m	109	84
6300	560	2871	4,6	5,5	54-1 m	110	84
7100	500	2871	4,6	5,5	53-1 m	107	78
8000	450	2892	4,7	5,5	51-1 m	103	72
9000	500	2892	4,7	5,5	52-1 m	103	78
10000	500	2900	4,8	5,5	53-1 m	103	84
11200	560	2900	5,6	7,5	54-1 m	104	87
12500	560	2900	6,4	7,5	55-1 m	105	87
14000	630	2900	6,8	7,5	55-1 m	105	94
16000	630	2921	7,2	11,0	55-1 m	105	145
18000	710	2921	9,2	11,0	59-1 m	108	154
20000	710	1459	11,3	15,0	63-1 m	111	179
22400	800	1459	12,0	15,0	58-1 m	108	226
25000	800	1459	12,7	15,0	53-1 m	104	226
28000	900	1459	14,0	18,5	54-1 m	105	276
31500	900	1464	15,3	18,5	55-1 m	106	276
35500	1000	1464	16,6	22,0	55-1 m	106	323
40000	1000	1469	18,0	22,0	55-1 m	106	323
45000	1120	1469	20,5	30,5	57-1 m	107	494
50000	1120	1469	22,9	30,0	59-1 m	107	494
55000	1250	1469	25,8	30,0	60-1 m	108	568
63000	1250	1474	28,3	37,0	60-1 m	108	636
71000	1400	1474	32,8	37,0	60-1 m	108	733
80000	1400	981	37,2	45,0	59-1 m	107	1073
90000	1400	981	39,5	45,0	60-1 m	108	1073
100000	1400	981	41,9	55,0	61-1 m	109	1143

Gesamtdruck /Total pressure 1600 Pa							
Volumen-strom	Ventilator-größe	Dreh-zahl	Wellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
Volume-flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
5000							
5600							
6300							
7100							
8000	560	2900	7,0	11,0	60-1 m	110	138
9000	500	2900	7,0	11,0	57-1 m	108	132
10000	500	2900	7,1	11,0	54-1 m	106	132
11200	500	2900	7,5	11,0	52-1 m	106	132
12500	560	2921	7,8	11,0	50-1 m	106	138
14000	560	2921	8,8	11,0	54-1 m	107	138
16000	630	2927	9,9	15,0	57-1 m	107	147
18000	630	2927	11,4	15,0	55-1 m	108	147
20000	630	2927	12,9	15,0	53-1 m	109	147
22400	710	2927	14,6	18,5	54-1 m	110	179
25000	800	2931	16,3	22,0	54-1 m	110	246
28000	1000	2931	18,7	22,0	60-1 m	112	303
31500	1120	1469	21,1	30,0	66-1 m	114	494
35500	1120	1469	22,8	30,0	66-1 m	114	494
40000	1120	1469	24,4	30,0	65-1 m	113	494
45000	1120	1469	28,2	37,0	64-1 m	112	562
50000	1120	1474	31,9	37,0	62-1 m	110	562
55000	1120	1474	34,7	45,0	61-1 m	110	612
63000	1120	1474	37,5	45,0	60-1 m	110	612
71000	1250	1474	41,8	55,0	61-1 m	111	766
80000	1250	1478	46,1	55,0	61-1 m	111	766
90000	1400	1478	57,3	75,0	61-1 m	111	1043
100000	1400	1478	68,4	90,0	60-1 m	110	1123

Bezugsdaten: Dichte= 1.2 kg/m³
Umrechnungsfaktoren/Conversion factors
Druck/Pressure: 1 Pa=0.01 mbar=0,102 mm=1.4504 x 10^{-4} Psi=9.869 x 10^{-6} atm=4.02 x 10^{-3} in WG
Volumenstrom/Volume flow rate: 1 m^3/h=2.777 x 10^{-4} m^3/s=0.588 cfm=4.4029 gpm
Kraftbedarf/Power: 1 kW=1.341 HP=1.360 PS=1000 Nm/s=0.24 kcal/s

Bemerkungen:
1.) Die hier getroffene Auswahl ist nur ein kleiner Teil der möglichen Ventilatoren. Andere Drehzahlen, niedrigerer Schalldruck oder besserer Wirkungsgrad kann in den meisten Fällen realisiert werden.
2.) Gestörte Anströmungs- und Austrittverhältnisse sind nicht berücksichtigt.
3.) Eine endgültige Auswahl sollte mit einem unserer Verkaufsingenieure abgestimmt werden.

Reference: Density = 1.2 kg/m³

Remarks:
1.) The shown selection only represents a small part of the possible fans for each working point. Other fan speeds, lower sound pressure or better efficiency can in most cases be selected.
2.) Disturbed inlet and outlet conditions have not been considered.
3.) A final selection should be discussed with one of our sales engineers.

Axial-Ventilatoren
Typenauswahltabellen

Axial Flow Fans
Fan Selection Tables

irektantrieb / irect ri e 60 z

Gesamtdruck /Total pressure 120 Pa							
olumen-strom	entilator-größe	reh-zahl	ellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
olume flow rate	an size	Speed	Shaft power	Motor power	Sound pressure	Sound power	otal mass
m^3/h		min^{-1}	k	k	d ( )	d ( )	kg
1000							
1120	250	3276	0,1	0,22	23-1m	76	13
1250	250	1619	0,1	0,15	21-1m	72	18
1400	280	1619	0,1	0,15	20-1m	72	18
1600	315	1619	0,1	0,15	20-1m	72	20
1800	315	1619	0,1	0,15	21-1m	73	20
2000	355	1619	0,1	0,15	21-1m	73	16
2240	355	1619	0,1	0,15	22-1m	74	16
2500	400	1619	0,1	0,15	21-1m	73	17
2800	400	1619	0,1	0,15	22-1m	74	17
3150	450	1619	0,1	0,21	23-1m	75	21
3550	450	1646	0,2	0,21	23-1m	75	21
4000	500	1646	0,2	0,21	24-1m	76	27
4500	500	1646	0,2	0,30	25-1m	76	28
5000	560	1096	0,2	0,30	25-1m	75	35
5600	560	1096	0,3	0,30	26-1m	76	35
6300	630	1096	0,3	0,45	26-1m	76	44
7100	630	1096	0,3	0,45	27-1m	77	44
8000	710	1096	0,4	0,45	28-1m	78	53
9000	710	1096	0,4	0,45	28-1m	78	53
10000	800	830	0,4	0,66	26-1m	77	109
11200	800	830	0,5	0,66	27-1m	78	109
12500	900	830	0,6	0,66	27-1m	78	139
14000	900	829	0,6	0,90	28-1m	79	145
16000	1000	829	0,8	0,90	28-1m	79	172
18000	1000	829	0,8	1,3	32-1m	80	173
20000	1120	708	0,9	1,3	31-1m	80	267
22400	1120	708	1,0	1,3	31-1m	80	267
25000	1250	586	1,1	1,3	32-1m	80	341
28000	1250	586	1,2	1,8	32-1m	81	359
31500	1400	586	1,4	1,8	33-1m	81	456
35500	1400	586	1,7	2,6	33-1m	82	475
40000	1400	586	1,9	2,6	34-1m	82	475
45000	1400	586	2,2	2,6	34-1m	83	475
50000	1600	586	2,5	3,6	35-1m	83	631
55000	1600	586	2,7	3,6	36-1m	84	631
63000	1600	586	3,3	4,8	37-1m	85	666

Gesamtdruck /Total pressure 160 Pa							
olumen-strom	entilator-größe	reh-zahl	ellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
olume-flow rate	an size	Speed	Shaft power	Motor power	Sound pressure	Sound power	otal mass
m^3/h		min^{-1}	k	k	d ( )	d ( )	kg
1000	250	3276	0,1	0,22	23-1m	76	13
1120	250	3276	0,1	0,22	24-1m	77	13
1250	250	3276	0,1	0,22	24-1m	77	13
1400	280	3276	0,1	0,22	26-1m	78	18
1600	280	3276	0,1	0,22	27-1m	79	18
1800	315	1619	0,1	0,15	23-1m	75	20
2000	315	1619	0,1	0,21	24-1m	76	20
2240	355	1619	0,1	0,21	24-1m	76	16
2500	355	1619	0,2	0,21	24-1m	77	16
2800	400	1648	0,2	0,21	25-1m	77	18
3150	400	1648	0,2	0,21	26-1m	77	18
3550	450	1655	0,2	0,30	25-1m	77	22
4000	450	1655	0,2	0,30	26-1m	78	22
4500	500	1655	0,3	0,30	26-1m	76	26
5000	500	1655	0,3	0,44	27-1m	79	28
5600	560	1676	0,3	0,44	30-1m	80	34
6300	560	1676	0,4	0,44	31-1m	81	34
7100	630	1096	0,4	0,45	29-1m	79	44
8000	630	1093	0,4	0,66	29-1m	79	45
9000	710	1093	0,5	0,66	30-1m	80	54
10000	710	1093	0,6	0,66	31-1m	81	54
11200	800	1092	0,6	0,90	30-1m	81	106
12500	800	1092	0,7	0,90	31-1m	82	106
14000	800	1092	0,8	0,90	31-1m	82	106
16000	900	1123	1,1	1,3	31-1m	82	139
18000	1000	836	1,0	1,3	31-1m	82	173
20000	1000	836	1,2	1,3	32-1m	82	173
22400	1120	847	1,4	1,8	34-1m	83	285
25000	1120	847	1,5	1,8	34-1m	84	285
28000	1250	708	1,6	1,8	34-1m	83	359
31500	1250	708	1,8	2,6	35-1m	84	378
35500	1400	588	2,0	2,6	34-1m	83	475
40000	1400	588	2,3	2,6	35-1m	84	475
45000	1600	588	2,7	3,6	38-1m	84	631
50000	1600	588	3,0	3,6	40-1m	85	631
55000	1600	588	3,4	4,8	41-1m	86	666
63000	1600	588	3,9	4,8	42-1m	86	666

Bezugsdaten ichte 1 2 kg/m³

Reference ensit 1 2 kg/m³

Umrechnungsfaktoren/Conversion factors

Druck/Pressure: 1 a 0 01 mbar 0 102 mm 1 4504 10^{-4} si 9 869 10^{-6} atm 4 02 10^{-3} in G

Volumenstrom/Volume flow rate: 1 m³/h 2 777 10^{-4} m³/s 0 588 cfm 4 4029 gpm

Kraftbedarf/Power: 1 k 1 341 1 360 S 1000 m/s 0 24 kcal/s

Bemerkungen:

1) ie hier getroffene uswahl ist nur ein kleiner eil der möglichen entilatoren ndere rehzahlen, niedrigerer Schalldruck oder besserer irkungsgrad kann in den meisten llen realisiert werden

2) Gestörte nströmungs- und ustritts erh ltnisse sind nicht berücksichtigt

3) ine endgültige uswahl sollte mit einem unserer erkaufsingenieure abgestimmt werden

Remarks:

1) he shown selection onl represents a small part of the possible fans for each working point ther fan speeds, lower sound pressure or better efficienc can in most cases be selected

2) isturbed inlet and outlet conditions ha e not been considered

3) final selection should be discussed with one of our sales engineers

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WITT&SOHN
KWV Ventilatoren

Axial-Ventilatoren
Typenauswahltabellen

Axial Flow Fans
Fan Selection Tables

Direktantrieb /Direct Drive 60 Hz

Gesamtdruck /Total pressure 200 Pa							
Volumen-strom	Ventilator-größe	Dreh-zahl	Wellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
Volume flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
1000	250	3276	0,1	0,22	25-1m	76	13
1120	250	3276	0,1	0,22	25-1m	76	13
1250	250	3276	0,1	0,22	26-1m	79	13
1400	250	3276	0,1	0,22	26-1m	79	13
1600	280	3276	0,2	0,22	26-1m	79	17
1800	280	3276	0,2	0,22	27-1m	80	16
2000	315	3276	0,2	0,22	28-1m	80	18
2240	315	3301	0,2	0,22	28-1m	80	18
2500	355	1646	0,2	0,30	27-1m	79	18
2800	355	1646	0,2	0,30	27-1m	79	17
3150	400	1655	0,2	0,30	27-1m	79	21
3550	400	1655	0,3	0,30	28-1m	80	21
4000	450	1655	0,3	0,44	28-1m	80	26
4500	450	1676	0,3	0,44	29-1m	81	26
5000	500	1676	0,4	0,44	29-1m	81	28
5600	500	1676	0,4	0,66	29-1m	81	41
6300	560	1679	0,5	0,66	32-1m	82	47
7100	560	1679	0,5	0,66	33-1m	82	47
8000	630	1679	0,6	0,66	34-1m	83	54
9000	630	1686	0,7	0,90	35-1m	85	45
10000	710	1092	0,7	0,90	32-1m	82	59
11200	710	1092	0,8	0,90	33-1m	83	59
12500	800	1123	0,9	1,3	33-1m	84	109
14000	800	1123	1,0	1,3	33-1m	84	109
16000	900	1123	1,2	1,3	34-1m	85	139
18000	900	1129	1,3	1,8	35-1m	84	145
20000	1000	847	1,4	1,8	38-1m	84	191
22400	1000	847	1,6	1,8	37-1m	85	191
25000	1120	850	1,8	2,6	37-1m	85	304
28000	1120	850	2,0	2,6	37-1m	86	304
31500	1250	850	2,4	2,6	38-1m	87	376
35500	1250	863	2,8	3,6	43-1m	88	391
40000	1400	708	2,9	3,6	42-1m	87	488
45000	1400	708	3,2	3,6	42-1m	87	488
50000	1600	588	3,6	4,8	42-1m	87	666
55000	1600	588	3,8	4,8	38-1m	87	666
63000	1800	588	4,9	6,6	38-1m	87	772
71000	1800	588	5,2	6,6	39-1m	88	772
80000	1800	588	6,0	6,6	40-1m	89	772
90000	1800	588	7,1	9,0	40-1m	90	793
100000	2000	588	7,9	9,0	41-1m	91	1120

Gesamtdruck /Total pressure 250 Pa							
Volumen-strom	Ventilator-größe	Dreh-zahl	Wellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
Volume-flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
1000	250	3276	0,1	0,22	27-1m	80	13
1120	250	3276	0,1	0,22	27-1m	80	13
1250	250	3276	0,1	0,22	28-1m	81	13
1400	250	3276	0,1	0,22	28-1m	81	13
1600	250	3276	0,2	0,22	29-1m	82	13
1800	280	3301	0,2	0,22	30-1m	82	16
2000	280	3301	0,2	0,30	31-1m	83	16
2240	315	3301	0,2	0,30	31-1m	83	18
2500	315	3346	0,2	0,30	30-1m	82	18
2800	355	3346	0,3	0,44	31-1m	83	15
3150	355	3346	0,3	0,44	32-1m	84	15
3550	400	1676	0,4	0,44	30-1m	84	21
4000	400	1676	0,4	0,44	30-1m	82	21
4500	450	1676	0,4	0,66	31-1m	83	40
5000	450	1679	0,5	0,66	31-1m	83	39
5600	500	1679	0,5	0,66	28-1m	84	44
6300	500	1679	0,6	0,66	33-1m	85	44
7100	560	1686	0,6	0,90	34-1m	85	38
8000	560	1686	0,7	0,90	35-1m	85	38
9000	630	1686	0,8	1,3	36-1m	86	49
10000	630	1691	0,9	1,3	36-1m	86	49
11200	710	1691	1,1	1,3	37-1m	86	58
12500	710	1691	1,2	1,8	38-1m	88	62
14000	800	1129	1,2	1,8	35-1m	86	115
16000	800	1129	1,4	1,8	35-1m	86	115
18000	900	1129	1,6	1,8	36-1m	87	145
20000	900	1144	1,7	2,6	37-1m	87	162
22400	1000	1144	2,1	2,6	40-1m	88	189
25000	1000	1144	2,3	2,6	40-1m	88	189
28000	1120	863	2,5	3,6	39-1m	88	317
31500	1120	863	2,7	3,6	39-1m	88	317
35500	1250	863	3,3	3,6	40-1m	89	391
40000	1250	864	3,7	4,8	45-1m	90	426
45000	1400	864	4,4	6,6	45-1m	90	527
50000	1400	864	4,9	6,6	46-1m	91	527
55000	1600	708	4,9	6,6	45-1m	90	670
63000	1600	708	5,7	6,6	42-1m	90	670
71000	1600	588	6,4	9,0	41-1m	90	793
80000	1800	588	7,2	9,0	42-1m	91	793
90000	2000	588	8,2	13,0	41-1m	91	1150
100000	2000	588	9,1	13,0	42-1m	92	1150

Bezugsdaten: Dichte= 1.2 kg/m³

Reference: Density = 1.2 kg/m³

Umrechnungsfaktoren/Conversion factors

Druck/Pressure: 1 Pa=0.01 mbar=0.102 mm=1.4504 x 10^{-4} Psi=9.869 x 10^{-6} atm=4.02 x 10^{-3} in WG

Volumenstrom/Volume flow rate: 1 m^3/h=2.777 x 10^{-4} m^3/s=0.588 cfm=4.4029 gpm

Kraftbedarf/Power: 1 kW=1.341 HP=1.360 PS=1000 Nm/s=0.24 kcal/s

Bemerkungen:

1.) Die hier getroffene Auswahl ist nur ein kleiner Teil der möglichen Ventilatoren. Andere Drehzahlen, niedrigerer Schalldruck oder besserer Wirkungsgrad kann in den meisten Fällen realisiert werden.
2.) Gestörte Anströmungs- und Austrittsverhältnisse sind nicht berücksichtigt.
3.) Eine endgültige Auswahl sollte mit einem unserer Verkaufsingenieure abgestimmt werden.

Remarks:

1.) The shown selection only represents a small part of the possible fans for each working point. Other fan speeds, lower sound pressure or better efficiency can in most cases be selected.
2.) Disturbed inlet and outlet conditions have not been considered.
3.) A final selection should be discussed with one of our sales engineers.

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WITT&SOHN IGW Ventilatoren

Axial-Ventilatoren
Typenauswahltabellen

Axial Flow Fans
Fan Selection Tables

Direktantrieb /Direct Drive 60 Hz

Gesamtdruck /Total pressure 316 Pa							
Volumenstrom	Ventilatorgröße	Drehzahl	Wellenleistung	Motorleistung	Schalldruck	Schallpegel	Gesamtmasse
Volume flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
1000	250	3276	0,1	0,22	29-1m	82	13
1120	250	3276	0,2	0,22	29-1m	82	13
1250	250	3276	0,2	0,22	30-1m	83	13
1400	250	3301	0,2	0,22	30-1m	83	13
1600	250	3301	0,2	0,30	31-1m	84	13
1800	250	3346	0,2	0,30	32-1m	84	13
2000	280	3346	0,3	0,30	33-1m	85	16
2240	280	3346	0,3	0,44	33-1m	85	17
2500	315	3346	0,3	0,44	32-1m	84	19
2800	315	3358	0,4	0,44	33-1m	85	19
3150	355	3358	0,4	0,44	34-1m	86	15
3550	355	3358	0,4	0,65	34-1m	86	15
4000	400	1679	0,6	0,66	32-1m	84	37
4500	450	1679	0,5	0,66	33-1m	85	41
5000	450	1679	0,6	0,90	34-1m	86	31
5600	450	1686	0,7	0,90	34-1m	86	31
6300	500	1686	0,7	0,90	35-1m	87	37
7100	500	1686	0,8	0,90	35-1m	87	35
8000	560	1691	0,9	1,3	38-1m	88	45
9000	560	1691	1,0	1,3	37-1m	87	42
10000	630	1691	1,1	1,3	38-1m	88	49
11200	630	1698	1,3	1,8	39-1m	89	53
12500	710	1698	1,4	1,8	39-1m	89	62
14000	710	1698	1,6	1,8	40-1m	90	62
16000	800	1144	1,8	2,6	37-1m	88	141
18000	800	1144	1,9	2,6	38-1m	89	141
20000	900	1144	2,2	2,6	38-1m	89	162
22400	900	1145	2,5	3,6	39-1m	90	183
25000	1000	1145	2,8	3,6	41-1m	91	210
28000	1000	1145	3,0	3,6	43-1m	91	210
31500	1120	1139	3,6	4,8	43-1m	92	312
35500	1120	1139	4,2	4,8	44-1m	93	312
40000	1250	864	4,4	6,6	42-1m	91	430
45000	1250	864	5,1	6,6	45-1m	92	430
50000	1400	864	5,7	6,6	48-1m	93	527
55000	1400	869	6,3	9,0	48-1m	93	548
63000	1600	708	6,9	9,0	47-1m	92	691

Gesamtdruck /Total pressure 400 Pa							
Volumenstrom	Ventilatorgröße	Drehzahl	Wellenleistung	Motorleistung	Schalldruck	Schallpegel	Gesamtmasse
Volume-flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
1000							
1120							
1250							
1400	280	3301	0,2	0,30	34-1m	86	17
1600	280	3346	0,3	0,30	34-1m	86	17
1800	280	3346	0,3	0,44	34-1m	86	18
2000	280	3346	0,3	0,44	35-1m	87	18
2240	280	3358	0,4	0,44	35-1m	87	18
2500	280	3358	0,4	0,65	36-1m	88	18
2800	315	3358	0,4	0,65	36-1m	88	20
3150	315	3391	0,5	0,65	37-1m	89	20
3550	355	3391	0,6	0,65	36-1m	88	15
4000	355	3391	0,6	0,90	37-1m	89	19
4500	400	3392	0,7	0,90	39-1m	90	22
5000	400	3392	0,8	0,90	39-1m	90	22
5600	450	1686	1,0	1,3	36-1m	88	39
6300	500	1691	1,0	1,3	37-1m	89	41
7100	500	1691	1,1	1,3	37-1m	89	41
8000	500	1691	1,2	1,3	38-1m	90	41
9000	560	1698	1,3	1,8	40-1m	90	49
10000	560	1698	1,4	1,8	41-1m	91	49
11200	630	1698	1,6	1,8	41-1m	91	54
12500	630	1696	1,8	2,6	41-1m	91	49
14000	710	1696	2,0	2,6	41-1m	91	56
16000	710	1696	2,3	2,6	42-1m	92	56
18000	800	1709	2,9	3,6	44-1m	93	117
20000	800	1709	2,9	3,6	44-1m	95	117
22400	900	1145	3,1	3,6	41-1m	92	196
25000	900	1139	3,4	4,8	44-1m	92	206
28000	1000	1139	3,9	4,8	45-1m	93	218
31500	1000	1158	4,5	6,6	46-1m	94	223
35500	1120	1158	5,0	6,6	48-1m	94	317
40000	1120	1158	5,5	6,6	48-1m	95	317
45000	1250	869	6,3	9,0	45-1m	94	451
50000	1250	869	7,0	9,0	49-1m	94	451
55000	1400	869	7,6	9,0	46-1m	95	548
63000	1400	871	8,9	13,0	48-1m	96	588

Bezugsdaten: Dichte= 1.2 kg/m³

Reference: Density = 1.2 kg/m³

Umrechnungsfaktoren/Conversion factors

Druck/Pressure: 1 Pa=0.01 mbar=0.102 mm=1.4504 x 10^{-4} Psi=9.869 x 10^{-6} atm=4.02 x 10^{-3} in WG

Volumenstrom/Volume flow rate: 1 m^3/h=2.777 x 10^{-4} m^3/s=0.588 cfm=4.4029 gpm

Kraftbedarf/Power: 1 kW=1.341 HP=1.360 PS=1000 Nm/s=0.24 kcal/s

Bemerkungen:

1.) Die hier getroffene Auswahl ist nur ein kleiner Teil der möglichen Ventilatoren. Andere Drehzahlen, niedrigerer Schalldruck oder besserer Wirkungsgrad kann in den meisten Fällen realisiert werden.

2.) Gestörte Anströmungs- und Austrittsverhältnisse sind nicht berücksichtigt.

3.) Eine endgültige Auswahl sollte mit einem unserer Verkaufsingenieure abgestimmt werden.

Remarks:

1.) The shown selection only represents a small part of the possible fans for each working point. Other fan speeds, lower sound pressure or better efficiency can in most cases be selected.

2.) Disturbed inlet and outlet conditions have not been considered.

3.) A final selection should be discussed with one of our sales engineers.

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WITT&SOHN
IGW Ventilatoren

Axial-Ventilatoren
Typenauswahltabellen

Axial Flow Fans
Fan Selection Tables

Direktantrieb /Direct Drive 60 Hz

Gesamtdruck /Total pressure 500 Pa							
Volumen-strom	Ventilator-größe	Dreh-zahl	Wellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
Volume flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
2500	280	3391	0,5	0,65	38-1m	90	18
2800	280	3391	0,6	0,65	38-1m	90	18
3150	315	3391	0,6	0,90	39-1m	91	25
3550	315	3392	0,7	0,90	39-1m	91	25
4000	355	3392	0,8	0,90	40-1m	92	21
4500	355	3392	0,9	1,3	40-1m	92	21
5000	400	3406	1,0	1,3	41-1m	93	22
5600	400	3406	1,1	1,3	42-1m	94	22
6300	450	3406	1,3	1,8	43-1m	95	31
7100	450	3410	1,4	1,8	44-1m	96	31
8000	560	1696	1,4	1,8	42-1m	92	55
9000	560	1696	1,7	2,6	42-1m	92	48
10000	560	1696	1,9	2,6	43-1m	93	48
11200	560	1696	2,0	2,6	43-1m	93	48
12500	630	1696	2,2	2,6	43-1m	93	54
14000	630	1709	2,4	3,6	44-1m	94	65
16000	710	1709	2,8	3,6	44-1m	94	69
18000	710	1709	3,2	3,6	45-1m	95	69
20000	800	1726	3,6	4,8	45-1m	96	133
22400	800	1726	4,1	4,8	46-1m	97	133
25000	900	1158	4,3	4,8	43-1m	97	206
28000	900	1158	4,8	6,6	44-1m	95	211
31500	1000	1158	5,4	6,6	44-1m	95	237
35500	1000	1159	6,2	9,0	45-1m	96	262
40000	1120	1158	7,1	9,0	46-1m	97	361
45000	1120	1158	7,9	9,0	48-1m	97	361
50000	1250	1164	8,9	13,2	49-1m	98	458
55000	1250	1164	9,6	13,2	50-1m	99	458
63000	1400	871	11,1	13,0	50-1m	97	588
71000	1400	875	12,5	18,0	49-1m	98	669
80000	1600	875	13,6	18,0	50-1m	99	825
90000	1600	874	16,3	18,0	51-1m	100	825
100000	1800	708	17,4	22,0	54-1m	99	1038

Gesamtdruck /Total pressure 630 Pa							
Volumen-strom	Ventilator-größe	Dreh-zahl	Wellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
Volume-flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
2500							
2800	355	3392	0,8	0,90	41-1m	93	21
3150	355	3392	0,8	1,3	41-1m	93	21
3550	355	3392	0,9	1,3	41-1m	94	21
4000	355	3406	1,0	1,3	42-1m	94	21
4500	355	3406	1,1	1,3	42-1m	94	21
5000	355	3406	1,3	1,8	43-1m	95	25
5600	400	3410	1,4	1,8	43-1m	95	27
6300	400	3410	1,5	1,8	44-1m	96	27
7100	450	3410	1,7	2,6	45-1m	97	35
8000	450	3436	1,9	2,6	45-1m	97	35
9000	500	3436	2,2	2,6	46-1m	96	41
10000	500	3436	2,4	3,4	47-1m	96	47
11200	560	1709	2,6	3,6	45-1m	95	62
12500	630	1709	2,9	3,6	46-1m	96	73
14000	630	1709	3,2	3,6	46-1m	96	73
16000	630	1726	3,6	4,8	47-1m	97	89
18000	710	1726	3,8	4,8	47-1m	97	95
20000	710	1729	4,3	4,8	47-1m	97	95
22400	800	1729	5,0	6,6	47-1m	96	148
25000	800	1729	5,4	6,6	48-1m	98	148
28000	900	1750	6,2	9,0	49-1m	96	196
31500	900	1750	7,1	9,0	49-1m	98	196
35500	1000	1158	7,6	9,0	50-1m	98	276
40000	1000	1164	8,6	13,2	50-1m	98	297
45000	1120	1164	9,6	13,2	50-1m	99	427
50000	1120	1164	10,7	13,2	51-1m	100	427
55000	1250	1168	12,2	18,0	51-1m	100	498
63000	1250	1168	14,1	18,0	56-1m	101	498
71000	1400	1166	15,6	18,0	57-1m	102	598
80000	1400	1172	17,6	22,0	58-1m	103	683
90000	1600	880	19,7	26,0	58-1m	102	930
100000	1600	880	22,2	26,0	57-1m	102	930

Bezugsdaten: Dichte= 1.2 kg/m^3

Reference: Density = 1.2 kg/m^3

Umrechnungsfaktoren/Conversion factors

Druck/Pressure: 1 Pa=0.01 mbar=0.102 mm=1.4504 x 10^{-4} Psi=9.869 x 10^{-6} atm=4.02 x 10^{-3} in WG

Volumenstrom/Volume flow rate: 1 m^3/h=2.777 x 10^{-4} m^3/s=0.588 cfm=4.4029 gpm

Kraftbedarf/Power: 1 kW=1.341 HP=1.360 PS=1000 Nm/s=0.24 kcal/s

Bemerkungen:

1.) Die hier getroffene Auswahl ist nur ein kleiner Teil der möglichen Ventilatoren. Andere Drehzahlen, niedrigerer Schalldruck oder besserer Wirkungsgrad kann in den meisten Fällen realisiert werden.

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Remarks:

1.) The shown selection only represents a small part of the possible fans for each working point. Other fan speeds, lower sound pressure or better efficiency can in most cases be selected.

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WITT&SOHN
IGW Ventilatoren

Axial-Ventilatoren
Typenauswahltabellen

Axial Flow Fans
Fan Selection Tables

Direktantrieb / Direct Drive 60 Hz

Gesamtdruck /Total pressure 800 Pa							
Volumenstrom	Ventilatorgröße	Drehzahl	Wellenleistung	Motorleistung	Schalldruck	Schallpegel	Gesamtmasse
Volume flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
4000	355	3406	1,3	1,8	44-1m	96	26
4500	355	3410	1,4	1,8	44-1m	96	26
5000	355	3410	1,6	1,8	45-1m	97	26
5600	400	3410	1,7	2,6	45-1m	97	33
6300	450	3436	1,9	2,6	46-1m	98	35
7100	450	3436	2,1	2,6	46-1m	98	35
8000	450	3436	2,3	2,6	47-1m	99	38
9000	500	3445	2,6	3,4	47-1m	99	47
10000	500	3445	2,9	3,4	48-1m	100	47
11200	500	3445	3,4	4,8	49-1m	101	64
12500	560	1726	4,1	4,8	48-1m	98	89
14000	630	1726	4,5	6,6	48-1m	98	115
16000	630	1729	4,7	6,6	49-1m	99	109
18000	710	1729	4,9	6,6	49-1m	99	123
20000	710	1729	5,7	6,6	50-1m	100	117
22400	710	1750	6,5	9,0	50-1m	100	133
25000	800	1750	6,8	9,0	50-1m	101	172
28000	800	1750	7,7	9,0	50-1m	101	172
31500	900	1751	8,8	13,2	51-1m	102	236
35500	900	1751	9,9	13,2	51-1m	102	238
40000	1000	1751	11,3	13,2	53-1m	104	266
45000	1000	1757	13,1	18,0	53-1m	104	286
50000	1120	1168	13,9	18,0	53-1m	102	501
55000	1120	1166	14,9	18,0	53-1m	102	467
63000	1250	1172	17,5	22,0	54-1m	103	596
71000	1250	1172	19,6	22,0	54-1m	103	596
80000	1400	1172	22,2	26,0	55-1m	104	703
90000	1400	1175	25,2	36	55-1m	104	792
100000	1600	884	27,5	35	55-1m	103	1058

Gesamtdruck /Total pressure 1000 Pa							
Volumenstrom	Ventilatorgröße	Drehzahl	Wellenleistung	Motorleistung	Schalldruck	Schallpegel	Gesamtmasse
Volume flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
4000							
4500							
5000	355	3436	2,2	2,6	47-1m	99	33
5600	355	3436	2,5	3,4	47-1m	99	39
6300	400	3436	2,5	3,4	48-1m	100	39
7100	400	3445	2,7	3,4	48-1m	100	40
8000	400	3445	3,2	4,8	49-1m	101	56
9000	450	3445	3,3	4,8	49-1m	101	61
10000	450	3470	3,8	4,8	50-1m	102	61
11200	500	3470	4,1	4,8	50-1m	102	66
12500	560	3480	5,7	6,6	54-1m	104	102
14000	560	3480	6,6	9,0	55-1m	105	105
16000	560	3480	6,4	9,0	55-1m	105	96
18000	630	1750	7,3	9,0	51-1m	101	134
20000	630	1750	8,2	9,0	52-1m	102	134
22400	710	1750	8,0	9,0	52-1m	102	139
25000	710	1751	9,3	13,2	50-1m	103	201
28000	800	1751	9,8	13,2	52-1m	103	231
31500	800	1751	11,0	13,2	53-1m	104	214
35500	900	1757	12,2	18,0	53-1m	104	271
40000	900	1757	13,7	18,0	54-1m	105	258
45000	1000	1758	15,5	18,0	54-1m	105	286
50000	1000	1763	17,6	22,0	54-1m	106	310
55000	1120	1172	18,9	22,0	55-1m	104	596
63000	1120	1172	22,7	26,0	55-1m	104	606
71000	1250	1175	24,2	36	56-1m	105	730
80000	1250	1175	26,8	36	56-1m	105	730
90000	1400	1177	31,2	36	57-1m	106	792
100000	1400	1177	34,9	44	58-1m	107	887

Bezugsdaten: Dichte= 1.2 kg/m³

Reference: Density = 1.2 kg/m³

Umrechnungsfaktoren/Conversion factors

Druck/Pressure: 1 Pa=0.01 mbar=0.102 mm=1.4504 x 10^{-4} Psi=9.869 x 10^{-6} atm=4.02 x 10^{-3} in WG

Volumenstrom/Volume flow rate: 1 m^3/h=2.777 x 10^{-4} m^3/s=0.588 cfm=4.4029 gpm

Kraftbedarf/Power: 1 kW=1.341 HP=1.360 PS=1000 Nm/s=0.24 kcal/s

Bemerkungen:

1.) Die hier getroffene Auswahl ist nur ein kleiner Teil der möglichen Ventilatoren. Andere Drehzahlen, niedrigerer Schalldruck oder besserer Wirkungsgrad kann in den meisten Fällen realisiert werden.

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Remarks:

1.) The shown selection only represents a small part of the possible fans for each working point. Other fan speeds, lower sound pressure or better efficiency can in most cases be selected.

2.) Disturbed inlet and outlet conditions have not been considered.

3.) A final selection should be discussed with one of our sales engineers.

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WITT&SOHN
TCW Ventilatoren

Axial-Ventilatoren
Typenauswahltabellen

Axial Flow Fans
Fan Selection Tables

Direktantrieb /Direct Drive 60 Hz

Gesamtdruck /Total pressure 1200 Pa							
Volumen-strom	Ventilator-größe	Dreh-zahl	Wellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
Volume flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
5600	400	3445	3,1	3,4	49-1m	101	42
6300	400	3445	3,4	4,8	50-1m	102	59
7100	450	3445	3,4	4,8	50-1m	102	63
8000	450	3470	3,9	4,8	51-1m	103	62
9000	450	3470	4,3	4,8	51-1m	103	62
10000	450	3480	5,2	6,6	52-1m	104	82
11200	450	3480	5,8	6,6	53-1m	105	82
12500	500	3480	5,6	6,6	53-1m	105	84
14000	500	3505	6,4	9,0	54-1m	106	87
16000	560	3505	7,2	9,0	56-1m	106	96
18000	560	3505	8,5	13,2	57-1m	107	146
20000	710	1751	10,0	13,2	53-1m	104	202
22400	710	1751	11,2	13,2	53-1m	104	202
25000	800	1751	11,1	13,2	54-1m	105	231
28000	800	1757	12,5	18,0	54-1m	105	252
31500	800	1757	14,0	18,0	55-1m	106	252
35500	900	1758	16,1	18,0	55-1m	106	245
40000	900	1763	17,2	22,0	56-1m	107	305
45000	1000	1763	19,3	22,5	56-1m	107	295
50000	1000	1763	21,2	26,5	57-1m	108	341
55000	1000	1769	23,8	26,5	57-1m	108	330
63000	1120	1175	31,1	36	57-1m	106	758
71000	1250	1177	32,2	36	58-1m	107	777
80000	1250	1177	36,5	44	58-1m	107	872
90000	1250	1178	40,0	44	59-1m	108	872
100000	1400	1180	42,1	53	59-1m	108	1173

Gesamtdruck /Total pressure 1600 Pa							
Volumen-strom	Ventilator-größe	Dreh-zahl	Wellen-leistung	Motor-leistung	Schall-druck	Schall-pegel	Gesamt-masse
Volume-flow rate	Fan size	Speed	Shaft power	Motor power	Sound pressure	Sound power	Total mass
m^3/h	DN	min^{-1}	kW	kW	dB(A)	dB(A)	kg
5600							
6300							
7100							
8000	450	3480	5,5	6,6	53-1m	105	82
9000	450	3480	6,0	6,6	53-1m	105	82
10000	450	3480	6,6	9,0	54-1m	106	85
11200	450	3505	7,6	9,0	54-1m	106	85
12500	500	3505	7,4	9,0	55-1m	107	87
14000	500	3505	8,5	13,2	52-1m	107	146
16000	500	3512	9,6	13,2	53-1m	108	146
18000	560	3512	10,1	13,2	55-1m	108	146
20000	560	3512	11,3	17,0	56-1m	109	171
22400	560	3517	13,4	17,0	57-1m	110	171
25000	560	3517	15,2	17,0	57-1m	109	171
28000	800	1758	17,8	22,0	58-1m	107	291
31500	800	1763	20,1	22,0	57-1m	108	312
35500	900	1763	20,5	26,5	57-1m	108	332
40000	900	1763	22,8	26,5	58-1m	109	332
45000	900	1769	27,1	36	58-1m	109	412
50000	900	1768	28,7	36	59-1m	110	412
55000	1000	1769	31,4	36	59-1m	110	429
63000	1000	1769	34,4	44	60-1m	111	497
71000	1120	1771	40,1	44	63-1m	112	666
80000	1250	1180	48,4	53	61-1m	110	1127
90000	1400	1180	49,7	65	61-1m	110	1322
100000	1400	1180	55,5	65	62-1m	111	1322

Bezugsdaten: Dichte= 1.2 kg/m^3

Reference: Density = 1.2 kg/m^3

Umrechnungsfaktoren/Conversion factors

Druck/Pressure: 1 Pa=0.01 mbar=0.102 mm=1.4504 x 10^{-4} Psi=9.869 x 10^{-6} atm=4.02 x 10^{-3} In WG

Volumenstrom/Volume flow rate: 1 m^3/h=2.777 x 10^{-4} m^3/s=0.588 cfm=4.4029 gpm

Kraftbedarf/Power: 1 kW=1.341 HP=1.360 PS=1000 Nm/s=0.24 kcal/s

Bemerkungen:

1.) Die hier getroffene Auswahl ist nur ein kleiner Teil der möglichen Ventilatoren. Andere Drehzahlen, niedrigerer Schalldruck oder besserer Wirkungsgrad kann in den meisten Fällen realisiert werden.

2.) Gestörte Anströmungs- und Austrittsverhältnisse sind nicht berücksichtigt.

3.) Eine endgültige Auswahl sollte mit einem unserer Verkaufsingenieure abgestimmt werden.

Remarks:

1.) The shown selection only represents a small part of the possible fans for each working point. Other fan speeds, lower sound pressure or better efficiency can in most cases be selected.

2.) Disturbed inlet and outlet conditions have not been considered.

3.) A final selection should be discussed with one of our sales engineers.

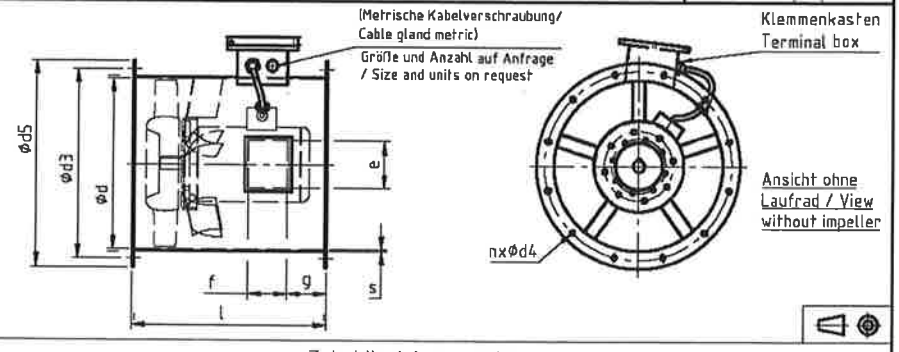
F:\Doku\Katalog\2axial\einzelne_Seiten\30_Axial.doc

WITT&SOHN
Ventilatoren

IGW- Axial- Ventilator
IGW- Axial- Flow Fan

Type: N, M, X, Y, H

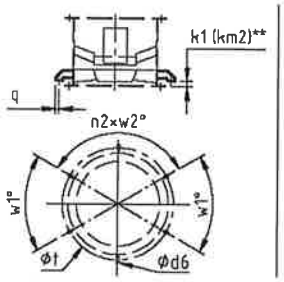
Bauform A
Design A
s = 3, 4, 6



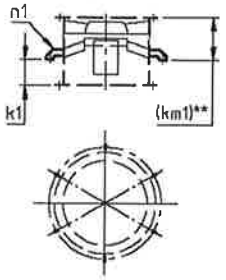
Zubehör / Accessories

Montagepratzen / Mounting brackets

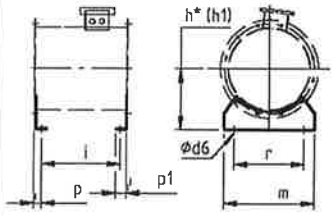
Einbaustellung / Inst. position: BU



Einbaustellung / Inst. position: BD

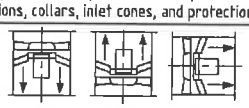


Montagefüße, geschraubt
Mounting feet, bolted
Alternativ geschweißt / Alternativ welded



Flexible Stutzen, Manschetten, Einströmdüsen, Manschettenkragen und Schutzgitter siehe Zubehör für IGW- Axial- Ventilatoren (M97-10-4)
Flexible connections, collars, inlet cones, and protection grilles look at accessories for IGW- Axial- Flow Fans (M97-10-4)

Einbaustellung
Installation
position



Eurovent : BD BU B

ISO 13349: Arrangement No. 4 ; Motor downstream: B
Flanschlochung nach / Flange holes acc. to DIN 24154-T2 : 1990-7
h*= mit / with, h1= ohne Einströmdüse / without inlet cone
k1= Witt- Standard oder/or **(km1 ; km2)= Marineausführung/navy design
n1 = Anzahl der Montagepratzen / number of mounting brackets

Größe / Size	i	Motorbaugröße Motor frame size	s	ød	ød3	~ ød5	n	ød4	e	r	g	Montagefüße / Mounting feet i	h	h1	m	p	p1	r	ød6	Montagepratzen / Mounting brackets ~ øt	q	km1	km2	k1	n1	w1*	n2	w2°
250	320	63 - 80	3 (6)	254	292	330	8	11,5	140	100	50	260	200	200	300	30	41	200	9	435	20	130	100	3 (6)	4	72	1	108
280	330	63 - 80		284	332	372	8	11,5				270	225	225	330	30	41	230	9	465	20	140	110					
315	390	63 - 90		319	366	406	8	11,5				330	245	245	375	30	41	275	9	500	20	160	130					
355	410	71 - 90		359	405	445	8	11,5				350	270	270	415	30	43	315	9	540	20	190	150					
400	460	71 - 112		404	448	488	12	11,5				380	300	300	450	50	62	350	9	585	20	200	160					
450	500	71 - 112		456	497	537	12	11,5				400	340	340	500	50	62	400	9	635	20	230	160					
500	570	71 - 132		506	551	591	12	11,5				470	375	375	550	50	64	450	11	730	25	260	200					
560	590	80 - 132		567	629	673	16	14				490	415	415	625	50	63	525	11	810	25	300	230					
630	610	90 - 132	4 (6)	637	698	742	16	14				510	460	460	660	50	66	560	14	885	30	320	250	4 (6)		80		100
	720	160L									160	620																
710	690	100 - 132		717	775	819	16	14			50	530	510	510	750	80	96	600	14	970	30	360	280					
	800	160L									160	640																
800	800	100 - 160		810	861	905	24	14	255	190	100	640	570	570	800	80	95	650	14	1060	35	410	320					
	910	180 - 200									210	750																
900	980	112 - 180		910	958	1002	24	14			100	820	620	620	850	80	100	700	18	1160	35	490	390					
	1090	200									210	930																

Sicherheitshinweis! Maschinen nur betreiben, wenn Schutzeinrichtungen (z.B. Schutzgitter) vorhanden und funktionsfähig sind
Security advice! Operate machine only when protectors are in place (for example protection grille) and fully functional.

WITT&SOHN
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Telefon : 04101/7007-0 Telefax : 04101/7007-30 e-mail : witt@wittfan.de

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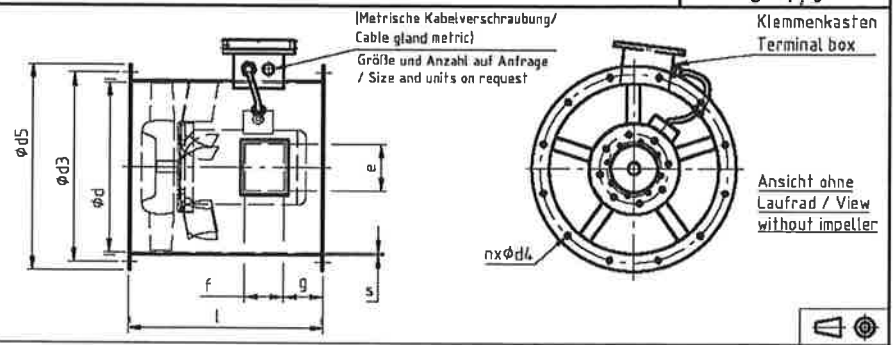
IGW- Axial- Ventilator
IGW- Axial- Flow Fan

Type: N, M, X, Y, H

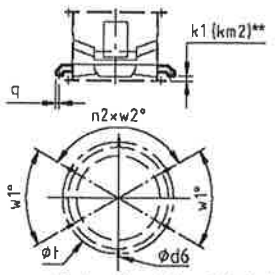
Bauform A
Design A
s = 4 , 6



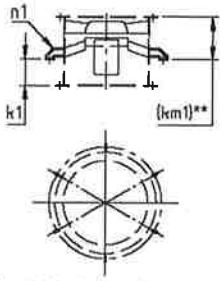
Zubehör / Accessories

Montagepratzen / Mounting brackets

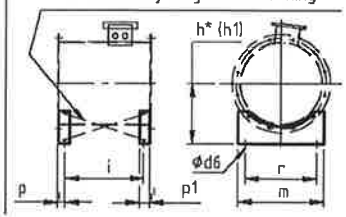
Einbaustellung / Inst. position: BU



Einbaustellung / Inst. position: BD

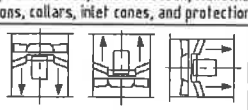


Montagefüße, geschraubt
Mounting feet, bolted
Alternativ geschweißt / Alternativ welded
Diagonal versteift, falls erforderlich
/ If necessary diagonal stiffening



Flexible Stutzen, Manschetten, Einströmdüsen, Manschettenkragen und Schutzgitter siehe Zubehör für IGW- Axial- Ventilatoren (M97-10-4)
Flexible connections, collars, inlet cones, and protection grilles look at accessories for IGW- Axial- Flow Fans (M97-10-4)

Einbaustellung
Installation
position



Eurovent : B0 BU B

ISO 13349: Arrangement No. 4 ; Motor downstream: B
Flanschlochung nach / Flange holes acc. to DIN 24154-T2 : 1990-7
h*= mit / with, h1= ohne Einströmdüse / without inlet cone
k1= Witt- Standard oder/or **(km1 ; km2)= Marineausführung/navy design
n1 = Anzahl der Montagepratzen / number of mounting brackets

Größe / Size	i	Motorbaugröße / Motor frame size	s	ød	ød3	~ ød5	n	ød4	e	f	g	Montagefüße / Mounting feet l	h	h1	m	p	p1	r	ød6	Montagepratzen / Mounting brackets ~ ø	q	km1	km2	k1	n1	w1°	h2	w2°
1000	1010	112 - 180	4 (6)	1012	1067	1111	24	14	265	190	100	850	675	675	900	80	100	750	18	1310	40	520	410	0	6	60	2	60
	1130	200 - 250									220	970																
1120	1060	132 - 200		1139	1200	1254	32	18			100	900	745	745	1000	80	100	850		1450	40	590	460					
	1180	225 - 250									220	1020																
1250	1090	160 - 225	6	1267	1337	1391	32	18			100	890	815	815	1100	100	120	2 475		1580	40	640	490					
	1290	250 - 280									220	1090																
1400	1130	180 - 225		1418	1475	1552	32	18			100	930	920	795	1350	100	120	2 600		1735	40	710	550					
	1230	250									220	1030																
1600	1160	200 - 225		1619	1675	1753	40	18			100	980	1050	895	1600	100	120	3 480		1935	40	800	610					
	1260	250									220	1080																
1800	1250	225		1821	1875	1955	40	18			100	1050	1200	995	1700	100	120	3 510		2135	40	890	690					
	1335	280									220	1135																

Sicherheitshinweis! Maschinen nur betreiben, wenn Schutzeinrichtungen (z.B. Schutzgitter) vorhanden und funktionsfähig sind.
Security advice! Operate machine only when protectors are in place (for example protection grille) and fully functional.

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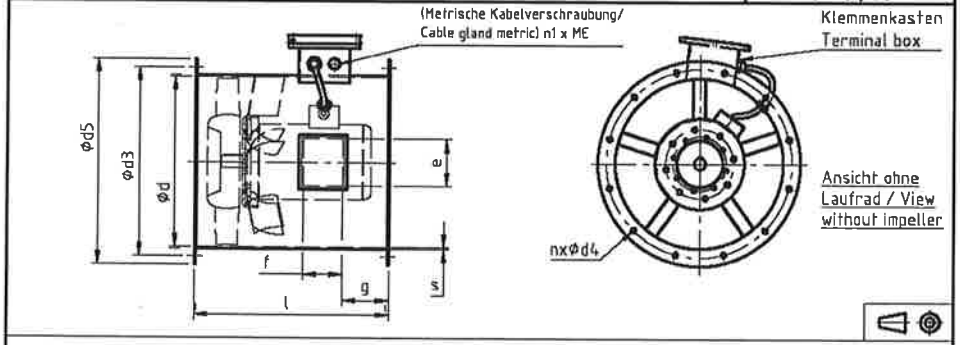
IGW- Axial- Ventilator
IGW- Axial- Flow Fan

Type: N, M, X, Y, H

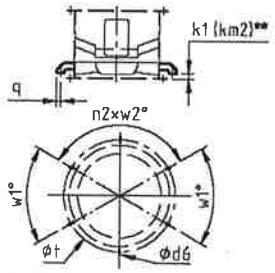
Bauform A
Design A
s = 8, 10



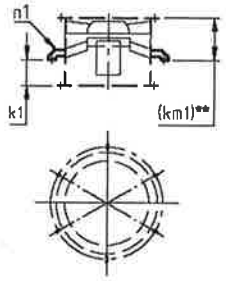
Zubehör / Accessories

Montagepratzen / Mounting brackets

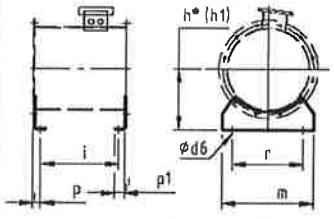
Einbaustellung / Inst. position: BU



Einbaustellung / Inst. position: BD

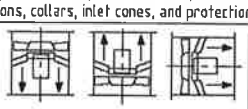


Montagefüße, geschraubt
Mounting feet, bolted
Alternativ geschweißt / Alternativ welded



Flexible Stutzen, Manschetten, Einströmdüsen, Manschettenkragen und Schutzgitter siehe Zubehör für IGW- Axial- Ventilatoren (M97-09-4)
Flexible connections, collars, inlet cones, and protection grilles look at accessories for IGW- Axial- Flow Fans (M97-09-4)

Einbaustellung
Installation
position



Eurovent : BD BU B

ISO 13349: Arrangement No. 4 ; Motor downstream: B
Flanschlochung nach / Flange holes acc. to DIN 82330 : 1998-12
h*= mit / with, h1= ohne Einströmdüse / without inlet cone
k1= Witt- Standard oder/or **(km1 ; km2)= Marineausführung/navy design
n1 = Anzahl der Montagepratzen / number of mounting brackets

Größe / Size	l	MBG	s	ød	ød3	~ ød6	n	ød4	e	r	g	Montagefüße / Mounting feet i	h	h1	m	p	p1	r	ød6	Montagepratzen / Mounting brackets ~ at	q	km1	km2	k1	n1	w1*	h2	w2*	n1	ME
250	320	63 - 80	10	253	326	366	12	14	140	100	50	260	200	200	300	30	41	200	9	435	20	130	100	10	4	72	1	108	1	20
280	330	63 - 80		284	355	387	12	14	140	100		270	225	225	330	30	41	230	9	465	20	140	110							
315	390	63 - 90		319	390	422	12	14	140	100		330	245	245	375	30	41	276	9	500	20	160	130							
355	410	71 - 90		359	430	462	16	14	140	100		350	270	270	415	30	43	315	9	540	20	180	150							
400	480	71 - 112		404	476	507	16	14	140	100		380	300	300	460	50	62	350	9	585	20	200	160						2	25
450	500	71 - 112		456	526	558	20	14	140	100		400	340	340	500	50	62	400	9	635	20	230	180							
500	570	71 - 132		506	575	608	20	14	140	100		470	375	376	550	50	64	450	11	730	30	260	200							
560	590	80 - 132		567	650	689	20	18	140	100		490	415	416	625	50	63	525	11	810	45	300	230							
630	610	90 - 132		637	720	759	20	18	140	100	180	510 620	460	460	660	50	68	580	14	885	45	320	250							
	720	160L																												
710	690	100 - 132		717	800	839	20	18	140	100	50	630	510	510	750	80	98	600	14	970	45	360	280	10 (8)					2	32
	800	160L									160	640																		
800	800	100 - 160	10 (8)	810	890	932	24	18	256	190	100	640	670	570	800	80	95	650	14	1080	45	410	320							
	910	180 - 200									210	750																		
900	980	112 - 180		910	990	1032	24	18	256	190	100	820	620	620	850	80	100	700	18	1160	55	490	390							
	1090	200									210	930																		
1000	1010	112 - 180		1012	1090	1136	28	18	256	190	100	850	675	675	900	80	80	750	18	1310	55	520	410							1)
	1130	200 - 250									220	970																		
1120	1060	132 - 180		1133	1230	1276	28	24	256	190	100	900	745	745	1000	80	80	850	18	1450	55	590	460	0	6	60	2	60		
		200									220	1020																	2)	
	1180	225 - 250																												

MBG=Motorbaugröße / Motor frame size

1) = 1x40, 1x32, 1x25 ; 2) = 1x60, 1x40, 1x25

Sicherheitshinweis! Maschinen nur betreiben, wenn Schutzeinrichtungen (z.B. Schutzgitter) vorhanden und funktionsfähig sind.
Security advice! Operate machine only when protectors are in place (for example protection grille) and fully functional.

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Wuppermannstraße 6-10, D-25421 Pinneberg, Germany
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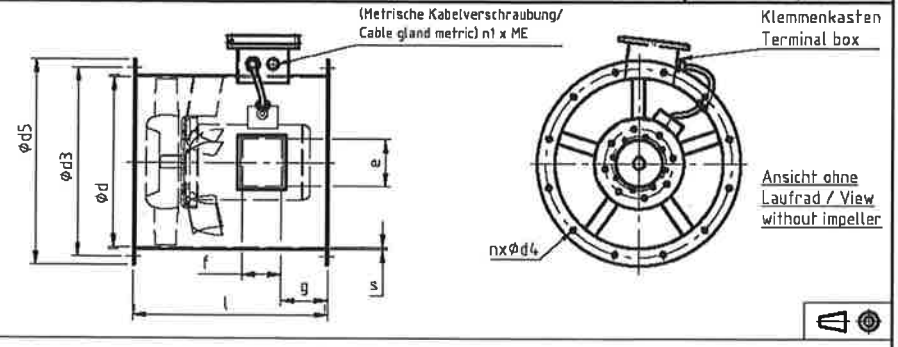
IGW- Axial- Ventilator
IGW- Axial- Flow Fan

Type: N, M, X, Y, H

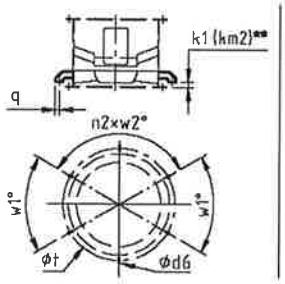
Bauform A
Design A
s = 8, 10



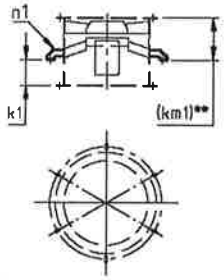
Zubehör / Accessories

Montagepratzen / Mounting brackets

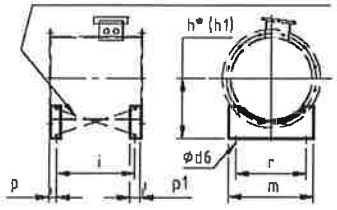
Einbaustellung / Inst. position: BU



Einbaustellung / Inst. position: BD

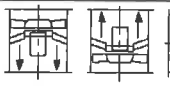


Montagefüße, geschraubt
Mounting feet, bolted
Alternativ geschweißt / Alternativ welded
Diagonal versteift, falls erforderlich
/ If necessary diagonal stiffening



Flexible Stutzen, Manschetten, Einströmdüsen, Manschettenkragen und Schutzgitter siehe Zubehör für IGW- Axial- Ventilatoren (M97-09-4)
Flexible connections, collars, inlet cones, and protection grilles look at accessories for IGW- Axial- Flow Fans (M97-09-4)

Einbaustellung
Installation
position



Eurovent : BD BU B

ISO 13349: Arrangement No. 4 ; Motor downstream: B
Flanschlochung nach / Flange holes acc. to DIN 82330 : 1998-12
h*= mit / with, h1= ohne Einströmdüse / without inlet cone
k1= Witt- Standard oder/or **(km1 ; km2)= Marineausführung/navy design
n1 = Anzahl der Montagepratzen / number of mounting brackets

Größe / Size	l	MBG	s	ød	ød3	ød5	n	ød4	e	f	g	Montagefüße / Mounting feet i	h	h1	m	p	p1	r	Montagepratzen / Mounting brackets ød6	t	q	km1	km2	k1	n1	w1*	h2	w2*	h1	ME
1250	1090	160 - 180	10 (8)	1267	1360	1411	28	24	265	190	100	890	815	815	1100	100	100	2x475	18	1680	66	640	490	0	6	60	2	60		3)
	1290	200 - 225									220	1090																		4)
	1450	250 - 280										1250																		5)
	1610	315-S(M)										1410																		
		316-L																												
1400	1130	180		1418	1510	1561	32	24	265	190	100	930	920	795	1350	100	100	2x600	18	1735	66	710	550							3)
	1230	200 - 225									220	1030					—													4)
	1330	250										1130																		
	1500	280										1300					180													5)
	1660	315-S(M)										1460																		
		316-L																												
1600	1180	200 - 225		1619	1710	1762	36	24	265	190	100	980	1050	895	1600	100	100	3x480	18	1935	66	800	610							4)
	1280	250									220	1080																		
	1380	280										1180					200													5)
	1540	315-S(M)										1340																		
	1700	316-L										1500																		
1800	1260	225		1821	1910	1964	40	24	265	190	100	1050	1200	995	1700	100	100	3x510	18	2135	66	890	690							4)
	1336	250									220	1135																		
	1435	280										1235					240													5)
	1590	315-S(M)										1390																		
	1750	316-L										1550																		

MBG=Motorbaugröße / Motor frame size

3) = 1x40, 1x32, 1x25 ; 4) = 1x50, 1x40, 1x25 ; 5) = 1x63, 1x50, 2x25

Sicherheitshinweis! Maschinen nur betreiben, wenn Schutzeinrichtungen (z.B. Schutzgitter) vorhanden und funktionsfähig sind.
Security advice! Operate machine only when protectors are in place (for example protection grille) and fully functional.

WITT&SOHN
IGW **Ventilatoren**
Postfach 2262,D-25412 Pinneberg, Germany
Wuppermannstraße 6-10, D-25421 Pinneberg, Germany
Telefon : 04101/7007-0 Telefax : 04101/7007-30 e-mail : witt@wittfan.de

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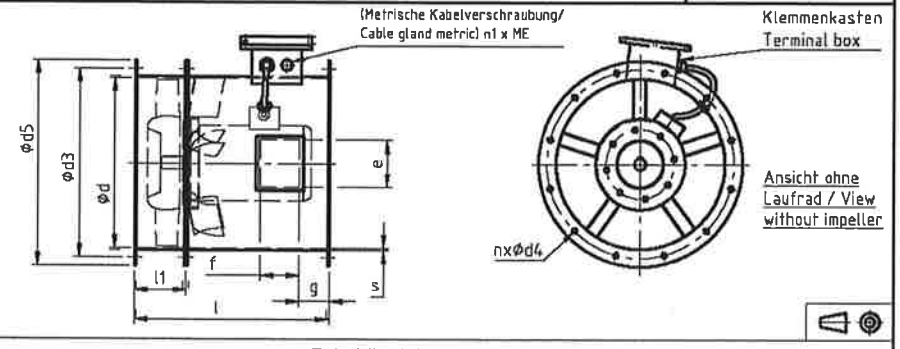
IGW- Axial- Ventilator
IGW- Axial- Flow Fan

Type: N, M, X, Y, H

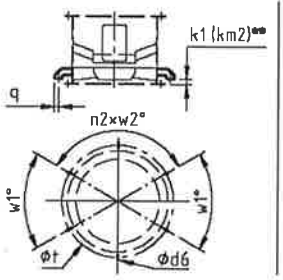
Bauform A
Design A
s = 10



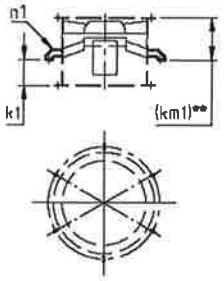
Zubehör / Accessories

Montagepratzen / Mounting brackets

Einbaustellung / Inst. position: BU

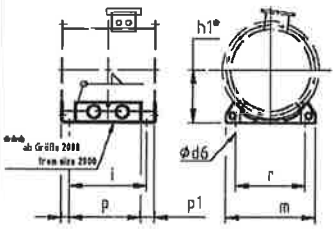


Einbaustellung / Inst. position: BD



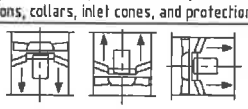
Montagefüße / Mounting feet

(***Gegenfundament oder/und Schwingungsdämpfer / Counter frame or/and oscillation damper)



Flexible Stutzen, Manschetten, Einströmdüsen, Manschettenkragen und Schutzgitter siehe Zubehör für IGW- Axial- Ventilatoren (M97-09-4)
Flexible connections, collars, inlet cones, and protection grilles look at accessories for IGW- Axial- Flow Fans (M97-09-4)

Einbaustellung
Installation
position



Eurovent : BD BU B

ISO 13349: Arrangement No. 4 ; Motor downstream: B
Flanschlochung nach / Flange holes acc. to Witt-Standard
h1*= mit / with, h1= ohne Einströmdüse / without inlet cone
k1= Witt- Standard oder/or **(km1 ; km2)= Marineausführung/navy design
n1 = Anzahl der Montagepratzen / number of mounting brackets

Größe / Size	l1	l	MBG	s	ød	ød3	~ød5	a	ød4	e	f	g	Montagefüße / Mounting feet: l	h1	m	p	p1	r	ød6	Montagepratzen / Mounting brackets: ca. 1	q	km1	km2	n1	w1°	p2	w2°	h1	ME
2000	-	1400	280	10	2022	2118	2206	44	24	296	255	200	1140	1023	2100	130	240		18	2580	65	1020	780	6	60	2	60		4)
	-	1600	280										1240																
	-	1655	315-S(M)										1305																
	550	1815	315-L									300	1555																5)
		1990	355										1730																
		2190	400										1930																
		2310	450										2050																
2240	-	1570	280		2282	2368	2466	48	24	296	255	200	1290	1153	2350	140	260		18	2840	65	1150	880						4)
	-	1715	315-S(M)										1435																
	610	1876	315-L									300	1595																6)
		2050	355										1770																
		2250	400										1970																
		2370	450										2090																
2600	-	1690	280		2524	2630	2748	48	24	296	255	300	1390	1293	2800	160	280		18	2940	65	1290	990						4)
	660	1765	315-S(M)										1485																
		1945	315-L										1645																5)
		2120	355										1820																
		2330	400										2030																
		2440	450										2140																
2800	-	1690	280		2827	2930	3054	58	24	296	255	300	1370	1447	2900	190	300		18	3250	70	1370	1040						4)
	780	1865	315-S(M)										1545																
		2025	315-L										1705																5)
		2200	355										1880																
		2400	400										2080																
		2520	450										2200																

MBG=Motorbaugröße / Motor frame size / Fehlende Maße auf Anfrage / Missing dimensions on request 4) = 1x50, 1x40, 1x25 ; 5) = 1x63, 1x50, 2x25

Sicherheitshinweis! Maschinen nur betreiben, wenn Schutzeinrichtungen (z.B. Schutzgitter) vorhanden und funktionsfähig sind.
Security advice! Operate machine only when protectors are in place (for example protection grille) and fully functional.

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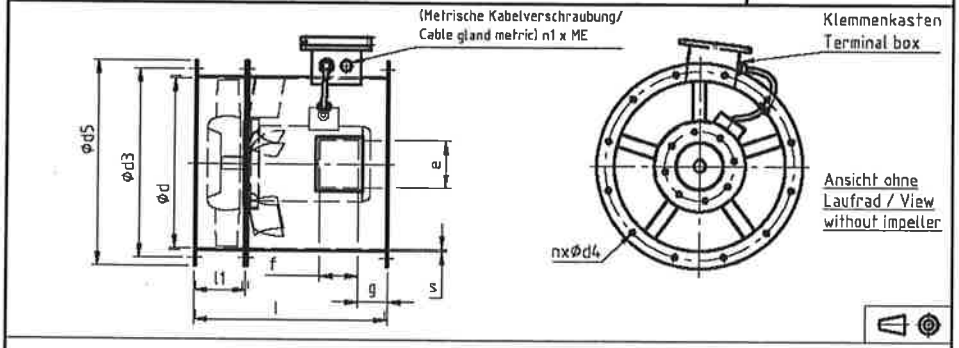
IGW- Axial- Ventilator
IGW- Axial- Flow Fan

Type: N, M, X, Y, H

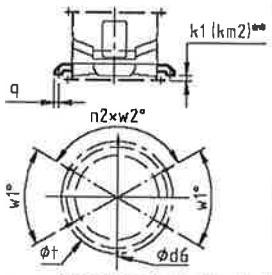
Bauform A
Design A
s = 12



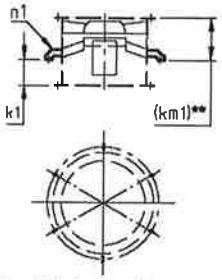
Zubehör / Accessories

Montagepratzen / Mounting brackets

Einbaustellung / Inst. position: BU

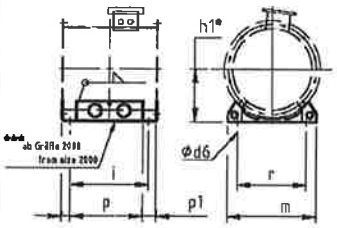


Einbaustellung / Inst. position: BD



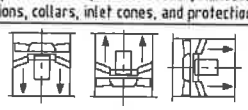
Montagefüße / Mounting feet

(*** Gegenfundament oder/und Schwingungsdämpfer / Counter frame or/and oscillation damper)



Flexible Stutzen, Manschetten, Einströmdüsen, Manschettenkragen und Schutzgitter siehe Zubehör für IGW- Axial- Ventilatoren (M97-09-4)
Flexible connections, collars, inlet cones, and protection grilles look at accessories for IGW- Axial- Flow Fans (M97-09-4)

Einbaustellung
Installation position



Eurovent : BD BU B

ISO 13349: Arrangement No. 4 ; Motor downstream: B
Flanschlochung nach / Flange holes acc to Witt-Standard
h*= mit / with, h1= ohne Einströmdüse / without inlet cone
k1= Witt- Standard oder/or **(km1 ; km2)= Marineausführung/navy design
n1 = Anzahl der Montagepratzen / number of mounting brackets

Größe / Size	l1	l	MBG	s	ød	ød3	~ ød5	n	ød4	e	f	g	Montagefüße / Mounting feet: i	h1	m	p	p1	r	Montagepratzen / Mounting brackets: ød6	ca. l	q	km1	km2	n1	w1*	n2	w2*	h1	ME
3150	-	1770	280	12	3182	3330	3451	64	24	295	255	300	1420	1646	3200	175	328		18	3650	70	1500	1150						4)
	-	1955	315-S(M)										1605																
	800	2115	315-L										1765																5)
		2290	355										1940																
		2490	400										2140																
		2610	450										2260																
3550	900	2055	315-S(M)		3585	3735	3854	64	28	295	255	500																	5)
		2215	315-L																										
		2390	355																										
		2590	400																										
		2710	450																										

MBG=Motorbaugröße / Motor frame size / Fehlende Maße auf Anfrage / Missing dimensions on request

4) = 1x50, 1x40, 1x25 ; 5) = 1x63, 1x50, 2x25

Sicherheitshinweis! Maschinen nur betreiben, wenn Schutzeinrichtungen (z.B. Schutzgitter) vorhanden und funktionsfähig sind.
Security advice! Operate machine only when protectors are in place (for example protection grille) and fully functional.

WITT&SOHN IGW Ventilatoren
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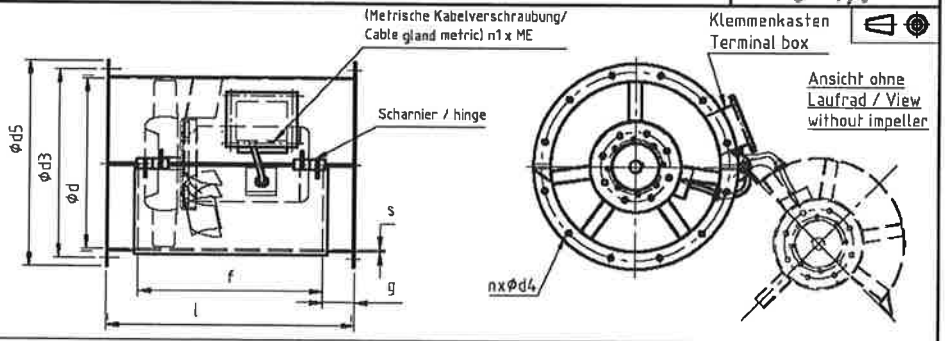
IGW- Axial- Ventilator
IGW- Axial- Flow Fan

Type: N, M, X, Y, H

Bauform B
Design B
s = 4, 6



Zubehör / Accessories

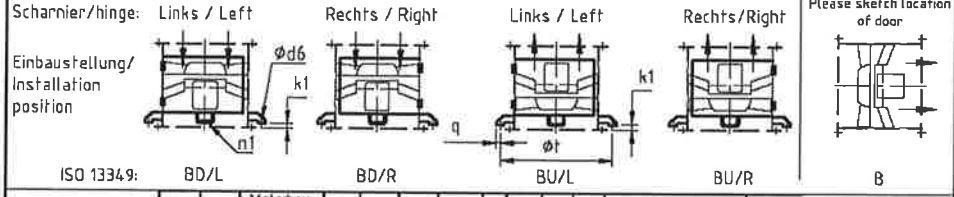
Flexible Stutzen, Manschetten, Einströmdüsen, Manschettenkragen und Schutzgitter siehe Zubehör für IGW-Axial- Ventilatoren (M97-10-4)
Flexible connections, collars, inlet cones, and protection grilles look at accessories for IGW- Axial- Flow Fans (M97-10-4)

ISO 13349: Arrangement No. 4 ; Motor downstream: B
Flanschlochung nach / Flange holes
acc. to DIN 24154-T2 : 1990-7
Montagefüße auf Anfrage / Mounting feets on request
n1 = Anzahl der Montagepratzen / number of mounting brackets

Achtung, schwere Tür, Kippgefahr, bauseits abfangen! / Warning, heavy door, customer must secure against tilting!

Montagepratzen symmetrisch verteilt/ Mounting brackets symmetrical distributed

Tür bitte einzeichnen / Please sketch location of door



Größe / Size	l	Motorbaugröße Motor frame size	s	ød	ød3	ød5	n	ød4	f	g	Montagepratzen / Mounting brackets ød6	øt	q	k1	n1	n1	ME
355	570	71 - 80	4 (6)	359	405	445	8	11,5	380	95	9	540	20	0	4	2	25
	590	90							400	95							
400	660	71 - 90		404	448	488	12	11,5	420	120	9	585	20				
	720	100 - 112							480	120							
450	700	71 - 90		456	497	537	12	11,5	440	130	9	635	20				
	740	100 - 112							480	130							
500	760	71 - 100		508	551	591	12	11,5	480	140	11	730	25			2	32
	860	112 - 132	6						580	140							
560	810	80 - 100	4 (6)	567	629	673	16	14	510	150	11	810	25				
	910	112 - 132							610	150							
630	900	80 - 112	6	637	698	742	16	14	540	180	14	885	30				
	1090	132 - 160							730	180							
710	1030	90 - 132		717	775	819	16	14	640	195	14	970	30				
	1140	160							750	195							
800	1090	100 - 132		810	861	905	24	14	670	210	14	1060	35			1)	
	1340	160 - 200							920	210							
900	1290	100 - 160		910	958	1002	24	14	840	225	18	1160	35				
	1430	180 - 200							980	225							
1000	1385	112 - 180		1012	1067	1111	24	14	925	230	18	1310	40		6		

1) = 1x40, 1x32, 1x25

Sicherheitshinweis! Maschinen nur betreiben, wenn Schutzeinrichtungen (z.B. Schutzgitter) vorhanden und funktionsfähig sind.
Security advice! Operate machine only when protectors are in place (for example protection grille) and fully functional.

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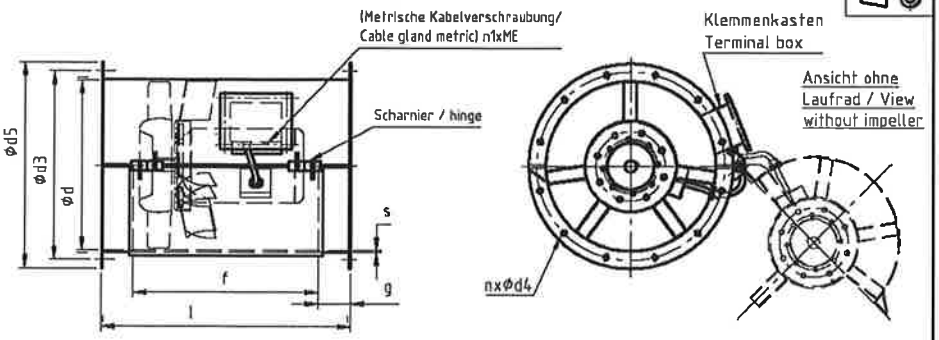
IGW- Axial- Ventilator
IGW- Axial- Flow Fan

Type: N, M, X, Y, H

Bauform B
Design B
s = 8, 10



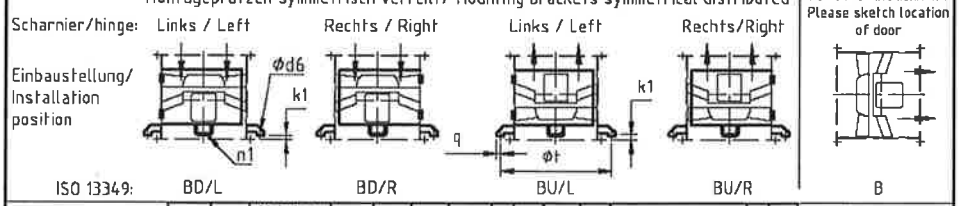
Zubehör / Accessories

Flexible Stutzen, Manschetten, Einströmdüsen, Manschettenkragen und Schutzgitter siehe Zubehör für IGW-Axial- Ventilatoren (M97-09-4)
Flexible connections, collars, inlet cones, and protection grilles look at accessories for IGW- Axial- Flow Fans (M97-09-4)

ISO 13349: Arrangement No. 4 ; Motor downstream: B
Flanschlochung nach / Flange holes
acc. to DIN 82330 : 1998-12
Montagefüße auf Anfrage / Mounting feets on request
n1 = Anzahl der Montagepratzen / number of mounting brackets

Achtung, schwere Tür, Kippgefahr, bauseits abfangen! / Warning, heavy door, customer must secure against tilting!

Montagepratzen symmetrisch verteilt/ Mounting brackets symmetrical distributed



Größe / Size	l	Motorbaugröße / Motor frame size	s	ød	ød3	~ød5	n	ød4	f	g	Montagepratzen / Mounting brackets ød6	~øt	q	k1	n1	n1	ME
355	570	71 - 80	10	359	430	462	16	14	380	95	9	540	20	0	4	2	25
	590	90							400	95							
400	660	71 - 90		404	475	507	16	14	420	120	9	585	20				
	720	100 - 112							480	120							
450	700	71 - 90		456	525	558	20	14	440	130	9	635	20				
	740	100 - 112							480	130							
500	760	71 - 100	10 (8)	506	575	608	20	14	480	140	11	730	30			2	32
	860	112 - 132							580	140							
560	810	80 - 100		567	650	689	20	18	510	150	11	810	45				
	910	112 - 132							610	150							
630	900	80 - 112		637	720	759	20	18	540	180	14	885	45				
	1090	132 - 160							730	180							
710	1030	90 - 132		717	800	839	20	18	640	195	14	970	45				
	1140	160							750	195							
800	1090	100 - 132		810	890	932	24	18	670	210	14	1060	45				
	1340	160 - 200							920	210							
900	1290	100 - 160		910	990	1032	24	18	840	225	18	1160	55			1)	
	1430	180 - 200							980	225							

1) = 1x40, 1x32, 1x25

Sicherheitshinweis! Maschinen nur betreiben, wenn Schutzeinrichtungen (z.B. Schutzgitter) vorhanden und funktionsfähig sind.
Security advice! Operate machine only when protectors are in place (for example protection grille) and fully functional.

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IGW Ventilatoren
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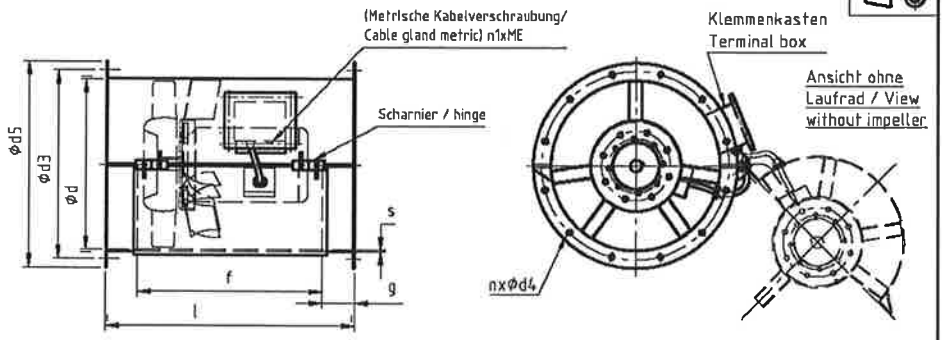
IGW- Axial- Ventilator
IGW- Axial- Flow Fan

Type: N, M, X, Y, H

Bauform B
Design B
s = 8, 10



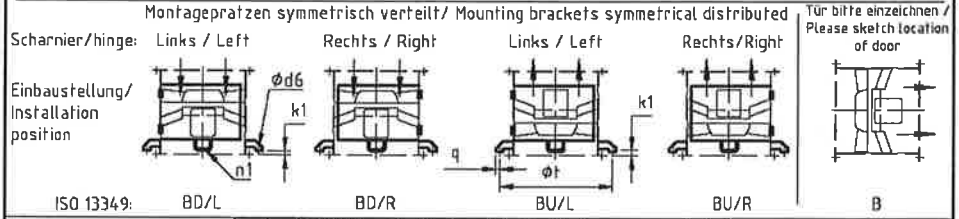
Zubehör / Accessories

Flexible Stutzen, Manschetten, Einströmdüsen, Manschettenkragen und Schutzgitter siehe Zubehör für IGW-Axial- Ventilatoren (M97-09-4)
Flexible connections, collars, inlet cones, and protection grilles look at accessories for IGW- Axial- Flow Fans (M97-09-4)

ISO 13349: Arrangement No. 4 ; Motor downstream: B
Flanschlochung nach / Flange holes
acc. to DIN 82330 : 1998-12
Montagefüße auf Anfrage / Mounting feets on request
n1 = Anzahl der Montagepratzen / number of mounting brackets

Achtung, schwere Tür, Kippgefahr, bauseits abfangen! / Warning, heavy door, customer must secure against tilting!

Montagepratzen symmetrisch verteilt/ Mounting brackets symmetrical distributed



Größe / Size	l	Motorbaugröße / Motor frame size	s	ød	ød3	ød5	n	ød4	f	g	Montagepratzen / Mounting brackets ød6	a	q	k1	n1	ME
1000	1305	112 - 160	10 (8)	1012	1090	1135	28	18	925	230	18	1510	55	0	6	1)
	1605	200 - 250							1145	230						
1120	1470	132 - 160		1139	1230	1275	28	24	990	240	18	1460	55			2)
		200							990	240						
	1630	225 - 250							1150	240						
1250	1540	160 - 180		1267	1360	1411	28	24	1040	250	18	1560	55			3)
		200-225							1040	250						4)
	1800	250							1190	250						
	1830	280							1320	250						
	1970	315M							1470	250						5)
	2120	315L							1620	250						
1400	1760	160		1418	1510	1661	32	24	1240	260	18	1735	55			3)
		225-250							1240	260						
	1890	280							1370	260						4)
	2040	315M							1520	260						
	2190	315L							1670	260						5)
1600	1840	200 - 250		1619	1710	1762	36	24	1280	280	18	1935	55			4)
	1970	280							1410	280						
	2120	315M							1560	280						5)
	2270	315L							1710	280						
1800	1950	225 - 250		1821	1910	1964	40	24	1330	300	18	2135	55			4)
	2060	280							1460	300						
	2210	315M							1610	300						5)
	2360	315L							1760	300						

1) = 1x40, 1x32, 1x25 ; 2) = 1x50, 1x40, 1x25 ; 3) = 1x40, 1x32, 1x25
4) = 1x50, 1x40, 1x25 ; 5) = 1x63, 1x50, 2x25

Sicherheitshinweis! Maschinen nur betreiben, wenn Schutzeinrichtungen (z.B. Schutzgitter) vorhanden und funktionsfähig sind.
Security advice! Operate machine only when protectors are in place (for example protection grille) and fully functional.

WITT&SOHN
IGW Ventilatoren
Postfach 2262,D-25412 Pinneberg, Germany
Wuppermanstraße 6-10, D-25421 Pinneberg, Germany
Telefon : 04101/7007-0 Telefax : 04101/7007-30 e-mail : witt@wittfan.de

unverbindlich | uncertified | 12.01.07 | M98-53-4 Blatt / Sheet: 2 / 2

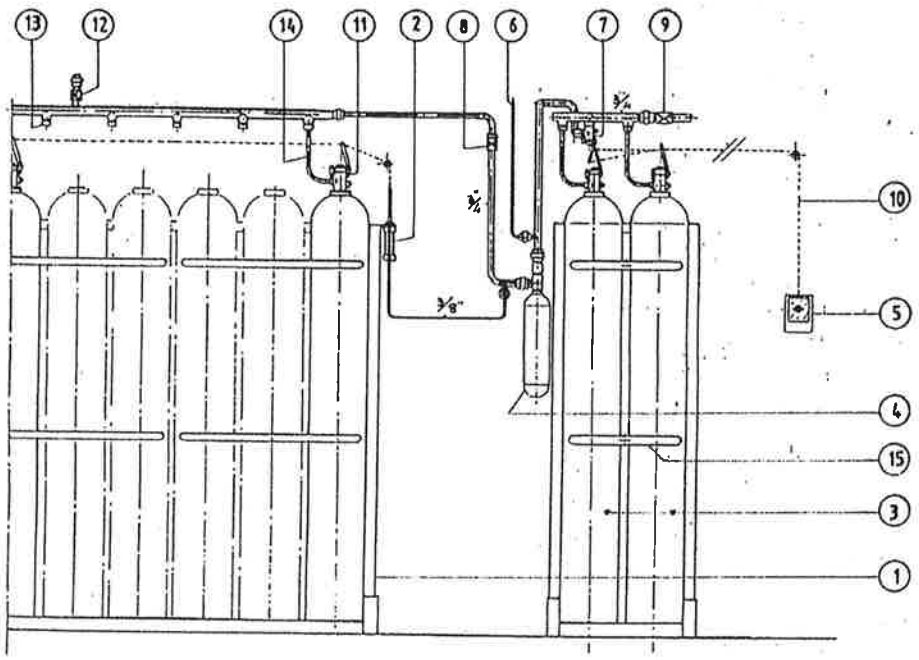
11. IMPIANTO CO_2

MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 166/1
Fg. - di -

Denominazione:

BATTERIA BOMBOLE CO2 CON BOMBOLE PILOTA
CO2 CYLINDERS BATTERY WITH PILOT CYLINDERS

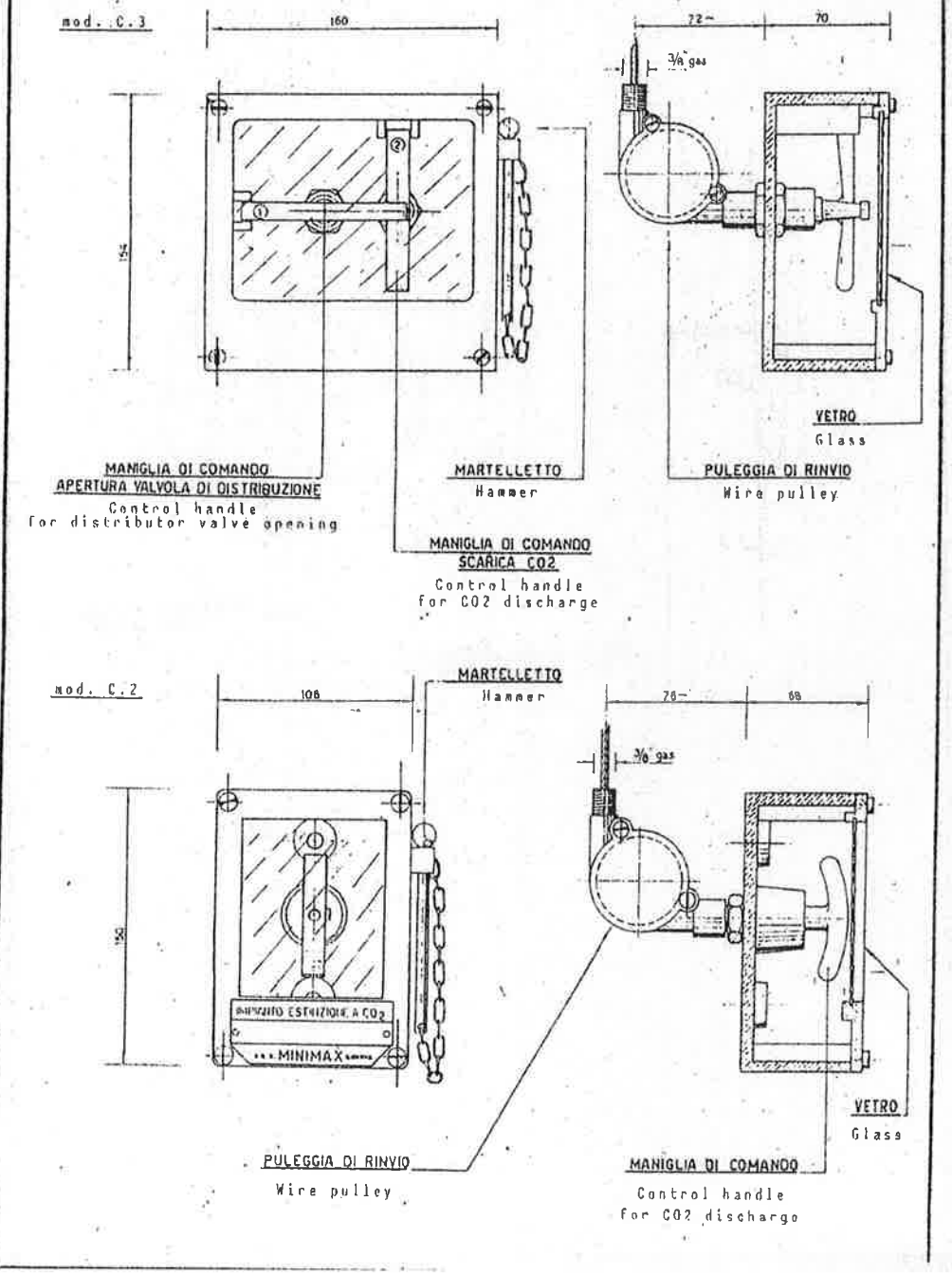


1	BATTERIA BOMBOLE -	CYLINDERS BATTERY -
2	PISTONE PNEUMATICO PER APERTURA SIMULTANEA AUTOMATICA DELLE BOMBOLE (STD. 88) -	PNEUMATIC PISTON FOR CYLINDERS SIMULTANEOUS AUTOMATIC RELEASE - (STD. 88)
3	BOMBOLE PILOTA -	PILOT CYLINDERS -
4	RITARDATORE AUTOMATICO - (STD. 150)	AUTOMATIC DELAYING DEVICE (STD. 150) -
5	DISPOSITIVO AZIONAMENTO COMANDO A DISTANZA (STD. 90) -	REMOTE CONTROL ACTING DEVICE (STD. 90) -
6	TUBAZIONE SIRENA DI PREALLARME -	ADVANCED ALARM SYREN PIPING -
7	VALVOLA DI SCARICO ALL'ATMOSFERA (IN POSIZIONE APERTA) -	DISCHARGE VALVE IN TO ATMOSPHERE (OPENED POSIT.) THROTTLED VALVE
8	VALVOLA STROZZATA - (STD. 348)	THROTTLED VALVE - (STD. 348)
9	VALVOLA AUSILIARIA DI TENUTA -	AUXILIARY VALVE -
10	CAVETTO D'ACCIAIO -	STEEL CABLE -
11	VALVOLA A LEVA (STD. 77 bis) -	QUICK RELEASE VALVE WITH LEVER (STD. 148) -
12	VALVOLA DI SICUREZZA CON SCARICO ALL'ATMOSFERA	SAFETY VALVE WITH DISCHARGE IN TO ATMOSPHERE -
13	VALVOLA DI RITEGNO - (STD. 626)	NO-RETURN VALVE - (STD. 626)
14	TUBO FLESSIBILE (STD. 627) -	FLEXIBLE HOSE - (STD. 627)
15	INGAFFATURE STRINGIBOMBOLE -	CYLINDERS IRON CLAMPS -

MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 90
Fg. 1 di 1

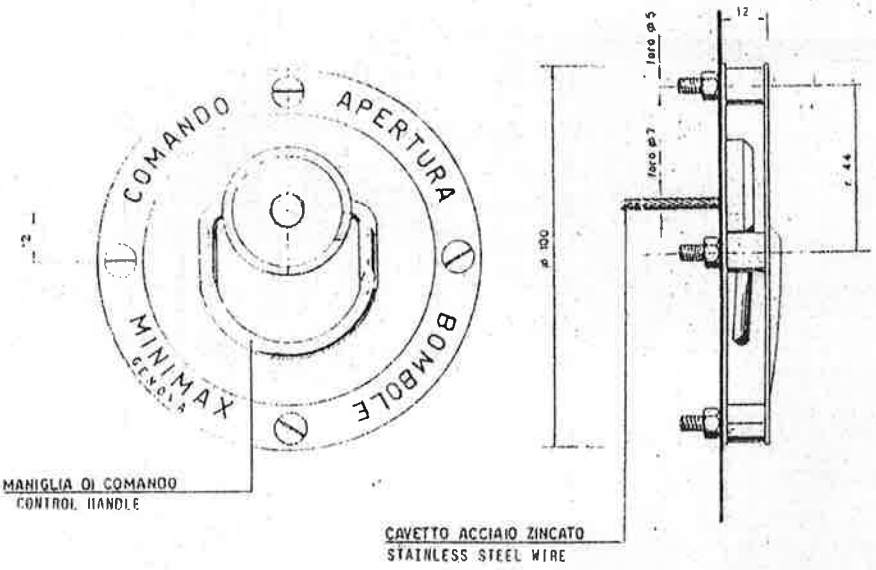
Denominazione: DISPOSITIVI DI TELECOMANDO SCARICA CO2
REMOTE CONTROL DEVICE FOR CO2 RELEASE



MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 238
Fg. ____ di ____

Denominazione:
DISPOSITIVO DI TELECOMANDO SCARICA CO2 PER NAUTICA DA DIPORTO - mod. C1
CO2 RELEASE PULL BOX FOR NAVIGATION ON PLEASURE - mod. C1

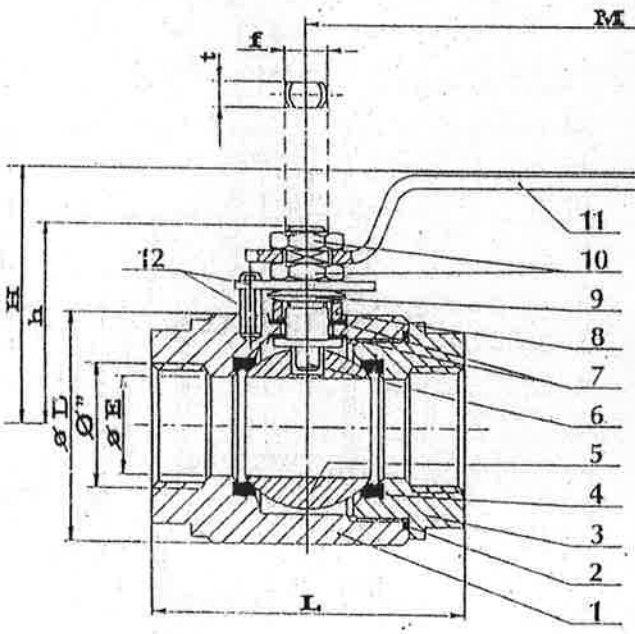


MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 4038
Pg. ' di '

Denominazione

VALVOLA A SFERA A PASSAGGIO TOTALE
BALL VALVE - FULL BORE



12	DISPOSITIVO D'ARRESTO STOP DEVICE
11	LEVA HANDLE
10	DADO CONTRODADO NUT - LOCK NUT
9	MOLLE A TAZZA SPRING WASHERS
8	PREMIBUSSOLA PRESSING BUSH
7	BUSSOLE BUSHES
6	STELO STEM
5	SFERA BALL
4	SEDI SEATS
3	GHIERA RING NUT
2	ANELLO RING
1	CORPO BODY
	DESCRIZIONE DESCRIPTION

TENUTE IN P.T.F.E. - FIRE SAFE -
TENUTE IN MATERIALI SPECIALI PER CLASSE 3000 Lbs
COSTRUZIONE DA BARRA IN CARBON STEEL E STAINLESS STEEL
ATTACCHI VALVOLA : GAS - ANSI B2.1 ; SOCKET/W. - BUTT/W.

DN	6	10	15	20	25	32	40	50
Ø"	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
ØE	10	10	14	19	24	29	38	48
L	65	65	73	80	98	104	125	154
M	135	135	135	135	180	180	275	275
H	53,5	53,5	61,5	64,5	77,5	81	108	130
Kg.	0,7	0,7	1	1,5	2,3	3,3	5	8,5

MINIMAX GENOVA

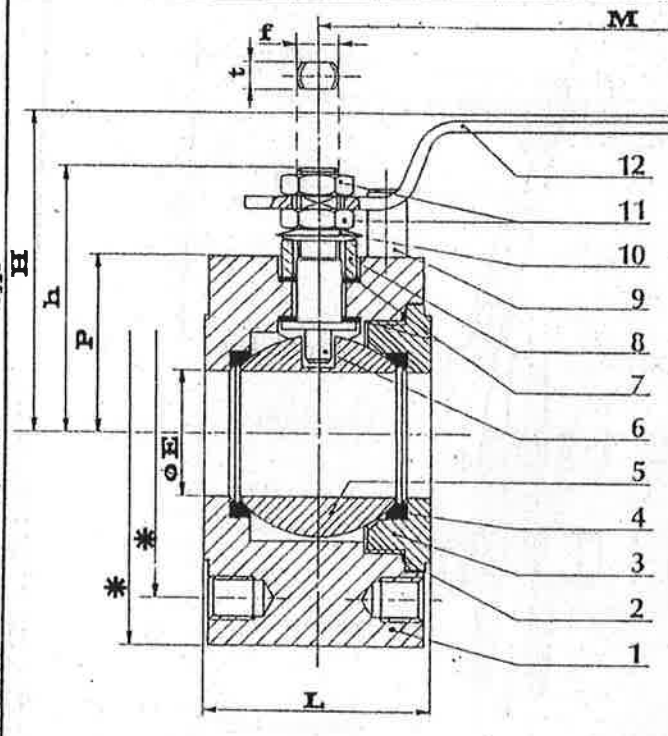
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 1378

Fg. / di /

Denominazione

VALVOLA A SFERA D'INTERCETTAZIONE PN 160



12	LEVA HANDLE
11	DADO CONTRODADO NUT LOCK NUT
10	MOLLE A TAZZA SPRING WASHERS
9	ARRESTO STOP
8	PREMIBUSSOLA PRESSING BUSH
7	BUSSOLE BUSHES
6	STELO STEM
5	SFERA BALL
4	SEDI SEATS
3	GHIERA RING NUT
2	ANELLO RING
1	CORPO BODY
	DESCRIZIONE DESCRIPTION

COSTRUZIONE DA BARRA IN CARBON STEEL DA DN 10 A DN 150

COSTRUZIONE DA BARRA IN STAINLESS STEEL DA DN 10 A DN 50

TENUTE SPECIALI - FIRE SAFE

* VALVOLA ACCOPPIABILE A FLANGE A NORME UNI - ANSI - DIN

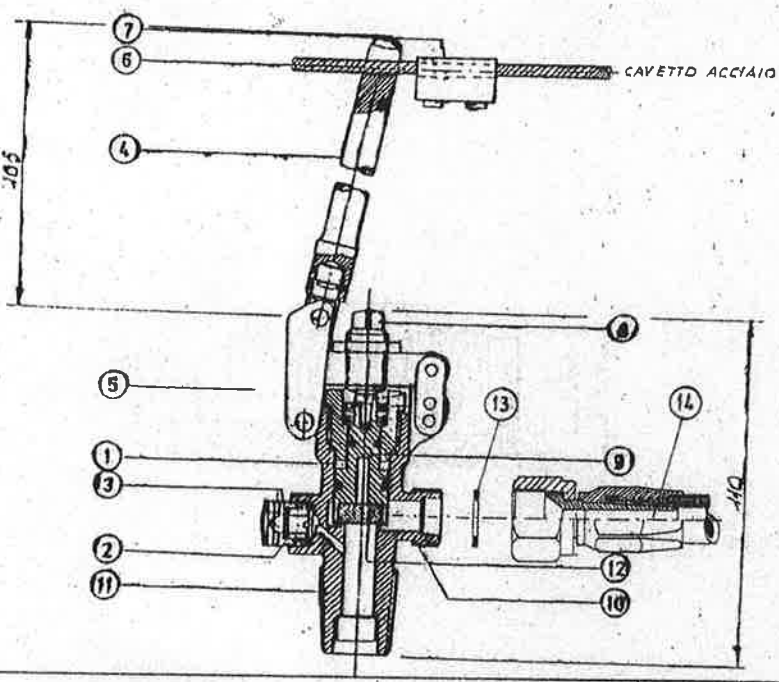
DN	10	15	20	25	32	40	50	65	80	100	125	150
Ø"								2½"	3"	4"	5"	6"
øE	14	14	19	24	29	38	48	64	76	95	118	150
L	55	55	60	65	75	85	100	125	150	185	220	280
M	145	145	145	275	275	380	380	440	440	610	810	810
H	65	65	60	105	115	127	135	160	180	250	270	300
Kg	2,5	2,5	3,5	4,5	6,5	11	13,5	25	33	50	75	100

MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 77 bis
Fg. ____ di ____

Denominazione:

VALVOLA A LEVA
LEVER VALVE

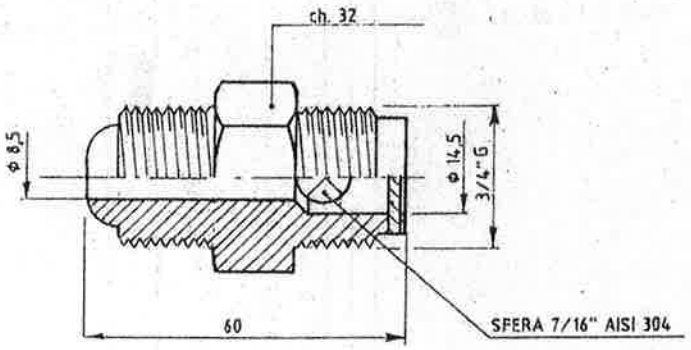


POS.	DENOMINAZIONE	DENOMINATION	MAT.LE	MAT.
1	CORPO VALVOLA	BODY VALVE	OTTONE	BRASS
2	VALVOLA DI SICUREZZA	SAFETY VALVE	"	"
3	DISCH. DI ROTTURA TAR.175/205 Kg/cmq.	BREAKABLE DISC TAR. 175/205	------	------
4	LEVA DI COMANDO	CONTROL LEVER	OTTONE	"
5	FORCELLA	FORK	"	"
6	FORO PASSAGGIO CAVETTO COMANDO	THROUGH HOLE CABLE CONTROL	"	"
7	MORSETTO DI BLOCCAGGIO	LOOCKING CABLE CLAMP	"	"
8	VITE REGOLAZIONE OTTURATORE	SHUTTER ADJUSTMENT SCREW	"	"
9	OTTURATORE	SHUTTER	"	"
10	ATTACCO USCITA Ø 21,8 x 14 TPI	OUTLET COUPLING	"	"
11	ATTACCO VALVOLA Ø 1" 11½ NGT W 28,8 x 14 TPI CONICO	VALVE COUPLING	"	"
12	SEGGIO DI TENUTA	SEAL SEAT	------	------
13	GUARNIZIONE DI TENUTA Ø 18,5x11 mm. (spess.1,5 mm.)	WASHER	FIBRA	FIBER
14	FLESSIBILE	FLEXIBLE HOSE		

MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 626
Fg. - di -

Denominazione: VALVOLA DI RITEGNO PER IMPIANTI CO2
NO RETURN VALVE FOR CO2 EXTINGUISHING SYSTEM

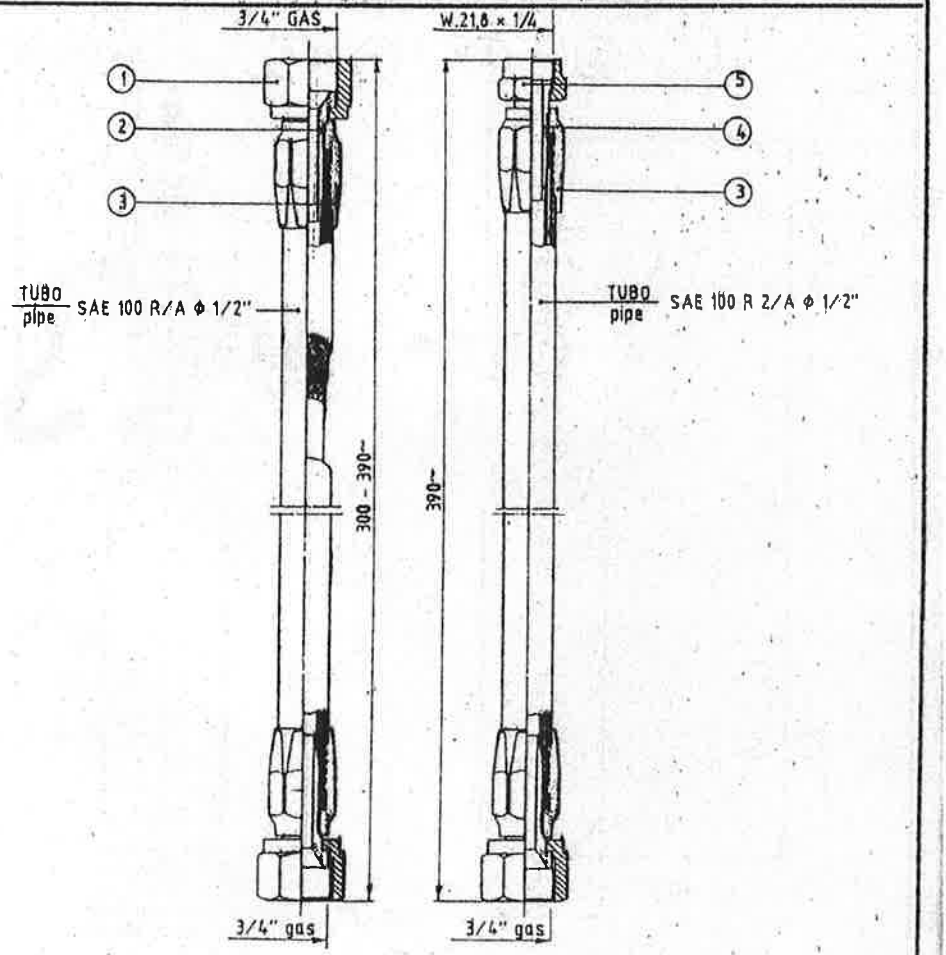


MATERIALE : OTTONE

MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 627
Fg. – di –

Denominazione: TUBI FLESSIBILI PER ALTE PRESSIONI - PER IMPIANTI A CO2.
HIGH PRESSURE FLEXIBLE PIPE - FOR CO2 EXTINGUISHING SYSTEM

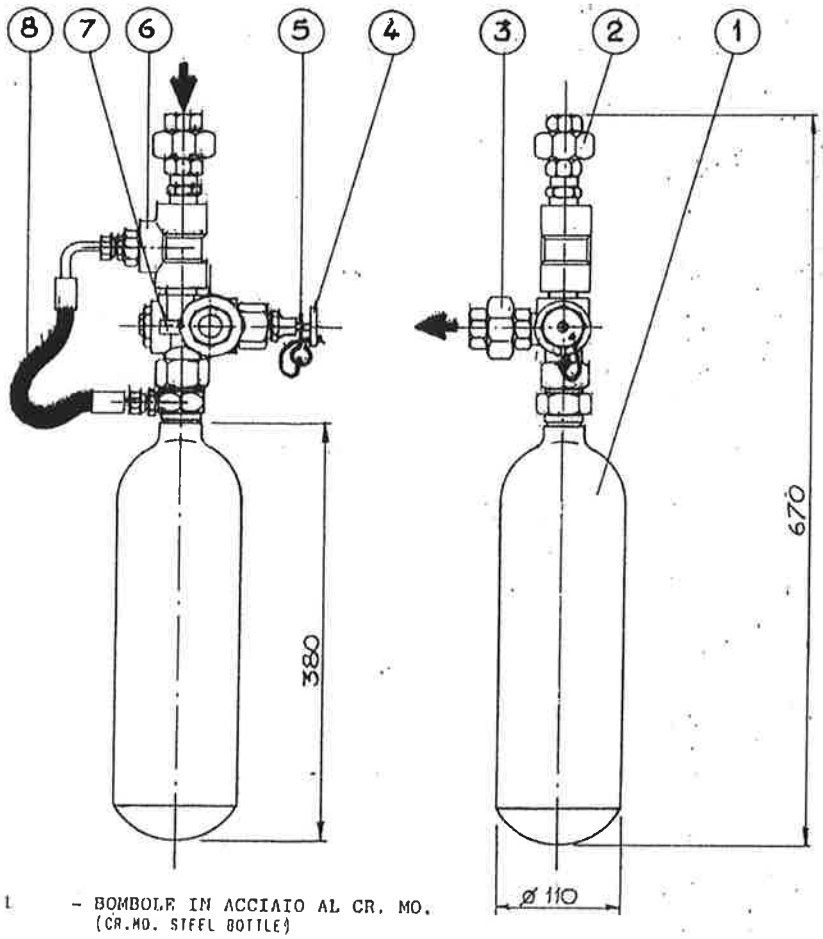


1, 2, 3, 4, 5 — MATERIALE : acciaio al carbonio - zincato

MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 150/1
Fg. 1 di 2

Denominazione: RITARDATORE AUTOMATICO PER IMPIANTI ESTINZIONE A. CO2
AUTOMATIC DELAYING DEVICE FOR CO2 EXTINGUISHING SYSTEM



1 - BOMBOLE IN ACCIAIO AL CR. MO.
(CR.MO. STEEL BOTTLE)

2 -3 - BOCCHETTONE DIRITTO ASA 3000 A 105 Ø 3/4"
(UNION ASA 3000 A 105 Ø 3/4")

4 - DISPOSITIVO DI INTERVENTO MANUALE
(EMERGENCY MANUAL DEVICE)

5 - SPINA DI SICUREZZA
(SAFETY PIN)

6 - RACCORDO A "T" ASA 3000 A 105
(TEE COUPLING ASA 3000 A 105)

7 - CORPO IN OTTONE STAMPATO
(BODY MADE OF PRESSED BRASS)

8 - TUBO FLESSIBILE SAE 100 R2A - Ø 1/4"
(FLEXIBLE HOSE SAE 100 R2A - Ø 1/4")

Lucca Bagliano (Ge)

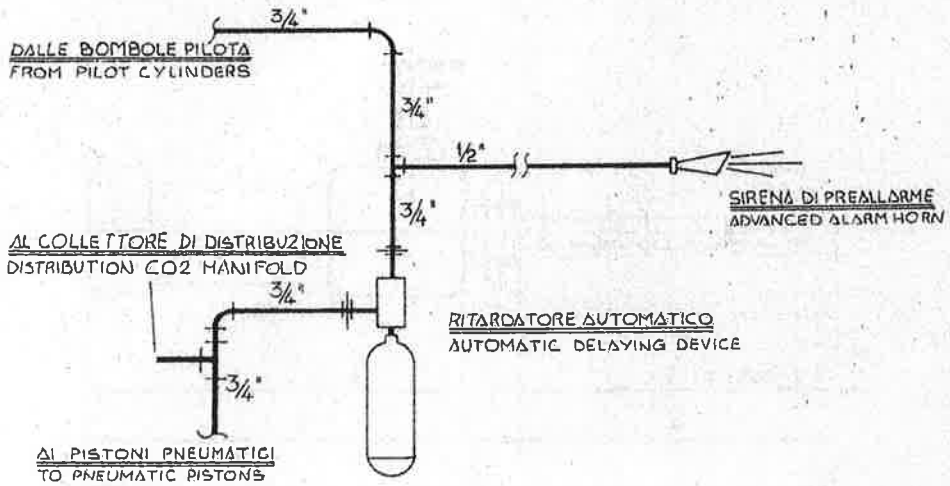
MINIMAX GENOVA

ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 150/1

Fg. 2 di 2

Denominazione



IL RITARDATORE AUTOMATICO "MINIMAX" CONSENTE DI MANTENERE INTERCETTATO IL CO2 PER UN PERIODO DI CA. 30" PERMETTENDO IN TAL MODO IL FUNZIONAMENTO DI UNA SIRENA DI PREALLARME ALLACCIATA A MONTE DELLO STESSO -.

MINIMAX AUTOMATIC DELAYING DEVICE ALLOWS THE OPERATING OF AN ADVANCED ALARM HORN KEEPING SHUT OFF CO2 FROM PILOT CYLINDERS FOR 30 SEC. APPROX.

IL RITARDATORE, IN CASO DI EMERGENZA, PUO' ESSERE AZIONATO MANUALMENTE RUOTANDO IL VOLANTINO, A POS. 4, IN SENSO ORARIO DOPO AVER TOLTO LA SPINA DI SICUREZZA.

THE DELAYING DEVICE, FOR EMERGENCY CONTROL, CAN BE OPERATED MANUALLY TURNING CLOCK WISE THE WHEEL, POS. 4, AFTER TAKING OUT THE SAFETY PIN.

N.B.: DOPO IL FUNZIONAMENTO IL RITARDATORE DEVE ESSERE RIPRISTINATO MANUALMENTE PER L'INTERVENTO SUCCESSIVO RIARMANDO IL MECCANISMO INTERNO -

AFTER OPERATION THE DELAYING DEVICE MUST BE MANUALLY RESTORED RESETTING THE INNER EQUIPMENT -

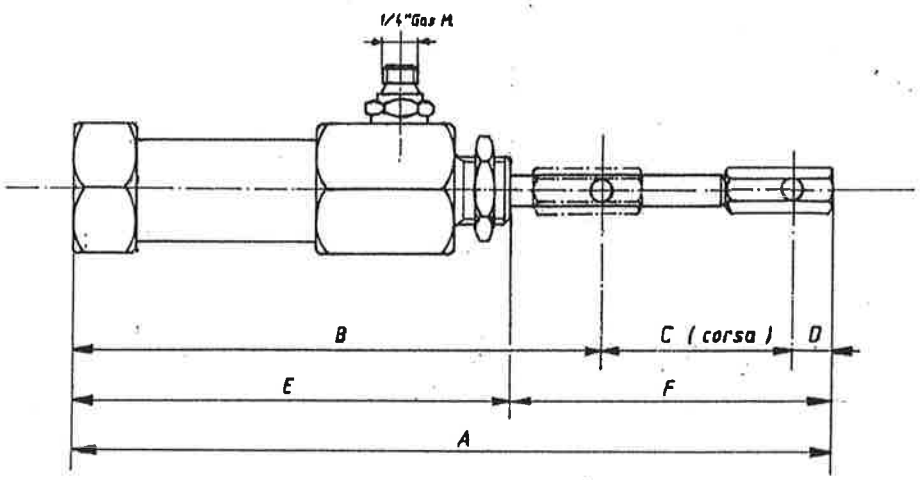
Lucesa Bogliasco (Ge)

MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 1956
Fg. ____ di ____

Denominazione

PISTONI PNEUMATICI PER APERTURA VALVOLE A LEVA E A SFERA



Mod.	Pos. con		A mm.	B mm.	C corsa mm.	D mm.	E mm.	F mm.
P1	Ø VALVOLE A LEVA	max n°14	280	195	70	15	160	120
P2 (*)		max n°30	305	215	75	15	180	125
P3 (**)		max n°30	320	225	80	15	195	125
P4	Ø VALVOLE A SFERA	3/4"	435	275	145	15	235	200
P5		1"	550	330	205	15	295	255
P6		1 1/4"	570	340	215	15	305	265
P7		1 1/2"-2"	865	505	345	15	465	400
P8		2 1/2"	1115	630	470	15	600	515
P9		3"-4"-5"	1230	690	525	15	650	580

(*) R.I.N.A.
(**) A.B.S. NB. DIMENSIONI DI MASSIMA NON IMPEGNATIVE

MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

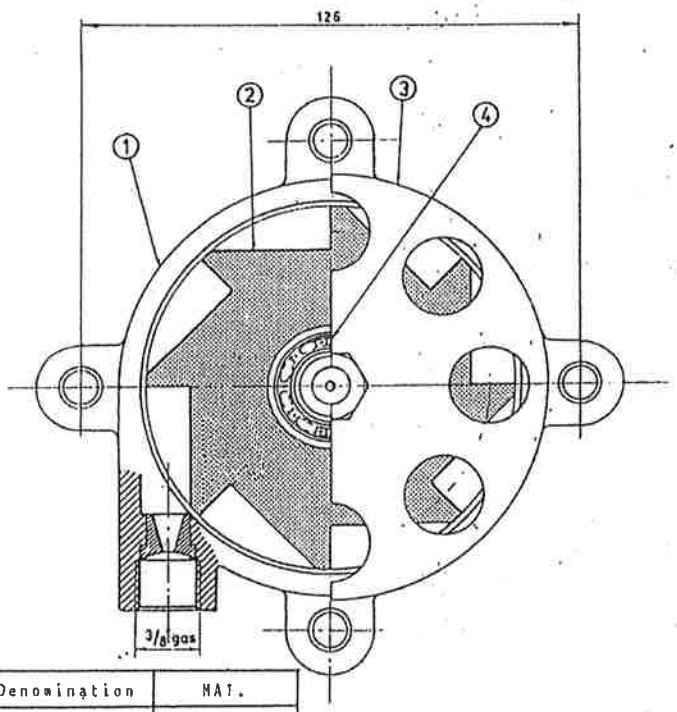
STD. N° 93
Fg. 1 di 1

Denominazione: DISPOSITIVI DI ALLARME PER IMPIANTI CO2
ALARM DEVICES FOR CO2 SYSTEMS

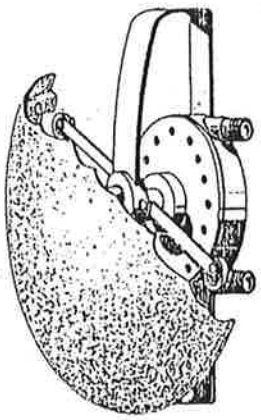
SIRENA ROTANTE
ROTATING SYREN

MISURE D'INGOMBRO
mm. 150 x 70
PESO kg. 1,900

OVERALL DIMENSIONS
mm. 150 x 70
WEIGHT: Kg. 1,900

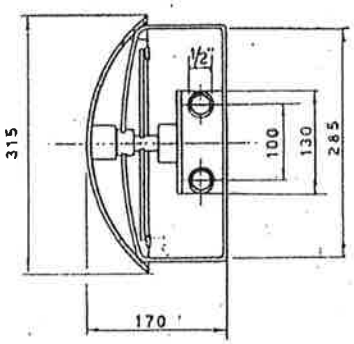


POS	COD.n°	DENOMINAZIONE	Denomination	MAT.
1	3455-01	CORPO SIRENA	Syrene body	OTTONE Brass
2	3455-02	GIRANTE	Wheel	ALLUM. Alum.
3	3455-03	COPERCHIO	Cap	OTTONE Brass
4	3455-04	CUSCINETTO	Bearing	----- ---



MANDATA
INLET

SCARICO
OUTLET



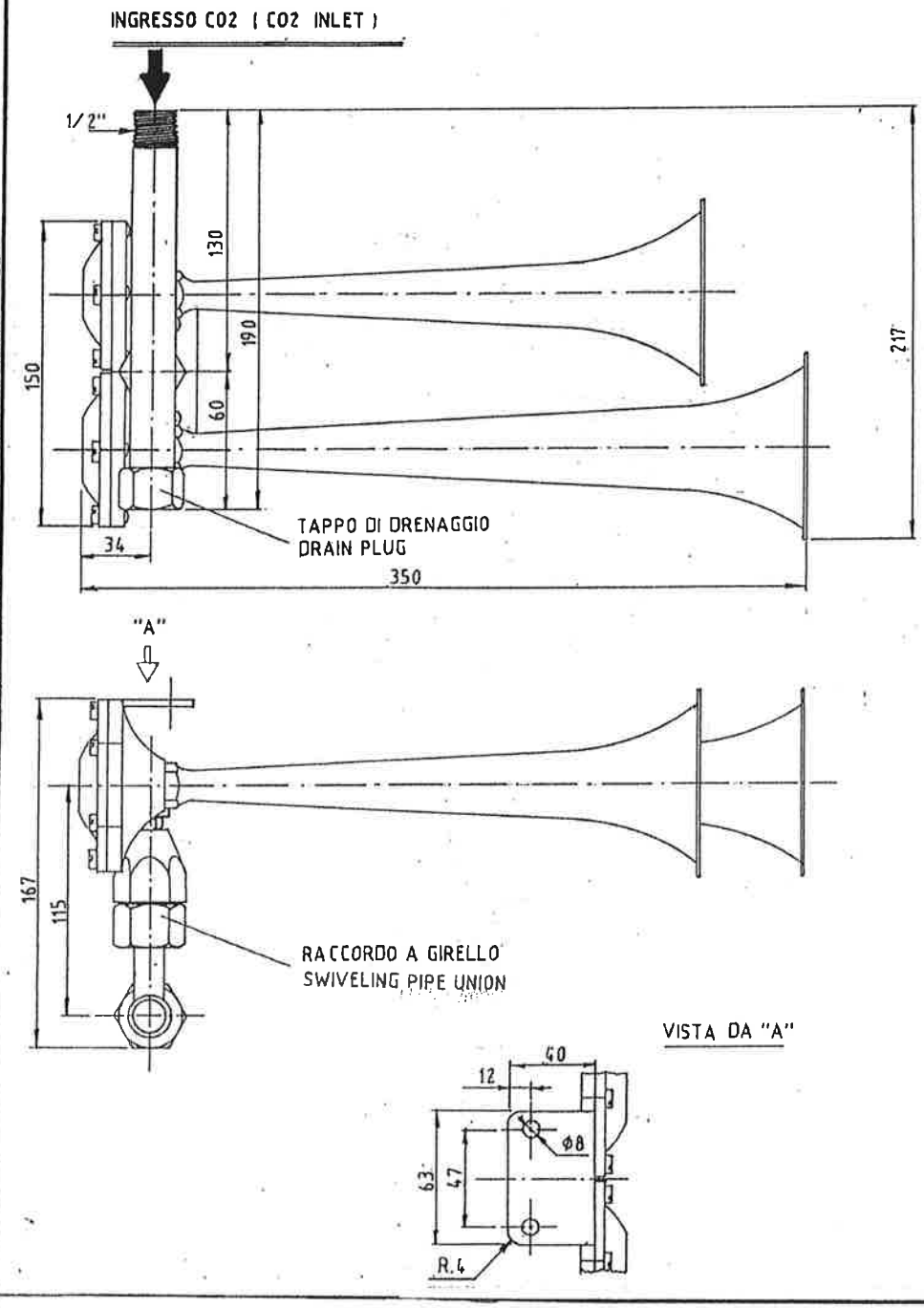
CAMPANA DI ALLARME A TURBINA
TURBINE ALARM BELL

MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 92/1
Fg. 1 di 1

Denominazione

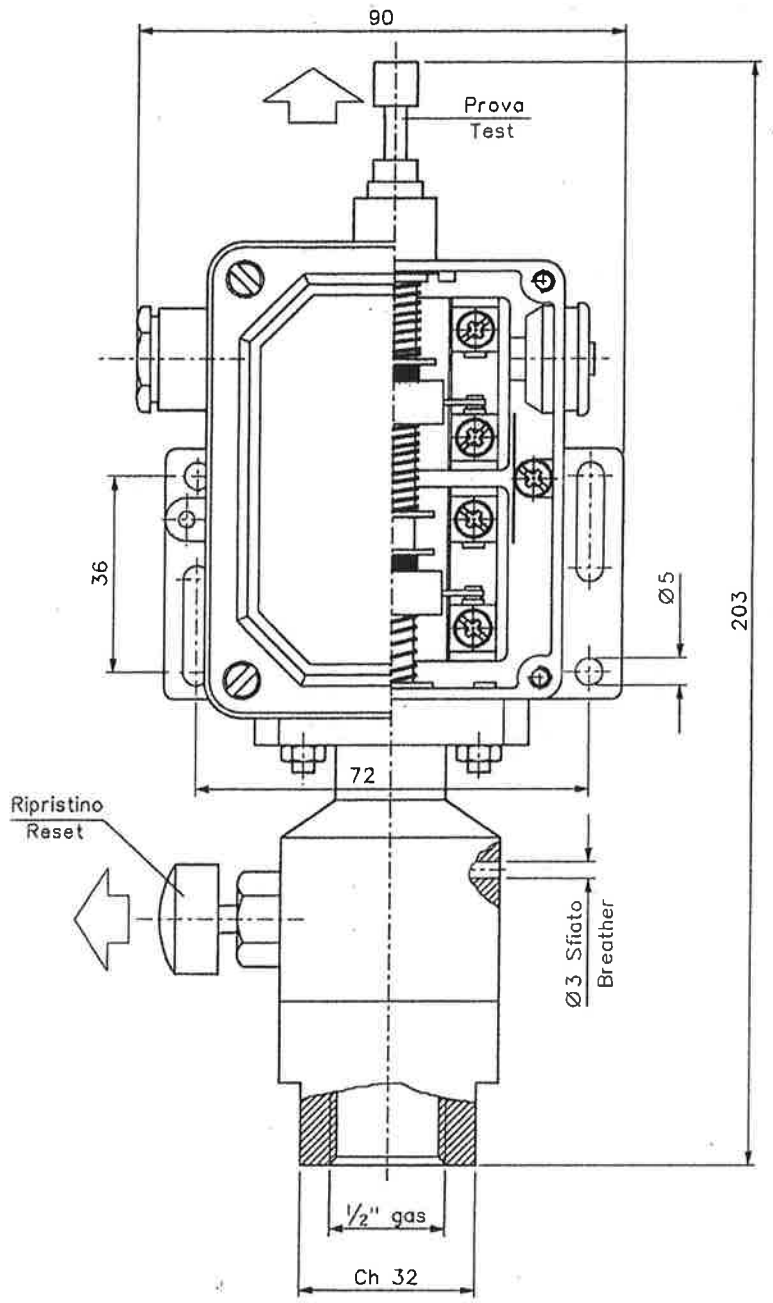
DISPOSITIVO D'ALLARME A CO2 TIPO TYPHOON
CO2 ALARM DEVICE TYPHOON TYPE



MINIMAX S. r. l. GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD N° 1930
Fg. ____ di ____

PRESSOSTATO A 4 CONTATTI ELETTRICI (2NA+2NC)
PRESSURE-SWITCH WITH 4 ELECTRIC CONTACTS (2NO+2NC)



MINIMAX GENOVA

ESTINTORI ED IMPIANTI ANTINCENDIO

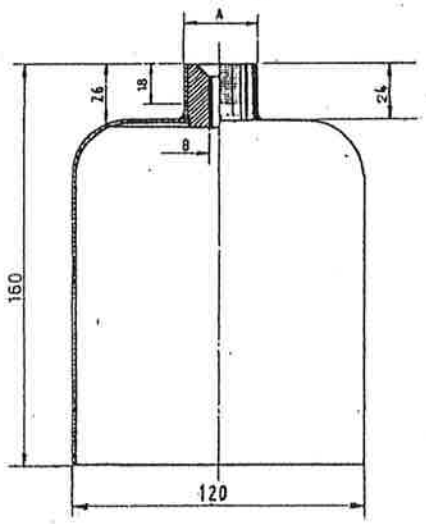
STD. N° 149/1

Fg. 1 di 1

Denominazione

CONO EROGATORE CO2

CO2 NOZZLE



A : FILETTATURA DA 3/4" OPPURE 1/2" GAS

B : ⌀ DA STABILIRSI

MATERIALE : Acc

A: THREAD Ø 3/4" OR 1/2" GAS

B: Ø TO BE FIXED

MATERIAL: Acc

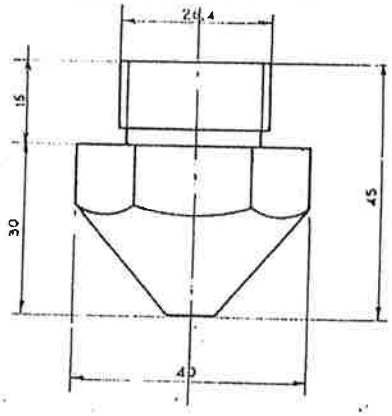
MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 236
Fg. ... di ...

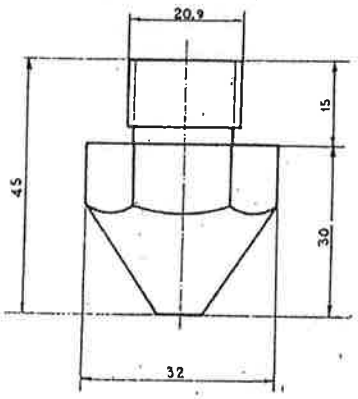
Denominazione:

UGELLI EROGAZIONE CO2
CO2 NOZZLES

TIPO A Ø 3/4" G.
CODICE 34 UEL - CODE 34 UEL



TIPO B Ø 1/2" G.
CODICE 12 UEL - CODE 12 UEL

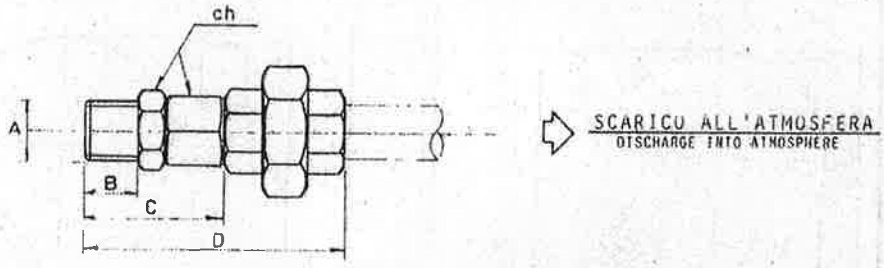


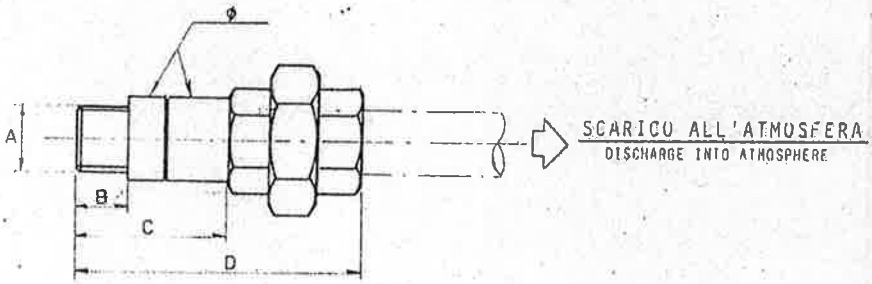
MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 145
Fg. – di' –

Denominazione:

VALVOLE DI SICUREZZA
SAFETY VALVE





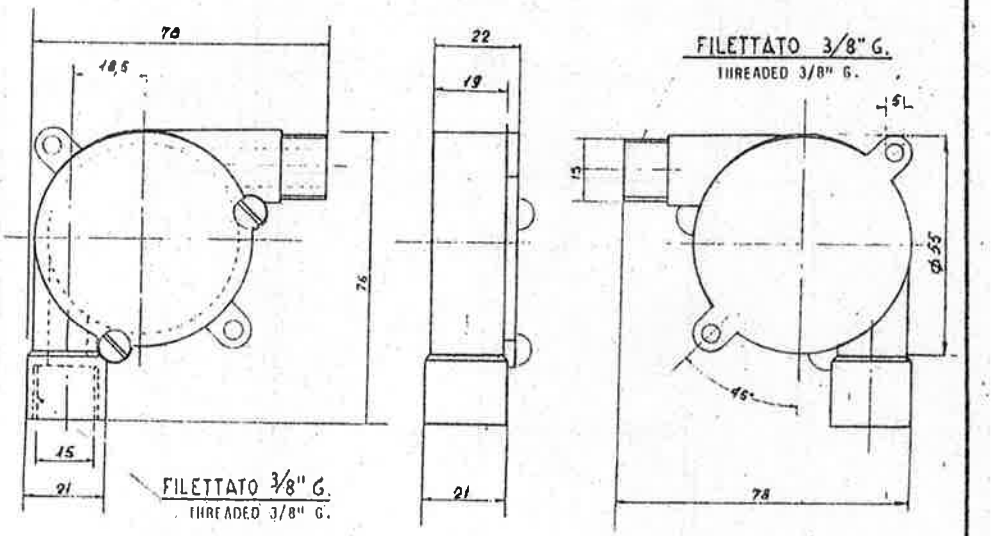
A	B	C	D	ch	φ
3/4" gas m	17	55	105	32	—
1" gas m	17	62	125	38	—
1 1/4" gas m	19	73	144	—	50

MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 237
Fg. ____ di ____

Denominazione:

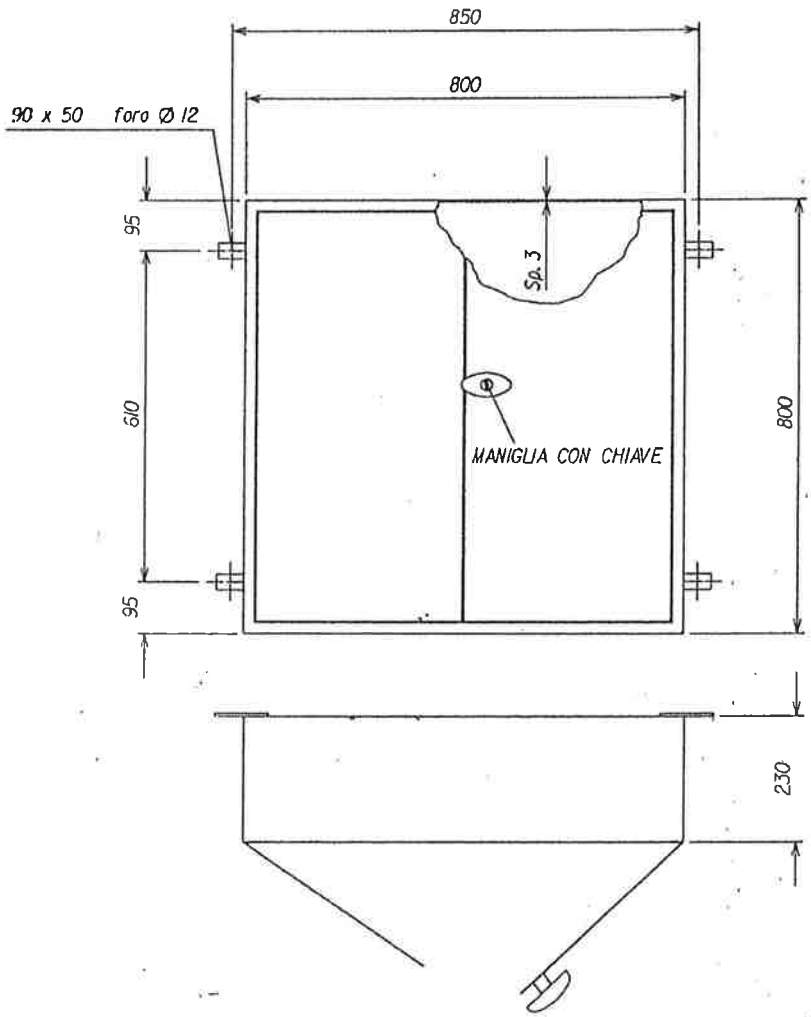
PULEGGIA DI RINVIO CAVETTO IN CUSTODIA STAGNA
CLOSED PULLEY FOR DRIVING GEAR BY STAINLESS STEEL WIRE



MINIMAX S. r. l. GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD N° 1656
Fg. ____ di ____

DIMENSIONI DI MASSIMA ARMADIO A DUE ANTE PER POSTO DI COMANDO

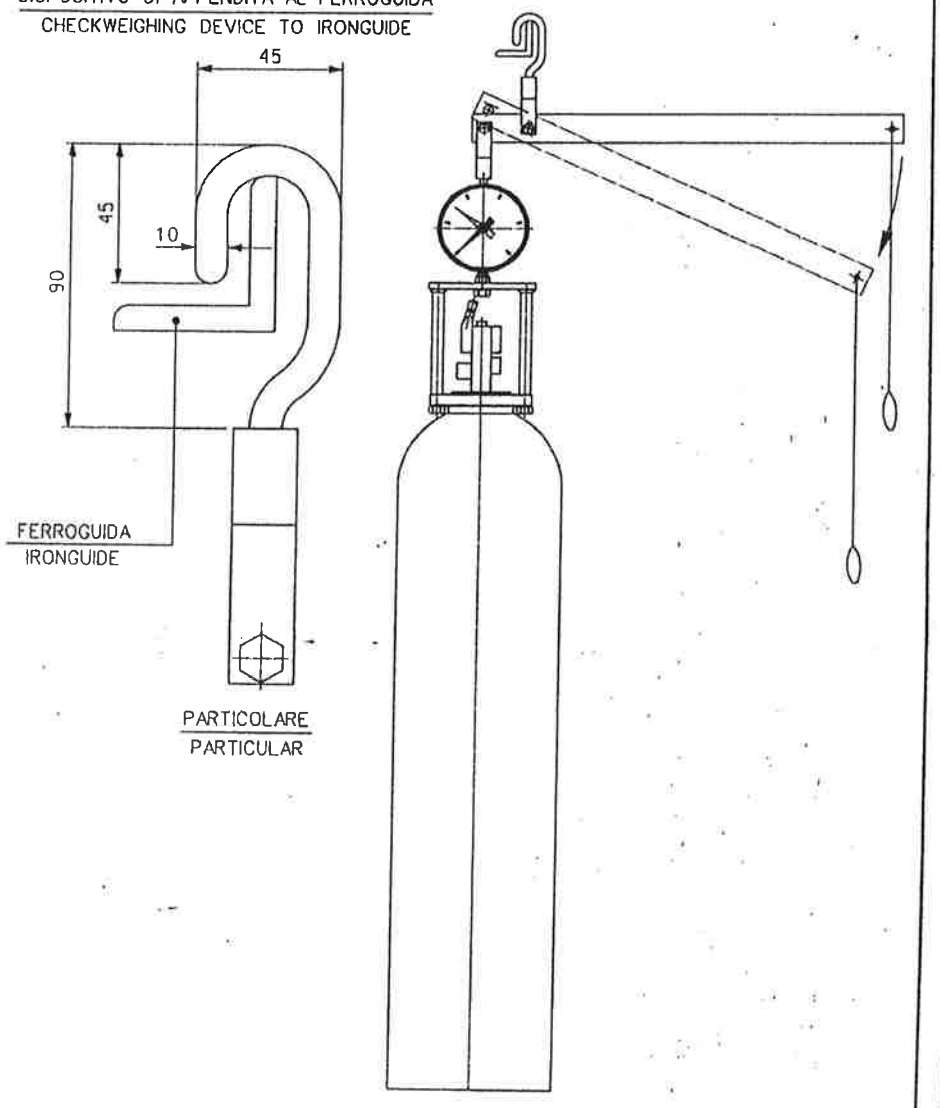


MINIMAX S. r. l. GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD N° 1652
Fg. ____ di ____

DINAMOMETRO PESABOMBOLE CO2
CO2 CYLINDERSWEIGHING DYNAMOMETER

DISPOSITIVO DI APPENDITA AL FERROGUIDA
CHECKWEIGHING DEVICE TO IRONGUIDE

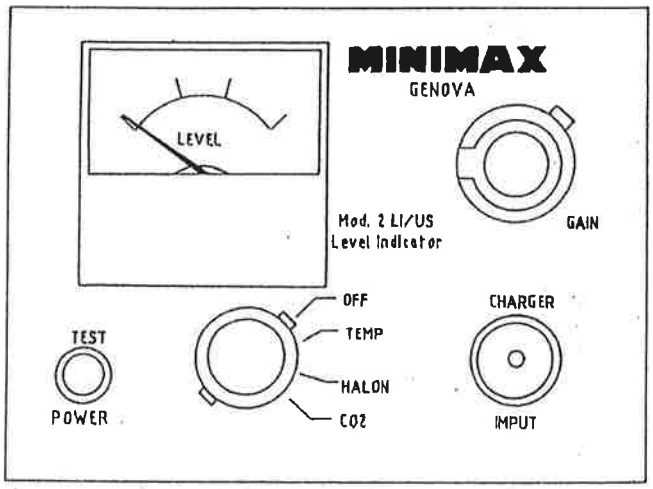


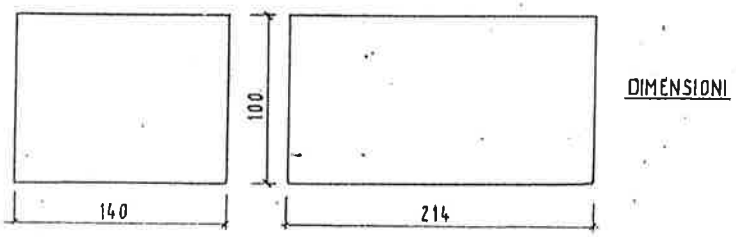
MINIMAX GENOVA
ESTINTORI ED IMPIANTI ANTINCENDIO

STD. N° 1122
Fg. / di /

Denominazione

INDICATORE DI LIVELLO AD ULTRASUONI mod. 2LI/US

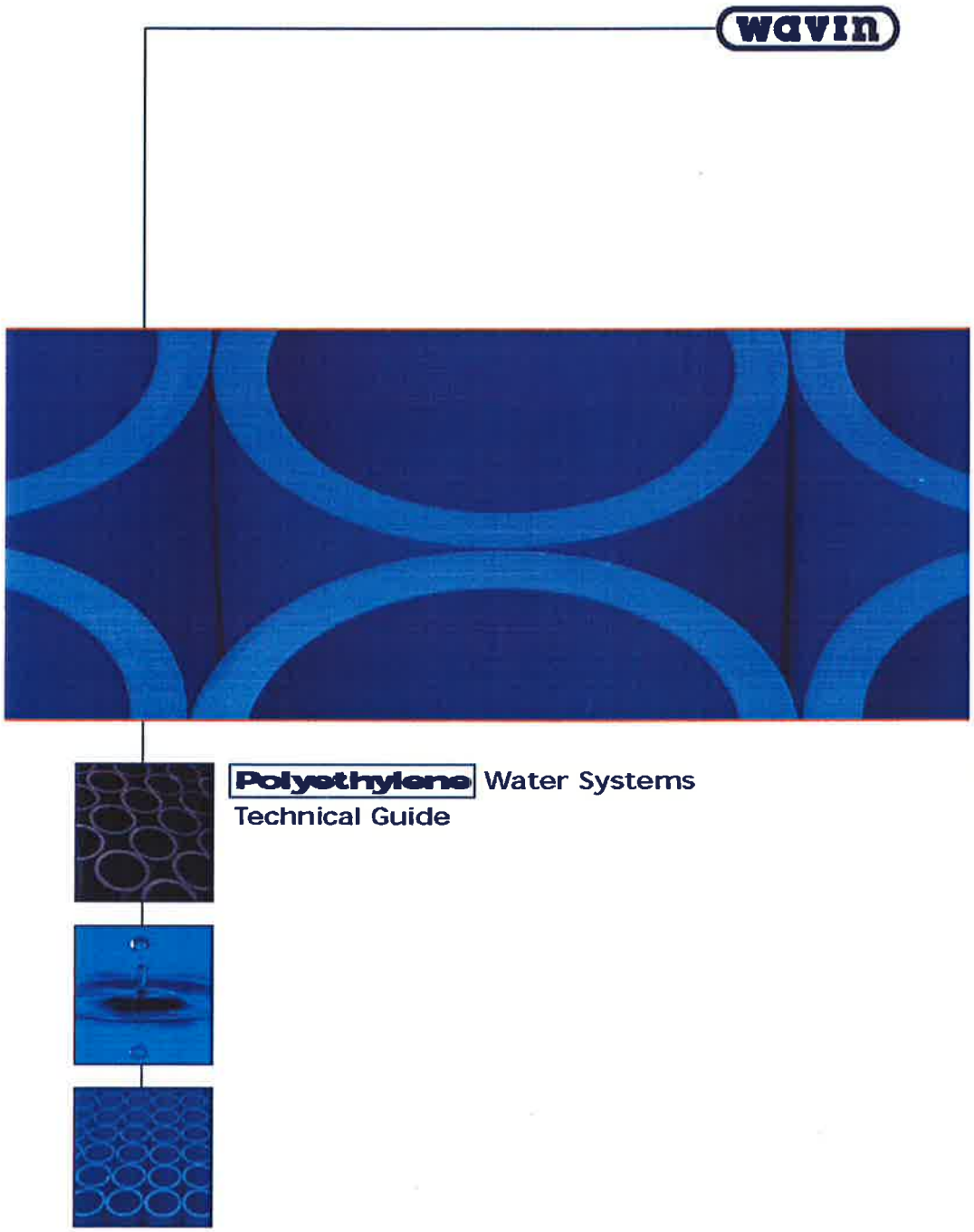


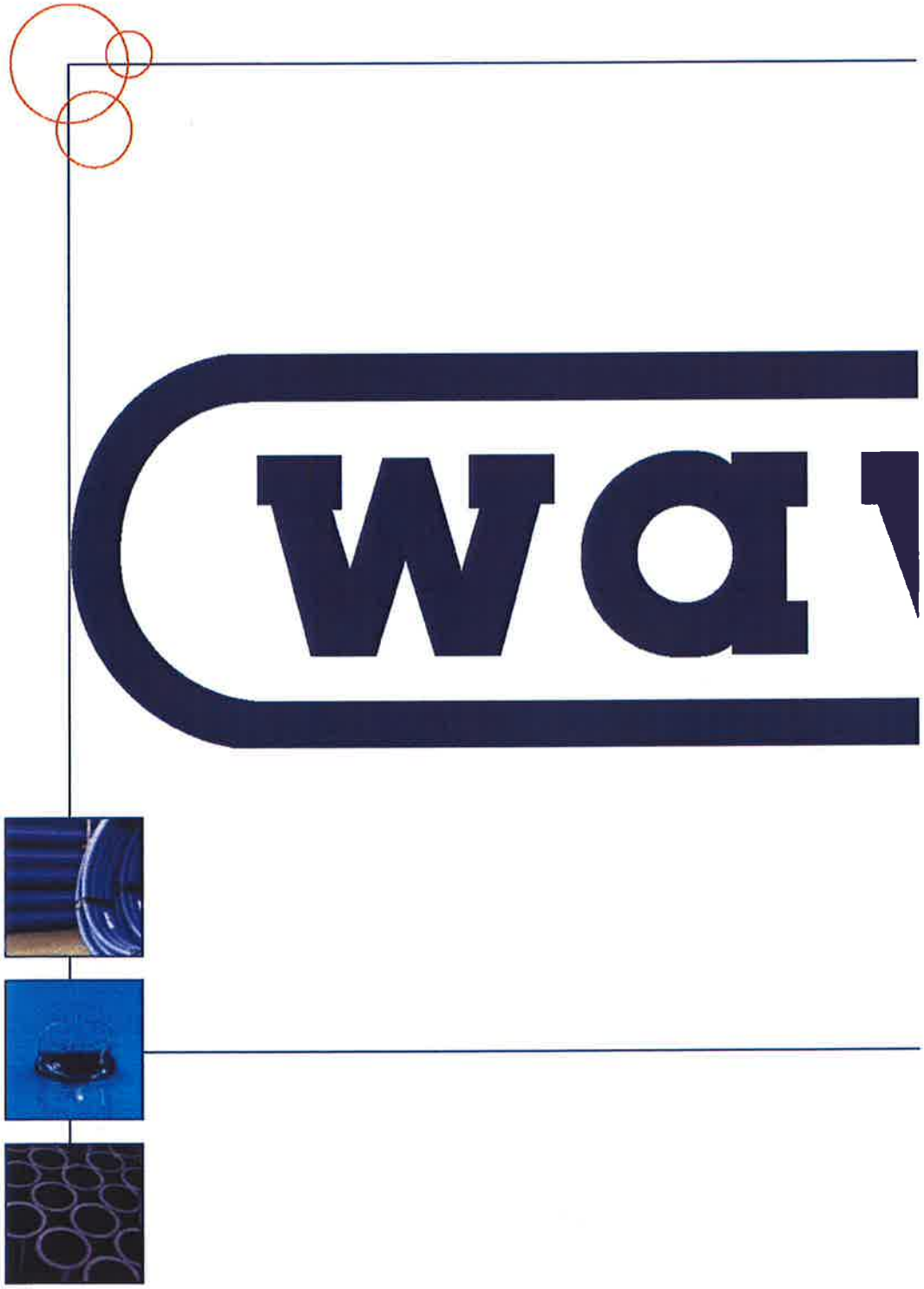


DIMENSIONI

LO STRUMENTO È DOTATO DI UNA PRATICA BORSA A TRACOLLA CON DUE TASCHE PER CONTENERE LA SONDA ED IL CAVO PER LA RICARICA.
INOLTRE LO STRUMENTO VIENE FORNITO IN UNA CASSETTA IN LEGNO CON CHIUSURA A CHIAVE
PESO TOTALE : 1300 gr (SOLO STRUMENTO)

12. TUBI IN POLIETILENE





wavin

Technical Guide Content

Wavin Plastics Limited is part of the 1.7 billion (NLG) Wavin Group of companies. As a group, Wavin operates in twenty-six countries, making it one of the largest converters of plastic, the largest manufacturer of plastic pipe systems and the largest industrial re-cycler of plastics world-wide. UK Headquarters are located in Chippenham, where Wavin Plastics Limited is the leading plastics pipe systems manufacturer for the Building, Utility and Civil markets.

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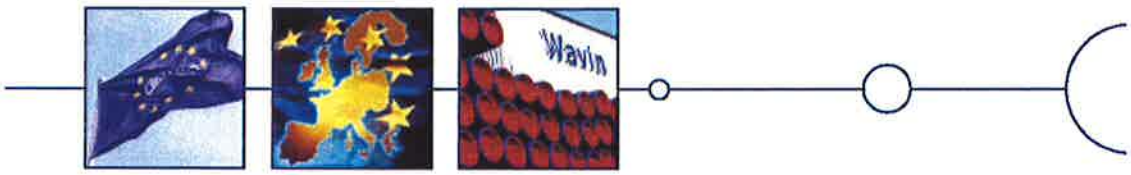
Flying the flag in Europe



Wavin was founded in 1955 by Johann Keller, Managing director of the Overijssel Water Company. Today the Wavin Group employs over 4500 people in 26 countries in Europe and South East Asia and works closely with over 40 licensees all over the world including Japan, the United States and South America.

Wavin Plastics occupies a 26-acre site on the outskirts of Durham City, employing over 140 people in the production of polyethylene and PVC-u pipe systems for the UK water industry, the agricultural market and the world-wide gas market.

Wavin Plastics pursues a policy of continuous development and investment. This has resulted in a major re-organisation of the manufacturing site, which now houses what is almost certainly the longest, most modern and technologically advanced polyethylene plant in Europe. This enables Wavin Plastics to offer pipe in long straight lengths up to 18 metres, as well as coils and drums up to 770 metres in length. With an investment of 1.4 million, the new layout incorporates the latest equipment from material conveying through extrusion to finished product handling, storage and despatch. In addition to the facilities at Brandon, applied research, technical support and product development are undertaken at the Wavin Advanced Centre for Research and Development in Holland.

Polyethylene Systems

Polyethylene pipe systems offer the water engineer many benefits:-

- Cost Saving with faster, easier installation
- Limited or no dig installation
- Maintenance free design life
- Corrosion resistance
- Suitability for renovation, lining and insertion
- No requirement for end load restraint for fusion welded systems
- Fully fused jointing ensuring water-tight system
- Flexibility, allowing for ground movement

06

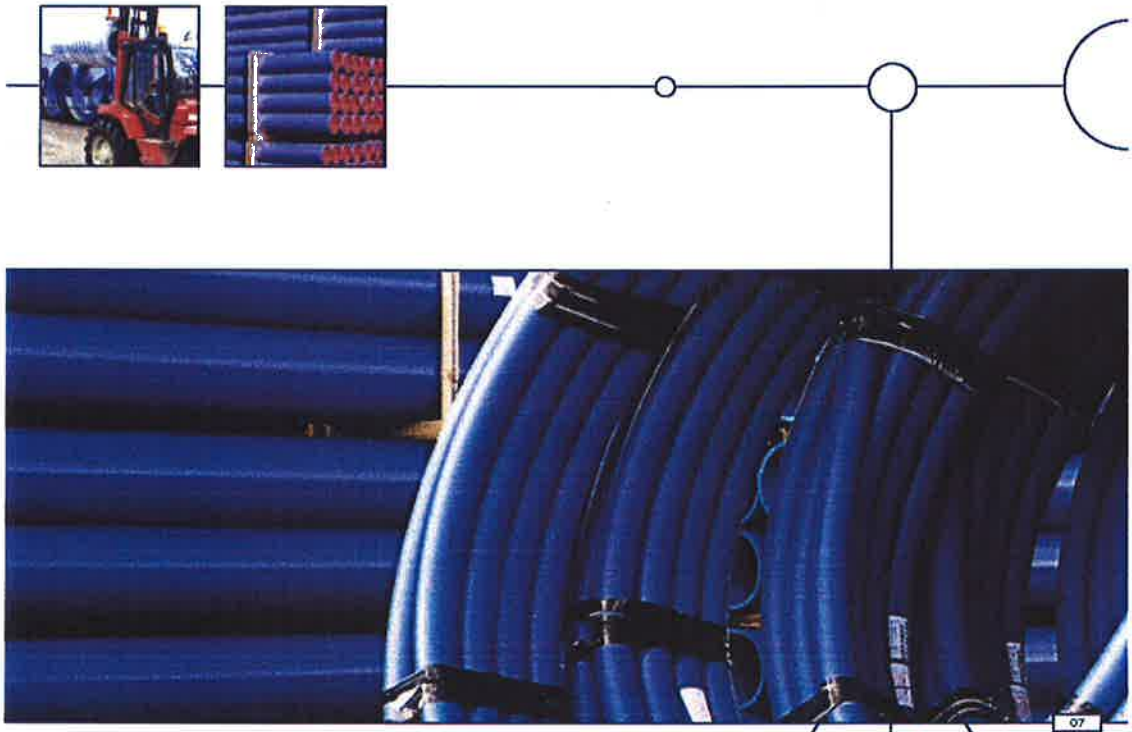
Wavin offers a choice of two materials:-

Medium density polyethylene (MDPE)

Medium Density Polyethylene (MDPE) with a strength classification, PE80, which refers to a pipe which has a minimum 50 years strength of 8Mpa. This enables operation at pressures up to 12.5 bar for an SDR 11 pipe, 8 bar for an SDR 17 pipe.

High performance polyethylene (HPPE)

High Performance Polyethylene (HPPE) with a strength classification, PE100, which refers to a pipe which has a minimum 50 years strength of 10Mpa. This enables operation at pressures up to 16 bar for an SDR 11 pipe or 10 bar for an SDR 17 pipe. Further details on the properties of these materials are given in the Design and Performance section of this guide.



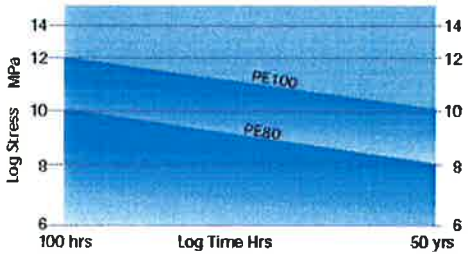
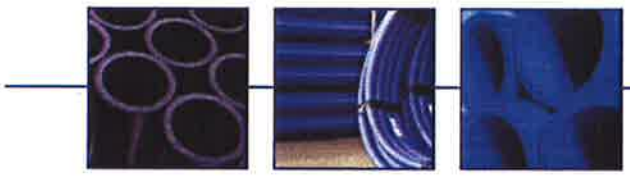


Figure 1. Material Classification


Polyethylene Systems
08
WavinSure
MDPE (PE80)
Wavin SupaSure
HPPE (PE100)
Wavin TS
HPPE (PE100)



WavinBlack
MDPE (PE80)

The WavinBlack system is a range of black MDPE (PE80) pipe and fittings suitable for use with above ground potable and below ground non potable water.

The system meets the requirements of BS 6730: 1986 for sizes up to and including 63mm, for use at pressures up to 12 bar. Sizes 90mm and above meet the requirements of WIS 4-32-17 (pipe), 4-32-14 and 4-32-15 (fittings). This system allows for use at pressures up to 12.5 bar.

WavinJet
HPPE (PE100)

The WavinJet system is a range of black HPPE (PE100) pipe and fittings suitable for use with above ground potable and below ground non potable water.

The system meets the performance requirements of WIS 4-32-17, 4-32-14 and 4-32-15 (fittings).

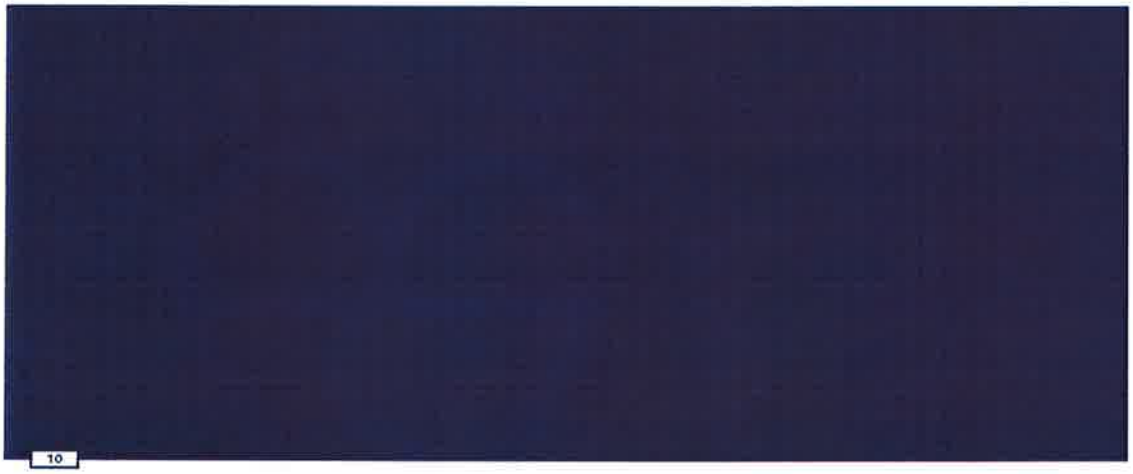
The material's higher performance characteristics enable pipe systems to operate at pressures up to 16 bar.

Details of the full product range can be obtained from the Wavin Sales Office.

Quality Control

All Wavin products are manufactured and tested under a Quality Management System that is third party certificated by the British Standards Institution against the requirements of BS EN ISO 9002 : 1994. Wavin Plastics Ltd. is a firm of assessed capability under the British Standard Institution (BSI) scheme (Registration Number FM 00217) for the manufacture and supply of pipe and fittings conforming to the Water Research Centre (WRc) Engineering Specifications.

The Registered Firm Approval covers the manufacture and supply against the following specifications:



WIS 4-32-03
Specification for blue polyethylene (PE80) pressure pipe for cold potable water nominal sizes 90mm to 1000mm for underground or protected use.

WIS 4-32-09
Specification for black polyethylene (PE80) pressure pipe for cold potable water or sewerage, nominal sizes 90mm to 1000mm for above ground use.

WIS 4-32-13
Specification for blue higher performance polyethylene (PE100) pressure pipe, nominal sizes 90mm to 1000mm for underground or protected use for the conveyance of water intended for human consumption.

WIS 4-32-14
Specification for PE80 and PE100 electrofusion fittings for nominal sizes up to and including 630mm.

WIS 4-32-15
Specification for PE80 and PE100 spigot fittings and drawn bends for nominal sizes up to and including 1000mm.

WIS 4-32-17
Specification for PE80 and PE100 blue and black polyethylene pressure pipes, nominal sizes 20mm to 630mm for pressurised water supply and sewerage duties.

Wavin also manufacture blue polyethylene pipes up to nominal size 63mm for below ground use for potable water to BS 6572 : 1985 under a Kitemark Licence issued by BSI.

Black polyethylene pipes up to nominal size 63mm for above ground use for cold potable water are manufactured to BS 6730 : 1986 under a Kitemark Licence issued by BSI.

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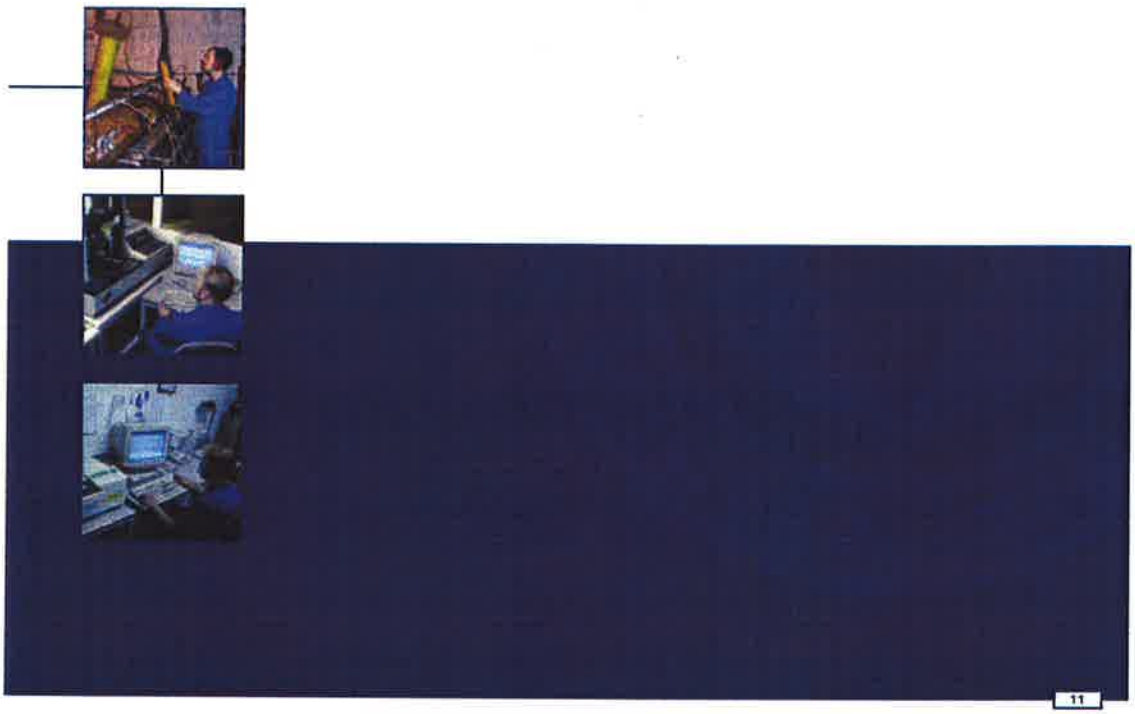


Wavin operate a policy of continuous improvement. Additional approvals, therefore, may be added to those detailed. Up to date information is always available from the Technical Services Helpdesk.

Wavin has continually maintained a commitment to quality and currently holds BSI Kitemark Licences for the following products:

BS 4962 : 1989
Plastic pipes and fittings for use as subsoil field drains.

BS 5255 : 1989
Thermoplastic waste pipe and fittings.

BS EN 1401-1 : 1998
PVC-u pipe systems for non pressure underground drainage and sewerage.

BS EN 7291 Parts 1&2 : 1990
Thermoplastic pipes and fittings for hot and cold water for domestic supply.

WIS 4-31-08 : 2001
Oriented Polyvinyl Chloride (PVC-O) pressure pipes for underground use.

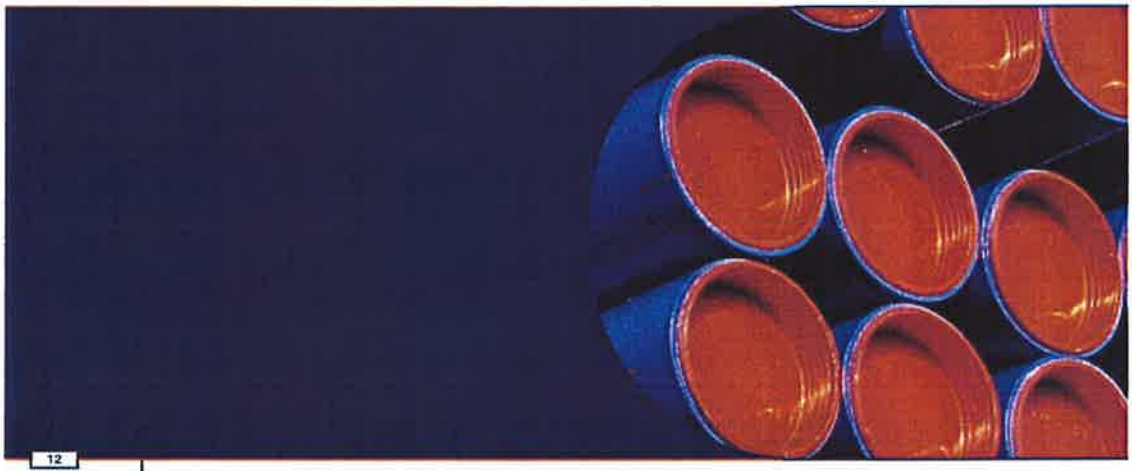
Additionally Wavin have supplied polyethylene pipe and fittings to British Gas since 1975 and have maintained their approval status up to and including 500mm SDR 11 pipe in PE80 and PE100.

Product Details

Wavin Polyethylene Pipe Systems are manufactured from PE80, commonly known as Medium Density Polyethylene (MDPE) and PE100, High Performance Polyethylene (HPPE) and can be used for both pressure and non-pressure applications. Wavin have been manufacturing polyethylene pipe systems since the early 1970's and since then have been at the forefront of materials and manufacturing technology. This has resulted in Wavin becoming the leading plastics manufacturer in Europe.

Polyethylene is now an established pipeline material for water, gas and industrial uses and provides a cost effective, reliable pipe system with excellent properties such as corrosion resistance, chemical resistance and flexibility.

Wavin Polyethylene Pipe Systems are available for numerous applications and are colour coded, following NJUG guidelines for each specific use.



12

Pipe Diameter mm	Nominal Bore (ID) mm SDR 11	SDR 17	SDR 21	SDR 26
20	15.25	-	-	-
25	20.5	-	-	-
32	25.8	-	-	-
50	40.4	-	-	-
63	50.9	-	-	-
90	72.9	78.3	81.0	-
110	88.1	95.1	98.0	-
125	101.2	108.5	112.5	-
160	128.6	140.3	144.0	147.4
180	145.9	158.0	161.9	165.8
225	182.4	197.3	202.4	207.4
250	202.9	219.6	224.9	230.4
280	227.1	245.9	251.9	258.0
315	255.6	276.8	283.4	290.3
355	288.1	311.5	319.4	327.6
400	324.9	351.2	360.0	368.7
450	365.1	395.2	404.9	414.8
500	406.3	439.9	449.9	460.9
560	454.7	493.9	505.7	516.5
630	511.5	553.7	566.8	580.8

Figure 2. Pipe Dimensions.

- **Light Blue/Dark Blue**
  Below ground potable water pipework
- **Black**
  Below ground pressure and non-pressure foul water pipework

  Above ground potable water pipework

  Above ground industrial pipework
- **Yellow**
  Below ground gas systems, up to 5.5 bar
- **Orange**
  Below ground gas systems, up to 7 bar

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Pipe Marking

All Wavin Polyethylene pipe products are marked for traceability in accordance with National or International Standards and the following information is repeated at metre intervals along the pipe.

Pipe Marking Details:
- Date of manufacture
- Machine No.
- Pipe Diameter
- Shift No.
- Product Standard
- Company Identification
- Material Grade
- Sequential metre marking
- SDR
- Nominal Pressure rating

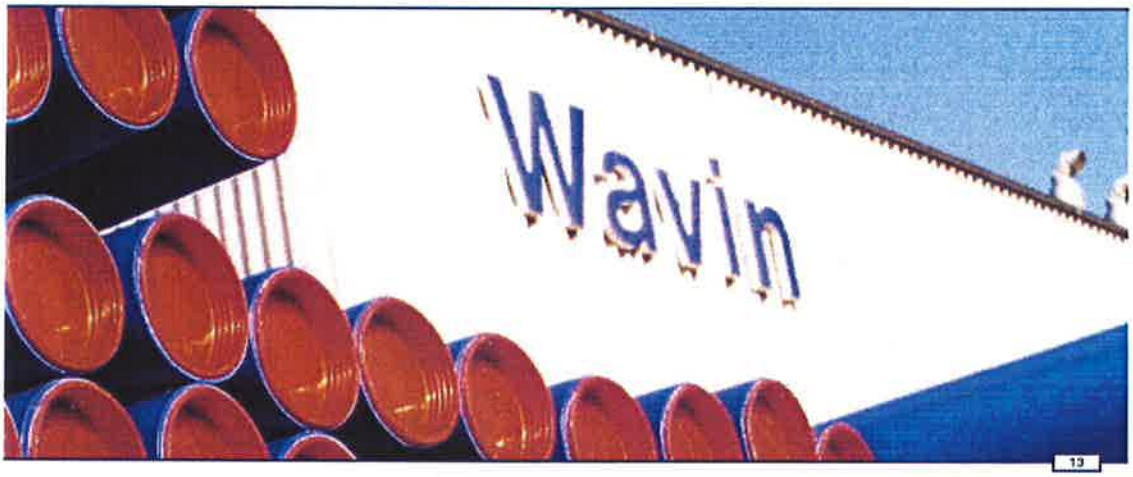


Figure 3. SDR - Relationship between pipe O.D. and wall thickness.

Standard Dimensional Ratio (SDR)

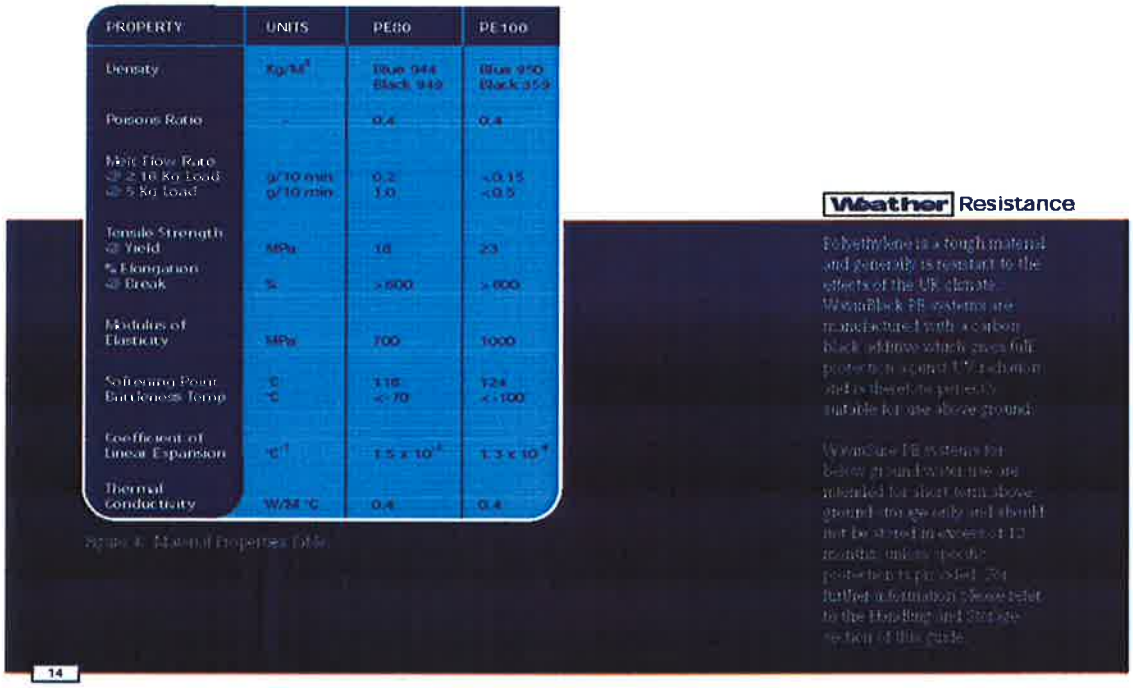
The Standard Dimensional Ratio (SDR) is used to describe the relationship between pipe diameter, wall thickness and therefore the pressure rating of the pipe.

The relationship between the pipe OD and wall thickness remains constant for all pipe sizes for a given pressure rating, and can be expressed in the following equation.

$$SDR = \frac{\text{Pipe Outside Diameter (Minimum)}}{\text{Pipe Wall Thickness (Minimum)}}$$

eg: SDR 11 = $\frac{250}{22.8}$

Characteristics & Properties



Abrasion Resistance

Polyethylene has an extremely low co-efficient of friction and therefore has significant advantages over other pipe materials for the transportation of abrasive slurries and in its resistance to abrasion.

WavinBlack polyethylene pipe has been used extensively for pumped slurry applications over many years and has been used for power station fly ash, china clay slurry, quarries and sand slurries. Field use and laboratory testing has shown that the performance of PE exceeds metallic pipe systems. This coupled with its flexibility, lightweight and ease of installation makes it the ideal choice for abrasive slurry applications.

The external effects of abrasive backfill materials have only a negligible effect on PE. Where pipe has been damaged by a sharp object and the cut or gouge exceeds 10% of the pipe wall thickness, the damaged section should be cut out and replaced. For further advice contact the Wavin Technical Services Helpdesk.

Low Temperature Usage

Site practices in the UK do not generally allow pipe laying to continue below 0°C, however there may be instances during installation or pipeline operation where temperatures below 0°C are encountered.

The mechanical properties of PE, operating pressure and impact resistance are maintained at temperatures as low as -60°C and therefore the moderate UK winter temperatures do not pose any particular problems to the performance of PE pipe.

Polyethylene is a particularly low thermal conductor and will delay the freezing of water within the pipe. Where the water does become frozen, the flexibility of PE and its ability to expand without rupture ensures the security of the pipeline.

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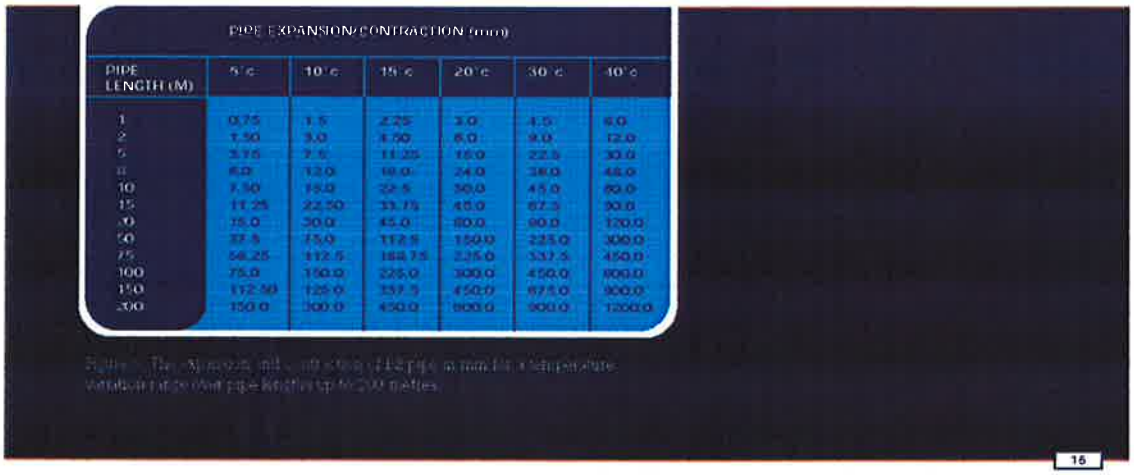
Expansion & Contraction

Polyethylene has a co-efficient of linear expansion of approximately 1.5 x 10 -4°C -1 which is approximately 10 times greater than metallic pipes. Expansion is an important factor which should therefore be considered in the design of pipelines where a significant variation in temperature is expected, particularly above ground pipework.

For design purposes pipe expansion can be more practically understood if we consider the expansion as 1.5mm/10°C/ m. In above ground installations careful consideration should be given to the positioning of support brackets and anchor points and the use of fully end load bearing joints. Where possible expansion and contraction may be accommodated at changes of direction. Where non-end load bearing fittings are used it is important that such fittings are securely anchored to prevent pipe pullout.

With below ground installations new pipelines should be allowed to stabilise to ambient temperatures before making the final tie-in connections, partial backfilling of the pipe will assist in minimising the effects of direct sunlight.



Chemical Resistance

The exceptional resistance of PE to chemical attack is well known and generally there are no naturally occurring ground conditions which affect the material.

Polyethylene does not corrode, rot, pit or lose its mechanical strength properties through electrical or chemical reactions with backfill soils.

Polyethylene does not, under normal operating conditions, support the microbiological growth of algae, bacteria or fungi, nor is it affected by these conditions.

Polyethylene may be affected by certain chemicals and care must be exercised when considering re-development of old industrial brownfield sites.

Where soil conditions are unknown or known to be harmful, a soils analysis should be carried out to determine any likely contaminants.
The harmful chemicals can be grouped into 3 main types:

- Oxidisers, eg very strong acids
- Cracking Agents, eg detergents
- Solvents, eg hydrocarbons (petrol, oil)

The degree of resistance to any chemical is dependent on concentration, temperature and the working pressure, all of which may have an effect on the lifetime of the pipeline. The effects may be detrimental to the pipes strength or permeate the pipe wall causing tainting of the potable water supplies.

Where pipework is to be laid in suspect conditions, eg: brownfield sites and petrol forecourts, expert advice should be sought before installing polyethylene. If conditions are such that the use of polyethylene would not be suitable, Wavin have developed 'Trigon' – a multi-layered barrier pipe specifically for carrying potable water through contaminated land. The Wavin Trigon system consists of three layers; an inner polyethylene core pipe which is approved for transporting potable water, followed by a layer of aluminium which acts as a barrier, and an outer sheath of polyethylene which is marked with distinctive brown stripes for easy identification.

Please contact the Wavin Technical Services Helpdesk for any further information.

Characteristics & Properties

Pressure Rating

MDPE (PE80) has a minimum required strength (MRS) derived from a 50 year extrapolated 97.5% lower confidence limit of 8 MPa and HPPE (PE100) has a MRS of 10 MPa. The Hydrostatic Design stress for both materials is determined by applying a safety factor of 1.25. The design life for the Water Industry requires a minimum life of 50 years, therefore the design stress for PE80 and PE100 is as follows:

PE80 = 5 MPa
PE100 = 8 MPa

Polyethylene pipe pressure rating is generally referred to in bar; 1 bar is approximately equivalent to 10.2 metre head. A harmonised UK Polyethylene Pressure Pipe specification has been developed alongside ISO/CEN working groups. The table below gives the pressure ratings and SDR's for PE80 and PE100 pipe.

DIAMETER	PE80 SDR	PE80 MAX WORKING PRESSURE (BAR)	PE100 SDR	PE100 MAX WORKING PRESSURE (BAR)
20mm	9	12.5	*	*
25-63mm	11	12.5	*	*
90-315mm	11	12.5	11	16
	17.0	8	17.0	10
	26	5	26	6
355-630mm	11	11.5 - 8	11	16
	17.0	8 - 5	17.0	10
	26	5 - 3.2	26	6

Figure 6. Pressure Rating

Electrolytic Reaction/ Electrical Conduction

Polyethylene is a poor conductor of electricity and does not suffer from electrolytic corrosion when in contact with metal components (valves etc) or when connected into existing metal pipelines.

As a non-conducting material PE should not be used for the earthing of electrical equipment nor can it be used as a conductor for frost protection systems. Similarly PE should not be used where there are high levels of static electricity, eg. in mines.

Permeability

Polyethylene under normal operating conditions is impermeable to gas and is used almost exclusively for Natural Gas and LPG gas systems. PE pipework for potable water can be laid in close proximity to PE gas mains following the NJUG recommendations for pipe separation distances. The presence of naturally occurring gas, such as is found in landfill sites, similarly has no effect on PE pipework.

Rapid Crack Propagation

PE80 and PE100 polyethylene materials are very tough and it is difficult to initiate brittle failure, even in the laboratory on pipework at very low temperatures. Failure is typically of a ductile nature and extensive testing has shown RCP failure will not occur in a pipeline full of liquid. Only when air is present at levels greater than 10% is RCP likely, and with modern PE materials any crack is arrested very quickly.

Therefore under normal distribution mains conditions, RCP failure is most unlikely. For further information contact the Wavin Technical Services Helpdesk.

Notch Sensitivity

Polyethylene is known to be extremely durable in normal use and it is not uncommon for pipes to be scratched and scuffed during handling and installation, particularly with re-habilitation methods such as slip lining and mains bursting.

This sort of typical site damage will have no adverse long-term effect on the pipe provided the damage does not exceed 10% pipe wall thickness. If the damage is greater than 10% the pipe should not be used. Further details on Rapid Crack Propagation and Notch Sensitivity can be found in the Design and Performance section of this guide.

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Operational Pressures for Elevated Temperature Use

Polyethylene is a thermoplastic material and a loss in strength occurs with increasing temperature. The maximum operating pressure for any specific pipe is based upon a 50 year design life at 20°C. Any increase above 20°C will result in a reduction in the maximum allowable operating pressure or lifetime or possibly both. Polyethylene pipe systems should not be operated above 60°C. The following chart gives the reduction factors to be applied to the maximum operating pressures at 20°C.

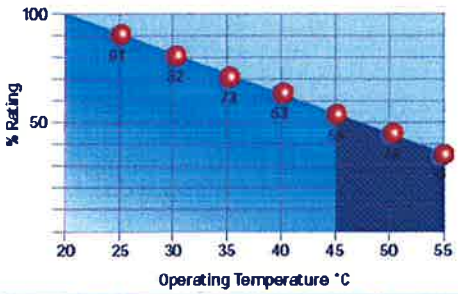


Figure 7. Pressure Reduction Factors for PE Pipe at Elevated Temperatures
If the temperature falls within this range the life expectancy of the pipe can be affected.
Please contact the Wavin Technical Services Helpdesk for further details.

Hydraulic Properties

Polyethylene pipe has an extremely smooth bore giving exceptionally good flow characteristics. As polyethylene is non-corrosive and maintains its smooth bore throughout its lifetime there is no deterioration in its hydraulic performance.

Polyethylene pipe is classed as hydraulically smooth and the hydraulic frictional co-efficients used for design purposes are as follows:

- Colebrooke - White Ks 0.003 mm
- Hazen Williams C = 150

All pipelines carrying water or slurries will see pressure losses due to the friction between the liquid and pipe wall. These are general losses due to fluid flow. In addition there are point losses caused by fittings in the system.

17

Flow Calculations

Pipe sizing and pressure drop can be determined using the Flow Charts overleaf. These are based on the Colebrook - White Formula. Using the required design flow rate (l/sec) the following data can be determined:

- Pipe Diameter (mm)
- Frictional Head Loss (m/1000 metres)
- Flow Velocity (m/sec)

Fittings Formula

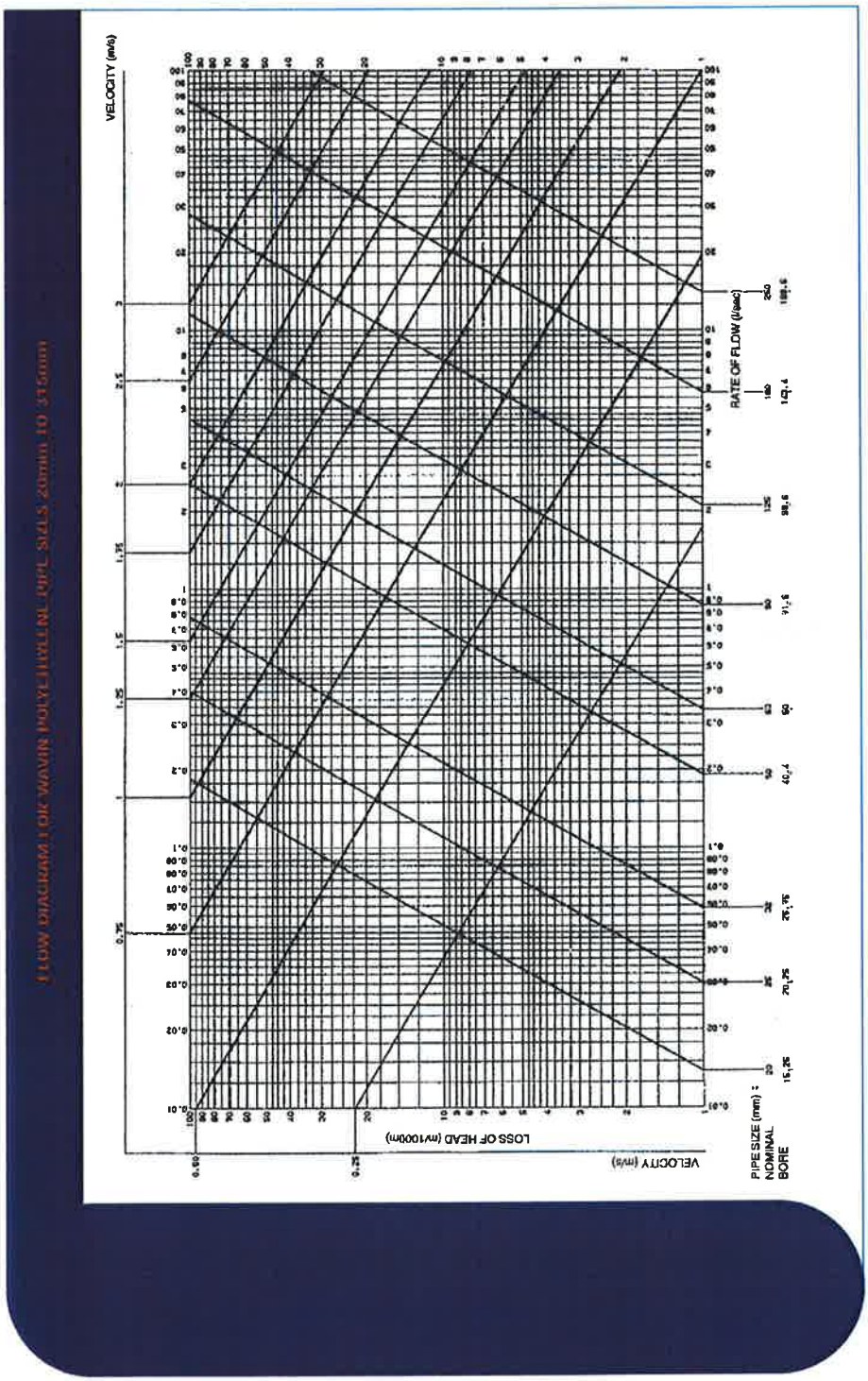
Determining the pressure drop in fittings is more complex. However, using a simple formula to give an equivalent increase in pipe length, pressure drop can be carried out using the following formula;

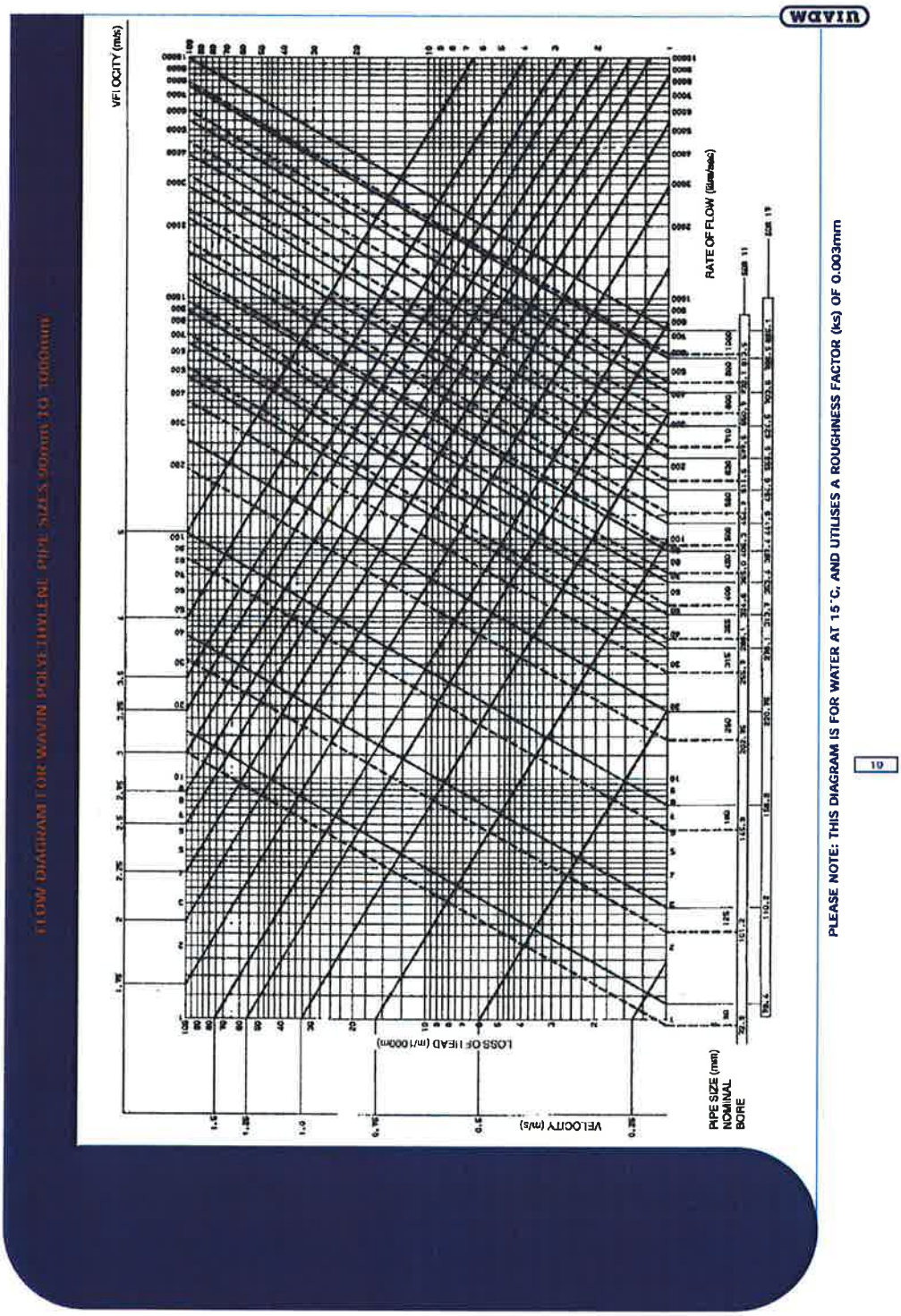
$L = F \pi ID$

where L = equivalent pipe length in metres
F = Fittings constant
ID = Internal diameter of the fitting

BEND	FITTING	F
90°	Elbow	0.030
45°	Elbow	0.015
90°	Tee (straight through)	0.020
90°	Tee (side branch)	0.075
90°	Long Radius Bend	0.020
45°	Long Radius Bend	0.010

Figure 8. Fittings Constant


FLOW DIAGRAM FOR WAVIN POLYETHYLENE PIPE SIZES 20mm TO 315mm
VELOCITY (m/s)
RATE OF FLOW (l/sec)
LOSS OF HEAD (m/100m)
VELOCITY (m/s)
PIPE SIZE (mm) : NOMINAL BORE
PLEASE NOTE: THIS DIAGRAM IS FOR WATER AT 15°C, AND UTILISES A ROUGHNESS FACTOR (ks) OF 0.003mm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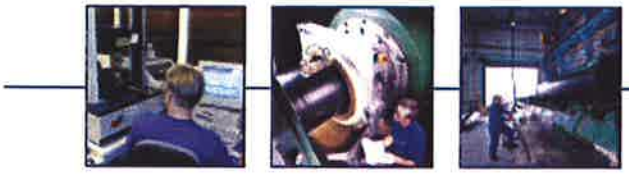
FLOW DIAGRAM FOR WAVIN POLYETHYLENE PIPE SIZES 90mm TO 1000mm
VELOCITY (m/s)
RATE OF FLOW (litre/sec)
LOSS OF HEAD (m/100m)
VELOCITY (m/s)
PIPE SIZE (mm) NOMINAL BORE
PLEASE NOTE: THIS DIAGRAM IS FOR WATER AT 15°C, AND UTILISES A ROUGHNESS FACTOR (ks) OF 0.003mm
19

Design & Performance Testing



Design for Internal Pressure

The burst pressure of polyethylene pipe is time dependent and therefore it is necessary to define the strength of the material at a reference lifetime.

The lifetime chosen for this reference value is 50 years - it should be noted that this does not mean that the pipeline will fail after 50 years, as the various safety factors that are incorporated into the design mean that the actual lifetime will be many times greater. In order to generate the burst strength of the material at 50 years, a number of pipe samples are pressure tested to failure at lifetimes between 10 and 10,000 hours. The results of these tests are graphically or numerically analysed to obtain the minimum required strength (MRS) at 50 years. A graphical representation of this process is shown in Figure 9.

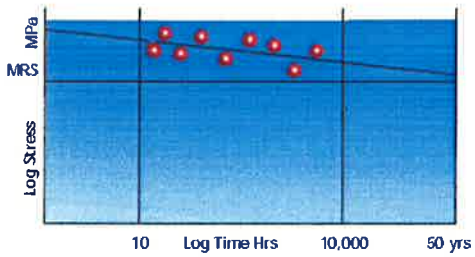


Figure 9. Hydrostatic Pressure Test Curve

Within the CEN and ISO Standards, it is recommended that the MRS value is based upon the 97.5% lower confidence limit obtained by regression analysis, in accordance with the method outlined in ISO / DTR 9080.2.

Within the Wavin range of polyethylene water systems, two basic polymers are included - Medium Density Polyethylene (MDPE) and High Performance Polyethylene (HPPE).

MDPE has a minimum required strength of 8MPa and is designated PE80 while HPPE has a minimum required strength of 10MPa and is designated PE100 as shown in the following table.

TYPE	MRS
PE80	8.0
PE100	10.0

Figure 10. MRS Classification at 20°C

Within the classification system developed at ISO/CEN, there has also been considerable discussion of the application of design factors that should be used to determine the allowable operating pressures (PFA) of a particular plastic pipe system. This design factor is applied to account for any 'unknown' loading or environmental conditions.

The classification group has recommended minimum values only, which allow the pipeline engineer to use additional factors if difficult conditions exist (eg surge, elevated temperature or poor ground conditions).

For polyethylene pipeline systems, the recommended design factor is 1.25, which enables the allowable operating pressure to be calculated for each system using Lame's formula for thick walled pipes:

Hoop stress: $\sigma = \frac{P}{2t}(D - t)$

where:

σ	= Hoop stress	MPa
P	= Max. operating pressure	bar
D	= Outside Diameter	mm
t	= Wall thickness	mm

Therefore:

$$\sigma = \frac{P}{2}\left(\frac{D}{t} - 1\right)$$

Now the Standard Dimensional Ratio (SDR) is related to the diameter and wall thickness of the pipe by the formula:

$$SDR = \frac{D}{t}$$

Therefore:

$$\sigma = \frac{P}{2}(SDR - 1)$$

or

$$P = \frac{2\sigma}{(SDR - 1)}$$

If this equation is applied to polyethylene pipe systems it is possible to calculate the allowable operating pressure (PFA) as shown below:

$$PFA = \frac{2 \times MRS}{(SDR - 1)\,\alpha}$$

where:

α = minimum design factor

This equation gives the stress in MPa. For conventional use, and to express the pressure in bar rating, the value in MPa is multiplied by 10. For example:

For PE80:

$$PFA = \frac{2 \times 8 \times 10}{(SDR - 1) \times 1.25} = \frac{128}{(SDR - 1)}$$

For PE100:

$$PFA = \frac{2 \times 10 \times 10}{(SDR - 1) \times 1.25} = \frac{160}{(SDR - 1)}$$

Design & Performance Testing

In calculating the operating pressure, it is normal to round up or down the values to the nearest useful pressure class shown in the table on the right.

It should be noted that the above represent the maximum operating pressures for the pipeline and additional consideration may cause engineers to reduce the operating pressure to a lower level. For example, on large diameter PE80 pipelines where rapid crack propagation may be of concern (please refer to the section on Fast Fracture).

	PRESSURE CLASS (BAR)		
TYPE	SDR 11	SDR 17	SDR 26
PE80	12.5	8.0	5.0
PE100	16	10	8

Figure 11. Pressure Class for Polyethylene Systems

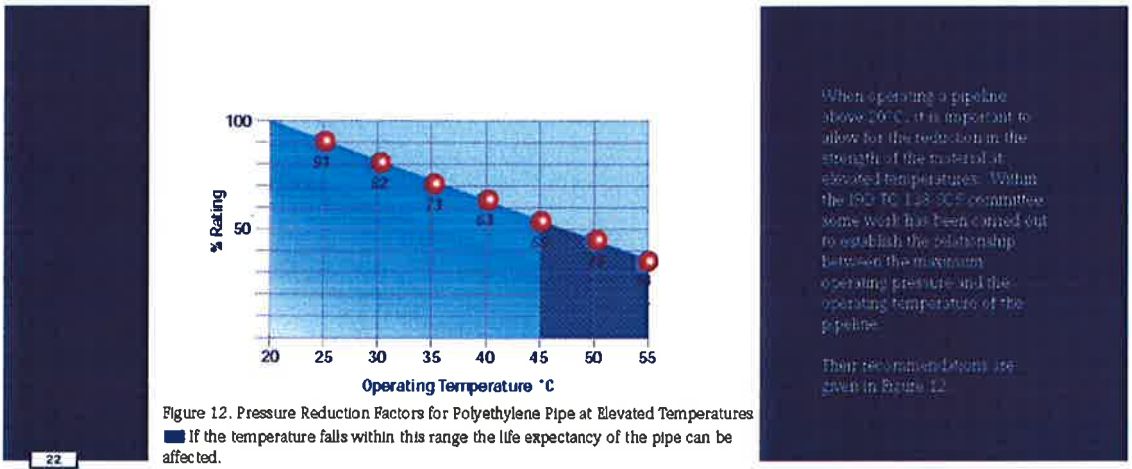


Figure 12. Pressure Reduction Factors for Polyethylene Pipe at Elevated Temperatures
■ If the temperature falls within this range the life expectancy of the pipe can be affected.
Please contact the Wavin Technical Services Helpdesk for further details.

Notch Sensitivity

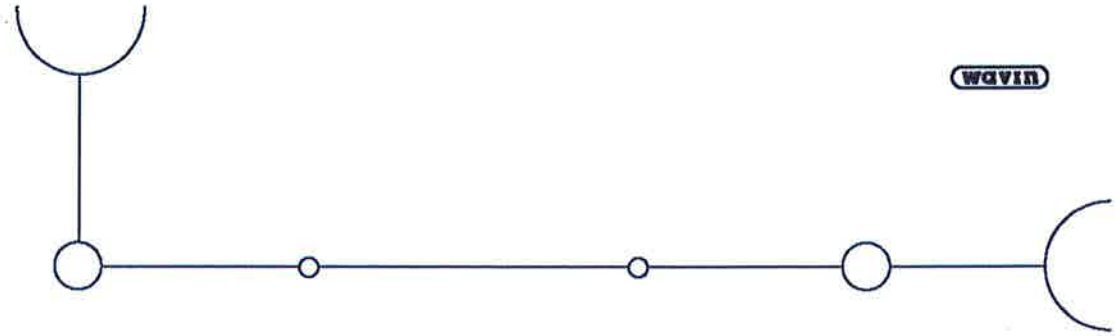
Many materials may be extremely strong in laboratory tests but when they are notched or scored in handling they can become very brittle. The classic material in this category is glass, which is brittle enough to snap along a defined line when it is lightly scored. When laying pipelines it is common for the pipe surface to become lightly scored.

This is particularly true when the pipe is being inserted into an existing main, or where trenchless laying methods are being used. In order to ensure that brittle failure will not develop in the short or long term from these surface notches, it is usual to carry out elevated temperature pressure tests on notched pipe samples. It should be noted that this test is only used within the UK, although discussions are now taking place within ISO/CEN committees for a wider adoption of these tests.

In practice, during installation it is recommended that pipe with notches up to a maximum of 10% of the wall thickness can be used.

	TEST CONDITIONS			
Type	Notch Depth	Temp °C	Stress (MPa)	Life (hrs)
PE80	20%	80	4.0	170
PE100	20%	80	4.6	170

Figure 13. Test Conditions for Polyethylene Systems



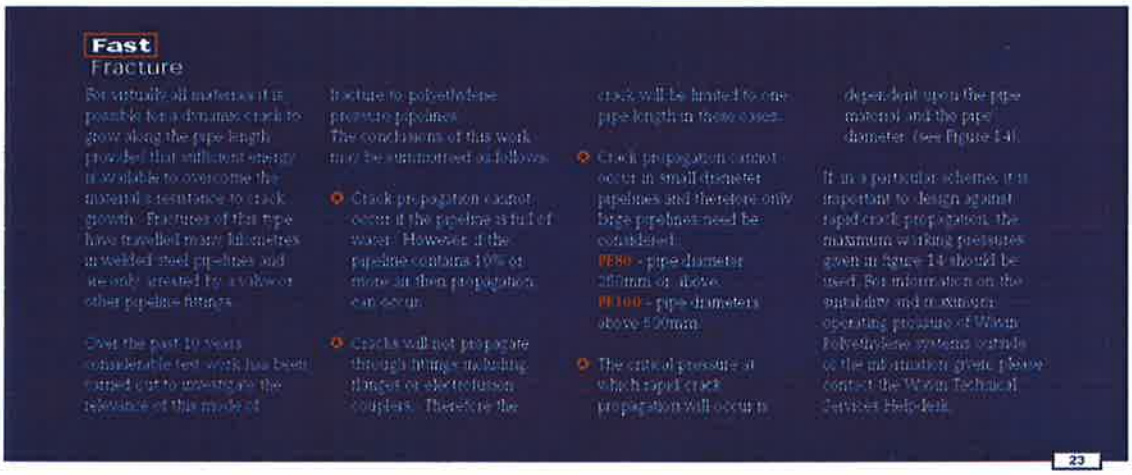
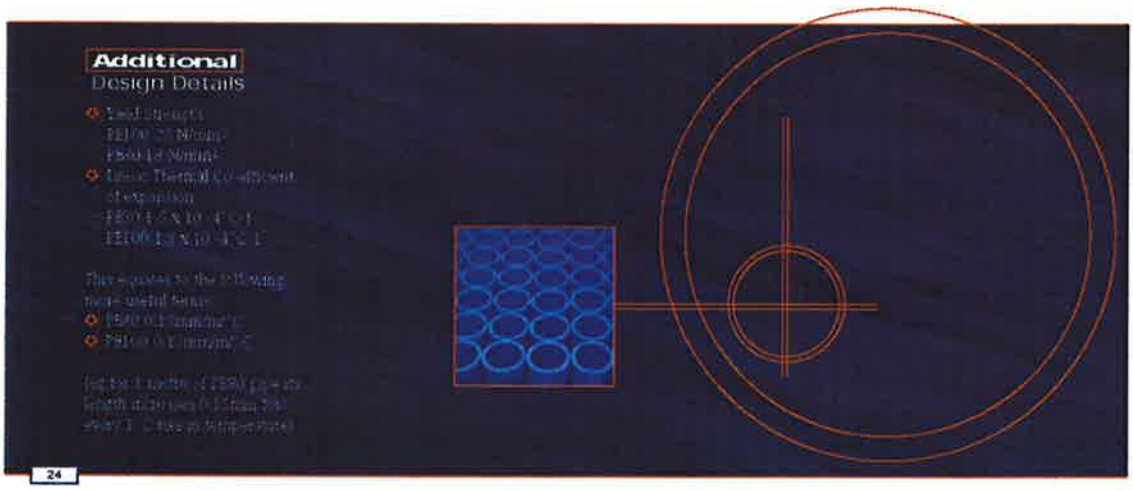


Figure 14. Critical Pressure Curve for Polyethylene Pipe

Design & Performance Testing

Other design Considerations

In designing any pipeline system, it is necessary to consider other factors that may influence the performance of the pipe. In most cases, sufficient data will have been gathered to provide formal design recommendations, but in other situations advice should be sought from the Wavin Technical Services Helpdesk.



Quality Assurance Testing

Continuous performance tests are carried out on Wavin polyethylene pipe systems during manufacture. These are:

TENSILE TESTS
Test specimens from pipe production are tensile tested to determine the yield strength and elongation at break. Typical minimum results give elongation at more than 600%.

DELAYED BURST TEST
For PE80 pipe, samples taken at regular intervals are subjected to a circumferential wall stress of 12 MPa for a period of one hour at 20°C. The pressure is steadily increased until the pipe bursts, and it must be at a stress greater than 16MN/m². For PE100 the same test is carried out at a wall stress of 12.5 MPa for 100 hours.

ELEVATED TEMPERATURE TEST
Samples from all production of pipe from PE80 material are notched to 20% of wall thickness at four points around the circumference and subjected to a wall stress of 4.0MPa (8 bar for SDR 11) at 80°C for a minimum period of 170 hours, to establish comparative performance trends in relation to the resistance of the system to failure by stress cracking.
For PE100 material, the notched pipe is subjected to a wall stress of 4.6MPa (9.2 bar for SDR 11). The purpose of this test is to monitor the stress crack resistance of the system and to ensure that crack growth does not occur in less than the required test life represented by the test.

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Product Information

Pipe Lengths

Pipe up to and including 180mm diameter is supplied in either straight lengths or as coils, 250mm diameter pipe and above is supplied in straight lengths. Straight pipe is supplied in bundles supported by wooden timbers.

Straight Lengths

Straight pipe can be supplied in lengths of up to 18m. This is of particular benefit for pipe diameters of 250mm and above for which coils of pipe are not available. Details on handling and transportation are given in the Handling section of this guide. To optimise space, export shipping standard lengths are 5.8m (20' containers) and 11.65m (40' containers), and are nested (smaller diameter inside larger diameter) where possible. Longer lengths are available dependent on site location and access. Please contact Technical Services for details.

Standard Coils

Coils of 50 and 100 metre lengths are available in pipe sizes up to and including 180mm. 150 metre coils are available up to and including 75mm. Figure 17 gives details of the coil dimensions. Other coil lengths may be available upon request.

LOOSE COILS PER LOAD

Pipe Diameter	50M Coils	100M Coils
20 mm	450	400
25 mm	400	400
32 mm	300	250
50 mm	100	90
63 mm	100	40
75 mm	35	30
90 mm SDR 11	40	20
90 mm SDR 17	25	20
125 mm	15	12
180 mm SDR 17	8	6

Figure 16. Loose Coils per Load

COIL DIMENSIONS

Nominal Dia. (mm)	Length (M)	Width (mm)	External Dia. (mm)	Nominal Dia. (mm)
20	25 50 100 150	85 130 150 185	680 680 900 900	700 700 700 700
25	25 50 100 150	110 140 180 205	850 850 900 955	700 700 700 700
32	25 50 100 150	130 165 200 245	874 900 972 1004	700 700 700 700
50	25 50 100 150	160 200 250 290	1400 1400 1550 1850	1300 1300 1300 1300
63	25 50 100 150	190 255 300 300	1438 1469 1502 1625	1300 1300 1310 1310

Figure 17. Coil Dimensions

Drum Lengths

Drums of pipe up to 770 metres in length are available in diameters 90mm, 125mm and 180mm. Figure 18 gives some details. Drums are ideal for rural applications with trenchless laying techniques, reducing the number of joints and utilising the flexible nature of polyethylene.

DRUM LENGTHS

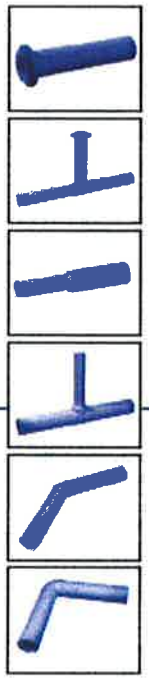
Pipe Diameter	Length (M)
90 mm	770
125 mm	440
180 mm	220

Figure 18. Drum Lengths

Fittings Range

Pupped Fittings

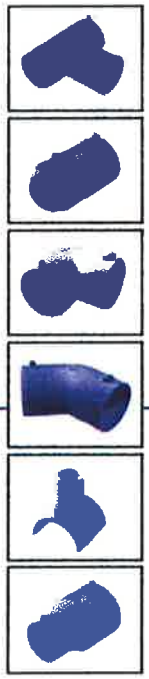
Pupped fittings are available in all ranges in sizes above 63mm. These fittings comprise of an injection moulded centre body with 500mm length of pipe (pups) butt welded to it as a standard. These fittings are primarily designed for butt fusion, but can also be used with electrofusion couplers. The illustrations (right) show some of these fittings.



Electrofusion Fittings

Electrofusion Fittings are available for use with Wavin polyethylene systems. These socket fittings consist of an injection moulded polyethylene body with an integral heating element. Some of the fittings available are shown right.

Details on jointing using electrofusion fittings are given in the installation section of this guide.



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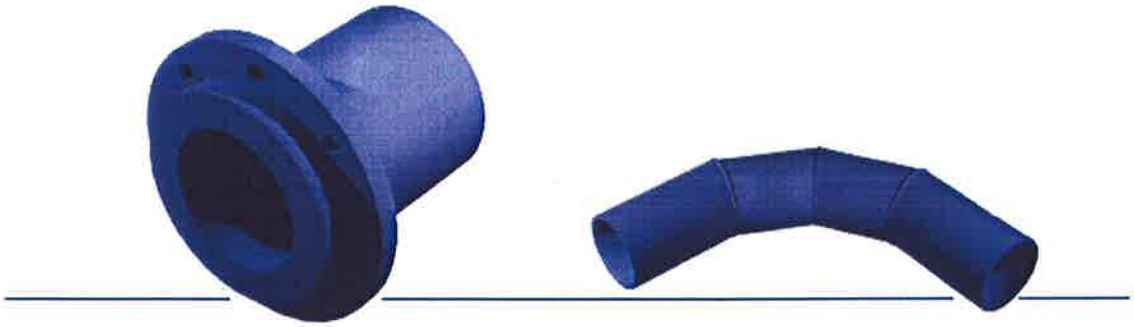


Spigot Fittings

Wavin polyethylene spigot fittings are available in all ranges. These fittings (shown right) are completely injection moulded and and are designed for use with electrofusion fittings.

Mitred Fittings

A range of mitred (or segmented) fittings are available to supplement the range of pupped fittings. These fittings (shown right) are manufactured from pipe using a computer controlled automatic butt fusion machine, and are available in sizes 63mm and above.

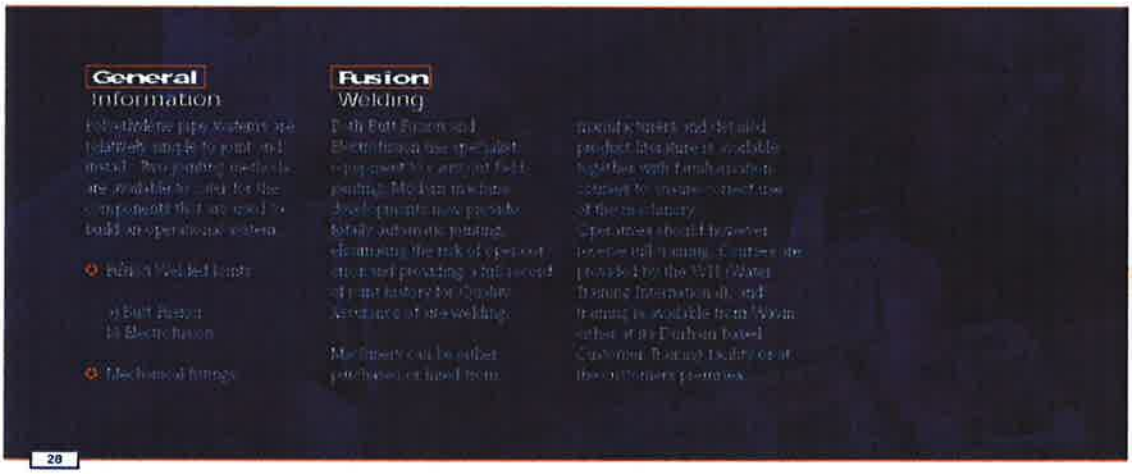
27

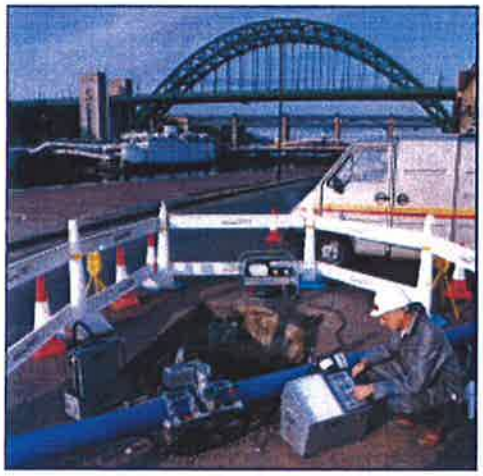
Drawn Bends

Wavin offer a range of long radius drawn bends in all ranges, in sizes 90mm and above. These fittings involve a specified length of polyethylene pipe pulled to a defined angle and are suitable for use with butt fusion and electrofusion couplers. Drawn bends are available in 90°, 45°, 22.5° and 11.25° angles as standard.

For details of the full range of polyethylene fittings, please consult the Wavin Potable Water Product Selector.

Jointing





Butt Fusion

Butt Fusion jointing involves the fusing together of two pipe ends in a specialist machine which prepares the pipe ends, heats them and brings them together under pressure to form a homogeneous weld.
The joint is fully end load resistant and is at least as strong as the parent pipe.

With Butt Fusion it is essential only similar grades of PE are welded, eg:

PE100 – PE 100 ✓
PE100 – PE80 ✗

and similar SDR's are used, eg:

SDR 11 – SDR 11 ✓
SDR 11 – SDR 33 ✗

Reference should be made to the Water Industry Specification WIS 4 - 32 - 08, Issue 2, 1994, which details all site fusion welding methods and covers the single and dual pressure methods. Dual pressure welding was introduced as a result of investigations into joint quality by the WRc and this procedure should be used for all pipes with a wall thickness greater than 20mm. Due to the low pressures involved in the dual pressure procedure, only fully automatic machines should be used; manual machines may still be used for single pressure Butt Fusion jointing.

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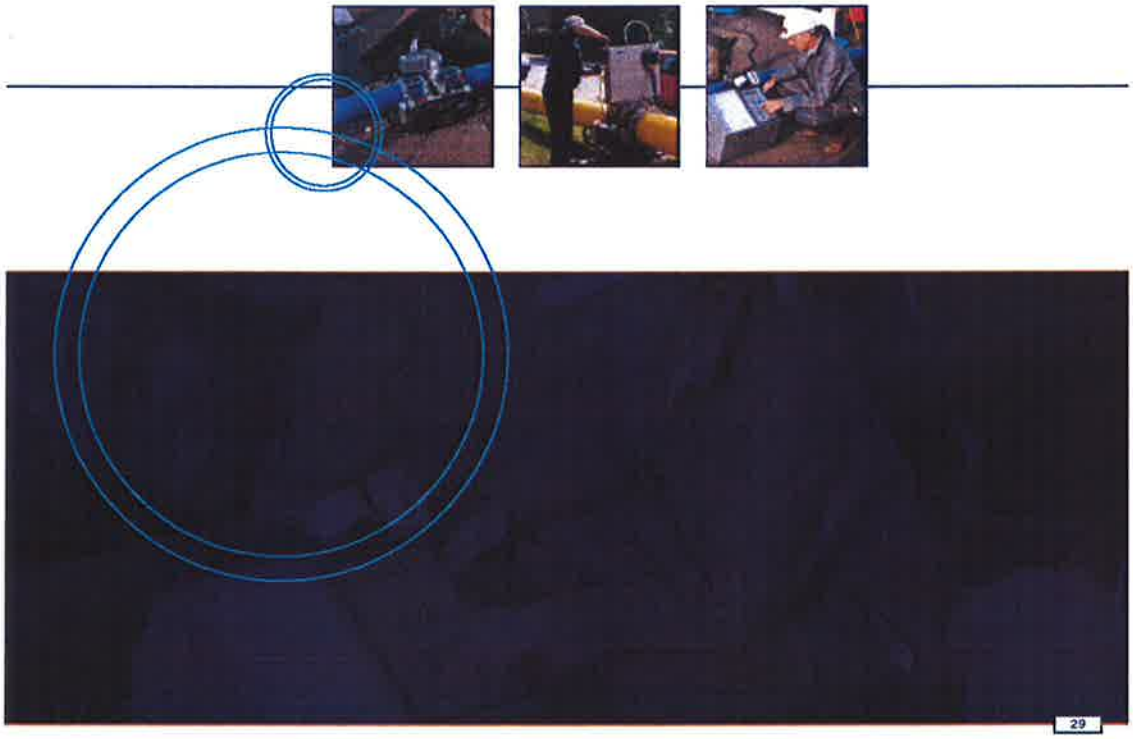

Equipment Required

- Butt Fusion machine, inclusive of trimmer, heater plate and hydraulic pump.
- 110v Generator, fuel
- Welding Tent/Base board
- Pipe support rollers
- Clean water, lint free cloths
- External de-beading tool
- Bead gauge
- Pipe end covers
- Indelible marker pen
- Pipe cutting tools

Procedures of Manual Butt Fusion

- Ensure the pipe ends are clean and if necessary, wash with clean water and dry.
- Cut the pipe ends square and clamp securely in the B/F machine.
- Align and level the pipes with pipe support rollers.
- To prevent cooling of the heater plate blank off the free pipe ends.
- Trim the pipe ends until a continuous shaving is seen from each pipe end.
- Remove loose shavings and importantly, do not touch the prepared pipe ends.
- Close the clamps and check for good alignment of the pipe ends, the allowable mismatch is; 90mm-315mm pipe, 1 mm 355mm-630mm pipe, 2 mm Re-trim if mismatch is greater than these values.
- Open and close the clamps, noting the gauge pressure to close the clamps - This is the drag pressure. The fusion (jointing) pressure is obtained by adding the drag pressure to the hydraulic ram pressure given on the machine data plate.
- Place the heater plate in the machine, checking it is clean and undamaged and up to temperature, 225°C - 240°C.
- Close the clamps and apply the previously determined pressure until a bead of 2-3mm is formed.
- Reduce the pressure in the system to between 0 and drag, the heat soak time commences. Ensure the pipes maintain contact with the heater plate.
- Upon completion of the heat soak time, remove the heater plate and close the clamps immediately, (within 10 seconds).
- Maintain the required fusion (jointing) pressure for the specified cooling period.
- Remove the joint & allow to cool for a similar period.
- Clearly mark the joint and bead for identification with an indelible pen.
- Check the joint is free from any contamination, and check the bead widths meet the specified limits and are uniform.
- Remove the external bead and twist in several positions. If the bead splits at any position the joint should be cut out and re-made.

Jointing

Additional Notes for Butt Fusion

- If the heater plate requires cleaning this should be done when the plate is cold. The plate can be washed with clean water and lint free cloth and dried thoroughly. Isopropanol may be used to remove any oil or grease.
- Washing the heater plate may not remove very fine dusty particles, therefore at the start of each welding session a dummy weld should be carried out for pipes up to 180mm in diameter. For pipe sizes greater than 180mm, two dummy welds should be made. An actual joint need not be made, the dummy weld can be aborted at the end of the heat soak period. Pipe offcuts may be used.
- In very cold conditions, below 5°C, additional space heating must be provided in the fusion welding tent to maintain the required minimum ambient temperature for welding.
- Electrofusion "wet wipes" should not be used after the pipe ends have been trimmed, if any contamination does occur the pipe ends should be re-trimmed.

30

Electrofusion

Electrofusion fittings incorporate an electrical heating element which is energised via an E/F control box to heat the elements.

When the fitting is energised the material next to it becomes molten and in turn causes the pipe surface to melt, resulting in a molten pool of material fusing the materials of fitting and pipe. Once cooled this produces a fully fused and leak free joint.

Details of electrofusion procedures are given in WIS 4-32-08, Issue 2, 1994 and reference should be made to this document for further guidance.

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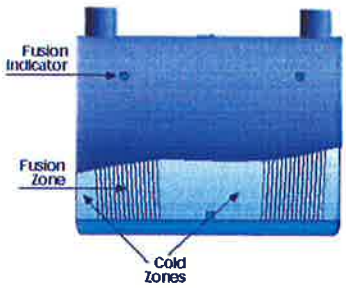


Figure 19. Cross section through an Electrofusion Coupler

Electrofusion Fitting Design

The design of an E/F fitting is crucial to its performance and is dependent on the position and pitch of the heating coil. The heat distribution should be consistent throughout the fusion cycle and over the full fusion area. The melt must be adequately controlled within the hot and cold zones to ensure a fully welded, homogeneous joint. The different zones of an E/F fitting are shown in Figure 19.

Automatic & Manual Fittings

Many manufacturers now offer Automatic and Manual fittings and it is important to ensure the E/F control unit is compatible with the fittings being used. Most control units can be operated in both Automatic and Manual mode.

Saddle Fittings (Tapping Tees)

Two styles of saddle fittings are available;

- stack loaded saddles
- under clamp saddles

Both styles provide a service connection to polyethylene mains and differ only in the manner they are clamped during fusion.

Stack loaded saddles are located with a stack loading tool which delivers the force required during fusion through the stack of the fitting, whereas, with underclamp saddles the jointing force is provided by a clamp device, located beneath the fitting and pulls the fitting down onto the pipe. The correct tooling must be used for each style of saddle.

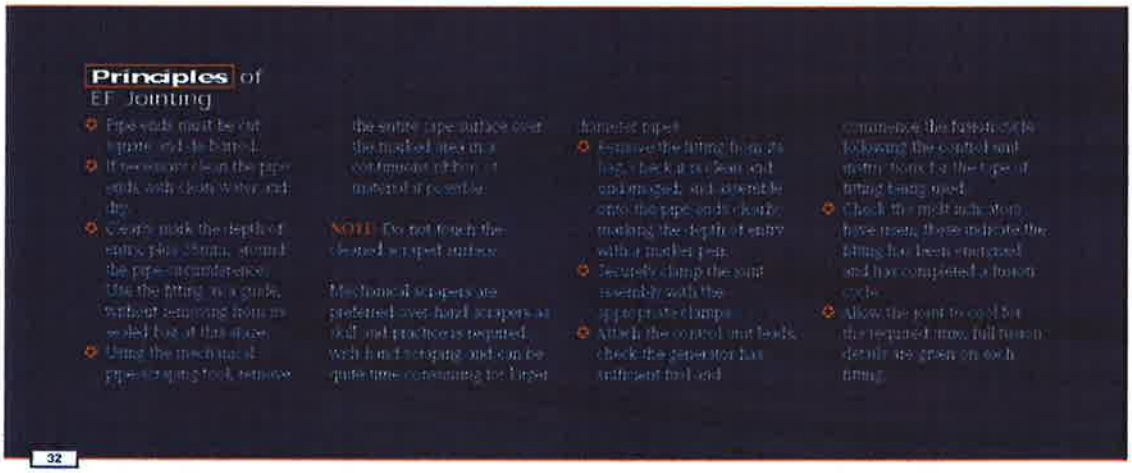
Equipment Required

A number of manufacturers produce E/F control boxes and the ancillary tooling required. The correct tooling must be used to ensure consistently reliable joints and this may be either purchased or hired from the tooling manufacturer or their agents. The site equipment should include:

- E/F control unit
- 110 volt generator
- 3 - 3.5 KVA for 39.5 volt fittings
- 6 - 7 KVA for 80 volt fittings
- Jointing shelter
- Pipe scraping tool, including mechanical scrapers for pipe end preparation and hand scrapers for saddle joints
- Pipe cutting tool
- Marker pen, solvent wipes, lint free cloths/paper towels

Jointing





Additional Notes for Electrofusion

- Jointing must always be carried out in dry and dust free conditions.
- Do not use rasps/files or abrasive sheets to prepare pipe ends.
- Always use the correct clamps for jointing.
- When jointing coiled pipe, additional re-rounding and pipe straightening tooling should be used to assist in the process.
- Do not extend control unit leads to the fittings and ensure the lead between generator and control unit is not excessive as an unacceptable power drop can be created.
- If the fusion cycle stops in mid-cycle first check for any control unit faults. Check for fuel. If the fault can be rectified, welding can re-commence providing the joint has cooled to ambient temperature and the fusion time is re-set for a further full cycle.
- For live connections, tapping into the water main should be carried out after all joints have cooled for a minimum of 30 minutes.
- Where B/F couplers are to be used for repair situations the existing main should be completely dry with no running water.

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Mechanical Joints Compression Fittings

There are numerous manufacturers of compression fittings suitable for use with polyethylene pipe, they are all based on the same design principle where an elastomeric ring seal is compressed between pipe and fitting. Some fittings require the use of pipe bore inserts to provide sufficient rigidity for the compression seal to be effective.

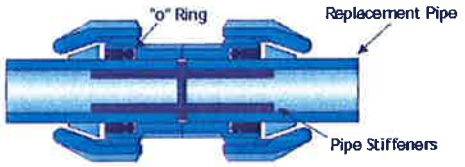
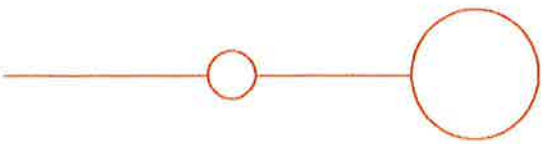


Figure 20. Cross Section through an Elastomeric Ring Seal

Flanged Joints

One of the simplest and earliest methods for connecting PE pipe to valves, hydrants and existing pipe materials is to use a polyethylene stub flange. Stub flanges are supplied pre-fabricated with either spigot or pupped pipe lengths and steel backing ring, drilled to suit metric PN16 flanges. Other flange drillings are available upon request.

As polyethylene pipe is sized on the O.D. and Ductile Iron, for example, is sized by its internal bore, allowances must be made for differences in pipe bore and discrepancies in corresponding mating flanges. This occurs more with larger diameter pipes and a flange converter will be required in these instances to ensure compatibility of pipe bores.



Jointing

Flange Convertor

Where a change in pipe bore is not acceptable, a steel flange converter can be used to maintain a clear bore, the diagram below shows a typical flange configuration for a 450mm PE stub flange to a 400mm D.I. flange.

TYPICAL BOLTING TORQUES (PE TO PE)

Pipe Diameter	Nominal Flange	Bolts	Torque (nm) ± 10%
63 (mm)	50 (mm)	M16 x 4	35
90 (mm)	80 (mm)	M16 x 8	35
125 (mm)	100 (mm)	M16 x 8	35
160 (mm)	150 (mm)	M20 x 8	60
225 (mm)	200 (mm)	M20 x 12	80
250 (mm)	250 (mm)	M24 x 12	100
315 (mm)	300 (mm)	M24 x 12	120
355 (mm)	350 (mm)	M24 x 16	150
400 (mm)	400 (mm)	M27 x 16	200
450 (mm)	450 (mm)	M27 x 20	250
500 (mm)	500 (mm)	M30 x 20	300

Figure 21. Typical Bolting Torques

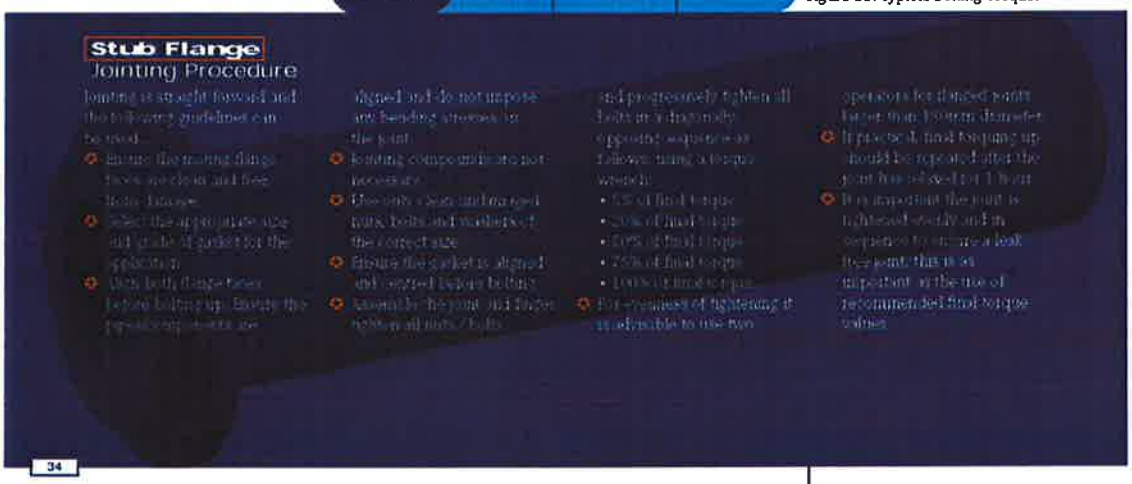


Figure 22. Flange Convertor

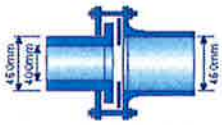


Figure 23. Standard Stub Flange Joint

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Testing & Commissioning

Site Pressure Testing

The traditional testing procedure used for most pipeline materials throughout the Water Supply Industry is given in BS CP 312 : Part 3 : 1973 : Section 10.
These procedures are generally intended for linearly elastic materials, eg ductile iron and steel, and are not suitable without modification for visco elastic materials such as polyethylene. Pipe manufactured from such materials exhibit creep and stress relaxation. With a PE pipe sealed under a test pressure, there will be a reduction in pressure (pressure decay) due to the visco elastic (creep) response of the material. This will occur even in a leak free system. This pressure decay is non-linear in an unrestrained pipe. In view of this characteristic the WRc have developed a pressure test which accounts for the effects of creep and stress relaxation. The full test procedure with detailed background data is given in the WRc "Manual for Polyethylene Pipe Systems for Water Supply Application", 1994. For further guidance reference should also be made to the manual.

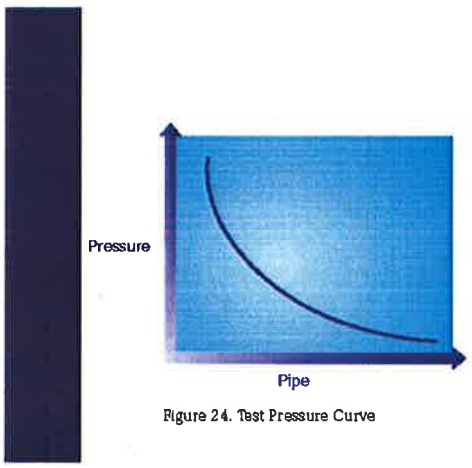

Figure 24. Test Pressure Curve

Test Procedure

- Upon reaching the test pressure, the test section is isolated.
- Pressure loading time is used as the base reference point, (t_l).
- A correction factor, 0.4_{tL}, is used to calculate ratios (N), this accounts for the pipeline beginning to relax during the pressurisation period.
- Take a first reading of pressure P_1 at t_1 where t_1 is equal to the pressure loading t_L.
  Corrected value = t_{1c}
  $t_{1c} = t_1 + 0.4t_L$
- Take a second reading of pressure P_2 at a decay time of $7t_L$ this is time t_2.
  Corrected value = t_{2c}
  $t_{2c} = t_2 + 0.4t_L$.

Calculate $N_1 = \frac{\log P_1 - \log P_2}{\log t_{2c} - \log t_{1c}}$

For a pipeline without leaks, N_1 should be:

a) 0.08 to 0.10 for pipes without constraint (eg sliplined, or not backfilled)
b) 0.04 to 0.05 for pipes with compacted backfill

If the resultant values are significantly less than those specified, this indicates that there is too great a volume of air in the pipeline. This air must be removed before a re-test can be satisfactorily carried out.

- Take a further reading of pressure P_3 at a decay time of not less than $15t_L$, this is time t_3.

$t_{3c} = t_3 + 0.4t_L$
Calculate $N_2 = \frac{\log P_2 - \log P_3}{\log t_{3c} - \log t_{2c}}$

The ratio N_2 should again be as those identified above. The test sensitivity can be increased by extending the value of t_3.

- If an unacceptable leak is indicated, all mechanical joints should first be checked, followed by checks on any Butt or Electrofusion joints.
- If a further test is necessary, a period of at least five times the first test period should elapse before re-testing. This allows the pipeline to recover from the previous pressurisation.

Commissioning Procedure

- Upon the successful completion of a test, the remaining pressure in the pipeline should be released slowly.

Following successful pressure testing all new mains, lined or re-furbished, should be commissioned in the following manner and in accordance with any local requirements:

- Cleaning and/or swabbing of the main
- Filling and sterilisation
- Flushing and/or neutralisation
- Refilling the main
- Bacteriological sampling
- Acceptance certification
- Introduction of the main into service

Installation

Wavin PE80 and PE100 polyethylene pipe systems provide a cost effective and simple to install pipe system.

Polyethylene is a thermoplastic material resulting in a lightweight, flexible pipe, which is totally corrosion resistant and leak free with proven fusion welded and mechanical jointing methods.

The following notes give a general guidance into the use of PE, and should be read in conjunction with the WRC "Manual for Polyethylene Pipe Systems for Water Supply Applications, 1994 and BS COP 312, Parts 1 and 3 Plastic Pipework".

Conventional Open Cut Trenching

Excavation and disposal of waste spoil are major factors in pipe installation. Landfill taxes are becoming a significant cost and environmental factors are forcing Engineers to look at new installation methods to minimise the disruption and amount of waste spoil generated.

The current practice in the UK is to lay service pipes at 750mm cover and mains at 900mm cover, measured from the pipe crown.

The width of the trench should be the minimum of pipe O.D. plus 250mm to allow for the correct compaction of sidefill. The location of cables and pipes from other utilities should be identified prior to excavation and generally at least 3 pipe lengths should be excavated prior to pipe installation to allow for obstructions to be avoided.

Polyethylene may in some instances be laid directly onto the trimmed trench bottom where the soil is uniform, fine grained and free from large stones and flints.

In other cases the trench should be excavated to a depth to allow for a minimum 100mm bed of gravel, crushed stone or coarse sand. A sand/gravel mix is also acceptable, provided the gravel is less than 20mm in size.

Further details on bed and fill materials are given in WIS 4-08-01.

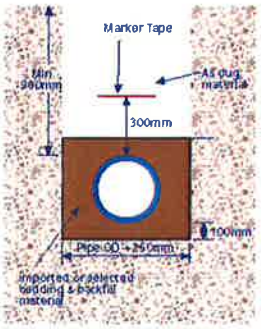

Figure 25. Typical Open-Cut Trench Detail

Backfilling

Polyethylene is a flexible material and can deform under load without damage. It is however, important that any deformation is minimised and that the placement of the correct sidefill and initial backfill materials is carried out correctly with adequate compaction.
A minimum 100mm cover should be placed above the crown of the pipe, with heavy compaction equipment not being used with less than 300mm cover. Backfilling can then proceed in 300mm layers. Trench reinstatement in Highways is covered in the NRASWA "Specification for the Reinstatement of Openings in Highways", 1992. This code was introduced with the aim that all highway reinstatement is completed as soon as possible to a consistent prescribed performance criteria.

Trench backfilling should commence as soon as possible after pipe laying to give the pipe protection from damage from objects possibly falling into the trench. To protect the pipe from potential future interference damage it is good practice to install a marker tape 300mm above pipe crown. Marker tapes can also include a tracer wire to allow future identification of the pipeline.

Shallow Cover

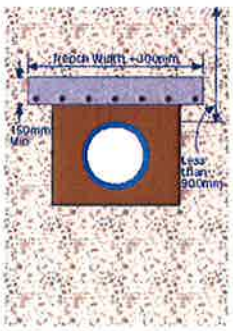

Figure 26. Recommended Protection for Shallow Pipes

There may be situations where pipes cannot be laid at the recommended depths of cover. In these situations for highways or traffic areas the pipe should be protected by placing a 150mm thick reinforced concrete bridging slab above the pipe. A 150mm thick granular cushion should be placed between the pipe crown and concrete, figure 26 details the typical application.

Installation Techniques

As discussed earlier a number of techniques have been developed to maximise the benefits of using polyethylene, these techniques are briefly discussed below.

Narrow Trenching

A modification of traditional open-cut trenching. Using either narrow backhoe buckets or chain trenchers, trenches 100mm wider than the pipe being installed are excavated. Coiled, drummed or pre-welded pipe strings can be quickly installed. Significant savings can be achieved through reductions in less excavated spoil, less imported fill materials and reduced labour.

Ploughing Techniques

Developed from agricultural machines laying land drainage, these machines are used for laying cross-country water and gas pipelines.

Pipes are laid with little disruption to the land which is quickly reinstated to agriculture. Pipe is installed continuously through a hollow plough with bed & surround material plus marker tape installed simultaneously as required.

Installation

Pipe Bursting

This is an ever-increasing method of re-habilitating an existing pipeline where a non-structural lining method would be unacceptable. With pipe bursting the existing pipe is cracked open and the new PE pipe is drawn into the hole created, and provides either a size for size replacement pipe or by use of reamers the original main can be upsized.

The present day hydraulic bursting tools are capable of cracking out both pipes and fittings in very demanding situations, and further adaptations are now capable of splitting ductile iron and steel mains.

With this technique, damage to adjacent utilities plant is possible and therefore care is required in the planning and operation of bursting.

Figure 27. Typical Bursting Operation

Moling

Moling has become an established no-dig method for the installation of small diameter service pipes and mains, and can give significant cost savings over open-cut trenching. Excavation is limited to launch and reception pits and moling is ideally suited for road crossings and installations under expensive paved areas and gardens where open-cut trenches would be very disruptive.

Note: The presence of other services should be established prior to moling.

The impact mole is an air driven percussion tool, which drives a borehole and usually pulls a new polyethylene pipe directly in behind it.

The technique can also be used on carriageways in a technique known as "pipe stitching" where pipe is installed from pit to pit.

36

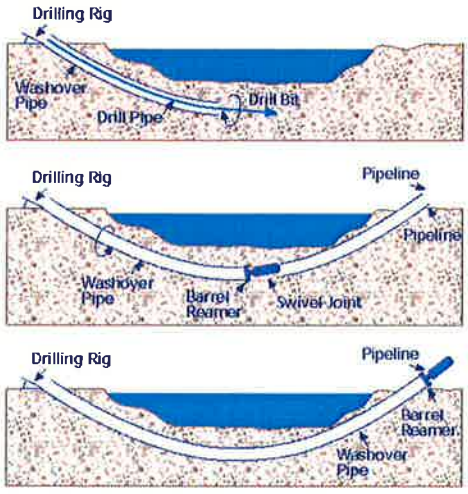

Figure 28 Typical Directional Drilling Operation

Directional Drilling

This technique has also become an established installation method for PE pipe and is used for road, rail and river crossings where open-cut work would be usually impracticable and prohibitively costly.

The hole is bored by either high-pressure liquid jets or with drill bits, and fully steerable systems are available by monitoring transmitters in the cutting head.

The operation involves drilling a small diameter 'pilot' hole beneath the obstacle and the final hole size is achieved by progressively back reaming up to the diameter required.
The PE pipe (coil or pre-welded string) is finally pulled through on the last pass. Experienced contractors are necessary with this technique to ensure the PE string is not over stressed on the final pull through.

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Slip Lining

The insertion of a smaller diameter PE pipe, slip-lining, into an existing pipeline is one of many no-dig techniques for re-habilitation of ageing pipelines.

With slip-lining there is inevitably a reduction in pipe bore, although this can be minimised by thorough cleaning of the old main and choosing the largest possible pipe size for insertion.

The smaller bore is also compensated for by the greatly improved flow characteristics of polyethylene and in many cases the higher operating pressure capability of the new pipe. Pressure grouting of the annular gap provides structural rehabilitation of the existing pipe and reinforces the overall strength of the new pipe. Grouting may also offer a more economical total installation by allowing the use of a thinner walled PE pipe. Consideration should be given to the resistance of the pipeline to grouting pressures and this will be dependent on pipe SDR and ovality (especially coiled or drummed pipe).

PERMISSIBLE GROUTING PRESSURES FOR PE PIPES

Deformation	0%	1%	3%	6%
SDR	Permissible Grouting Pressure (kN/m²)			
33	13	12	10	7
26	27	25	20	15
17	58	53	43	32
11	417	385	317	242

Figure 29. Permissible Grouting Pressures

Figure 30. Typical Slip Lining Operation

Close Fit Insertion Methods

A number of methods are available for the structural lining ofexisting pipes, maximising the overall cost savings of using the existing 'hole in the ground'.

Two methods rely on physically reducing the outside diameter of the liner pipe to provide a clearance gap for insertion. Both work by either passing the pre-welded pipe through rollers or a reducing die. The pipe is either re-expanded using water pressure or allowed to recover naturally when the winch load has been removed.

Wavin have developed and patented their own re-habilitation method based on reducing the liner pipe O.D. by physically deforming the pipe into a 'C' shape. This product which is factory formed is known as 'Compact Pipe' and is available in a range of diameters and SDR's .

For further details on Compact Pipe please contact our Technical Services Helpdesk.

Thin Wall Polyethylene Liners

For pipelines, which are still structurally sound and require rehabilitation for leakage or water quality problems, thin wall PE liners can provide the solution. With SDR's of 33 - 61 the pipe is either factory or site formed into a folded profile to reduce its diameter for ease of installation into the existing main.

Lengths of up to 700m can be pulled in, in one operation, and when in place the folded pipe is reverted with mains water, to form a close-fitting liner. The technique is particularly effective on small diameter mains, 3 - 12" diameter, with the full system comprising termination fittings and ferrule connections.

Pipe Bending

One of the major benefits of PE is its flexibility and this can be utilised to full advantage for buried pipework. Gradual changes of direction up to 11.5° can normally be accommodated by the pipe itself, without the need for additional fittings and the costs of jointing.

The accepted rule of thumb for Wavin PE pipe systems (warm conditions for SDR 11 pipe) is, Bend radius = 15 x pipe O.D.

For colder weather and SDR 17 pipe a safe bending radius is 25 x pipe O.D.
In very cold winter temperatures this increases to 35 x pipe O.D. Where thinner walled SDR 26 and SDR 33 pipes are being used these values should be increased by 50%. Fittings and pipe joints should not be included in bent pipe sections; formed bends and elbows should be used instead to prevent undue stresses in the pipeline.

Pipe Detection

For future location of PE pipelines and in line with good pipe laying practice, the simplest and most economical method is to lay a marker tape/ mesh which incorporates a tracer wire. This should be installed 300mm above the pipe crown and also provides protection from any future third party damage.

Pipe Anchorage & Thrust Blocks

A key feature of a welded PE pipeline is that it is a fully end load resistant system and thrust blocks are not required at changes of direction/diameter or branches, providing significant time and cost benefits to the total installed cost of the system. It should be remembered that any connection to a non-end load-bearing fitting will require anchorage to prevent pipe pull-out.

Where heavy ancillary plant is installed on a PE pipeline, provision should be considered for concrete support. This should provide support both for the dead weight and resist any turning movements under operating conditions, eg. valves and hydrants.

Installation

Pipe Entry into Structures

Pipe entry into rigid concrete or brickwork structures needs to take account of a number of design factors and should include:

- Differential settlement. This can usually be accommodated by the flexibility of the pipe itself and by incorporating a flexible annular seal to the pipe sleeve through the structure.
- Watertight seal. The protective sleeve should provide both a watertight seal to the structure and to the PE pipe passing through the sleeve.
- In some situations PE pipe may be connected to the structure by a rigid flanged joint. To prevent undue stresses through movement and settlement, support can be provided by a reinforced concrete plinth. The plinth should extend one pipe diameter or 300mm (min) from the flange face, with pipe straps bolted to the plinth.

ABOVE GROUND PIPEWORK, MAX. SUPPORT SPACINGS (M)

Pipe Diameter (mm)	SDR 11	SDR 17	SDR 26
32	0.80	x	x
63	0.90	x	x
90	0.95	0.90	x
110	1.00	0.90	x
125	1.15	1.00	x
160	1.40	1.30	1.20
180	1.50	1.40	1.30
225	1.80	1.60	1.50
250	2.00	1.80	1.70
315	2.25	2.10	1.80
355	2.75	2.50	2.30
400	3.00	2.75	2.50
450	3.25	3.00	2.90
500	3.50	3.20	3.00
560	3.75	3.60	3.20
630	4.00	3.70	3.40

Figure 31. Maximum Support Spacings for Above Ground Pipework. For availability of pipe sizes above 630mm, please contact the Wavin Sales Office.

Above Ground Installation

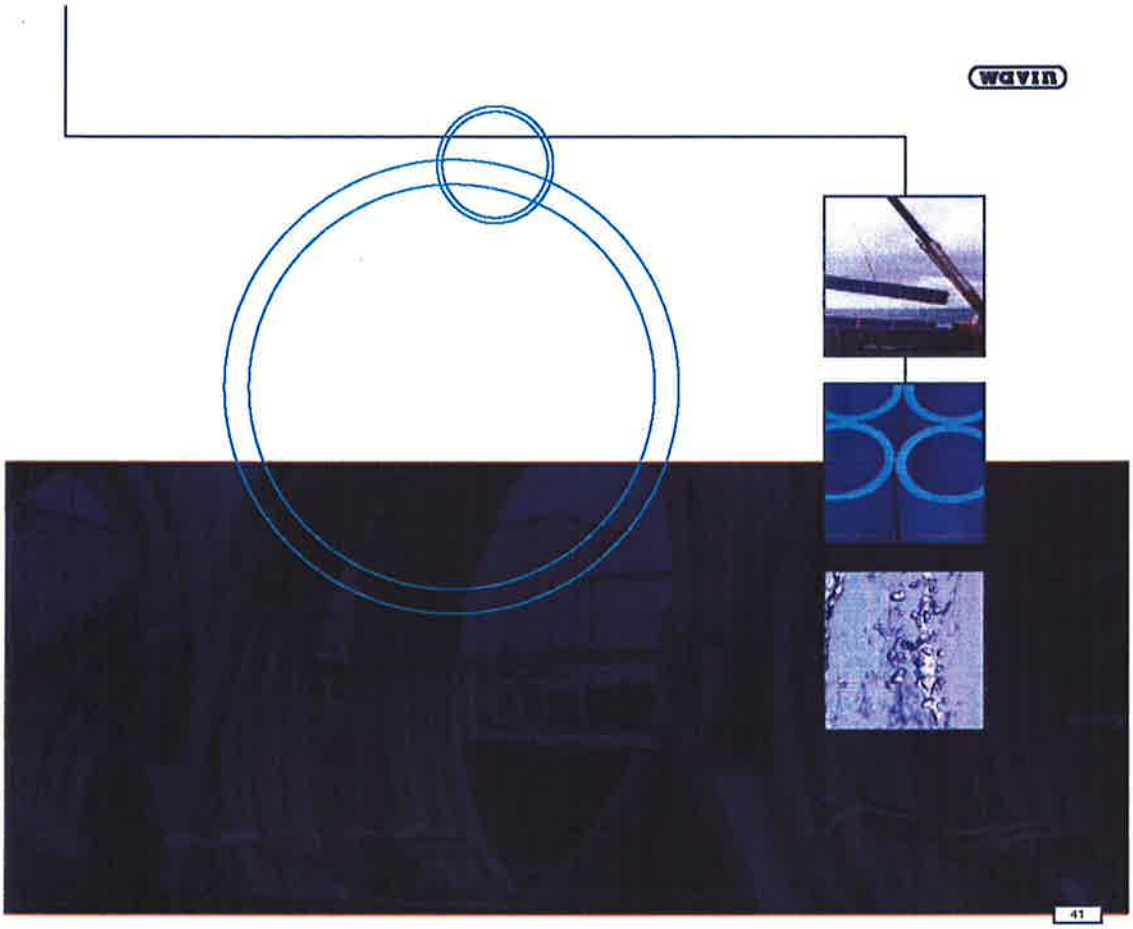
Where polyethylene pipe is to be installed above ground, WavinBlack PE systems should be used, providing protection against the effects of ultra-violet. Where blue PE systems are specified, the pipe requires protection against exposure to sunlight.

As polyethylene is a flexible pipe material, adequate pipe support must be provided to prevent sagging. Pipe supports should be designed to support both the pipe weight and its contents and also accommodate the weight of any heavy fittings, valves etc. The pipe brackets, straps or plinths should have flat surfaces, and be 0.5 x pipe O.D. or 100mm min wide (whichever is the greater) and have non-abrasive surfaces to prevent damage to the pipe. The support and bracketing design should allow for the stresses generated from thermal movement and if, for aesthetic reasons pipe deflection is unacceptable, continuous pipe support should be provided.

The above table gives recommendations for maximum support spacings for pipe full of water at an ambient temperature of 20°C or below. At temperatures of 40°C and above, continuous support is required. Above ground pipework should ideally be installed at or near the maximum operating temperature. The pipe will therefore be in its expanded state when installed.

As the pipeline cools, any contraction will be resisted by the pipe clamps, and when re-heated to its normal operating temperature, pipe sagging between supports will be minimised. Polyethylene is a good insulation material (thermal conductivity 0.4 w/m°C) and will help prevent or delay the freezing of the pipe contents.

The pipe itself will not fail if the contents do freeze as PE can safely expand to cater for the increased volume. It is, however, good practice for operational reasons to insulate pipework to prevent freezing and to ensure that the insulation is waterproofed. Pipework should be protected from possible impact damage and provision should be made for draining down horizontal pipe runs at low points in the system.



Contaminated Ground

Polyethylene is resistant to most naturally occurring ground contaminants. However, the greater use of previously developed land (brownfield sites) is resulting in a greater potential exposure to harmful contaminants.

The main concern for potable water pipework is the risk of long term mechanical damage to the material and of more importance, the contamination may cause water quality problems, taste and odour, due to permeation through the pipe wall. Former industrial sites pose the greatest problem. Development of the following sites should be carefully assessed:

- Coal workings, including coking and town gas production.
- Chemical works
- Gas works
- Paint and varnish works
- Wood plants (preservatives)
- Landfill sites
- Garages/petrol stations

Where there is a known risk of contamination, professional guidance should be sought on soils analysis to identify the range and degree of contaminants. The analysis can then be used to determine the suitability for polyethylene potable mains and services and whether suitable protection can be provided.

In some instances where contamination is negligible protection can be given with a clean sand/granular surround and a heavy gauge polyethylene membrane lining to the trench. If conditions are such that the use of polyethylene would not be suitable, the 'Trigon' barrier pipe has been developed specifically for carrying potable water through contaminated land. Further guidance is available from the Wavin Technical Services Helpdesk.

Handling & Storage

General Principles

Wavin polyethylene pipe systems are tough and relatively light and easy to handle although they can be damaged by sharp objects through scoring or gouging.

Therefore it is important that pipe and fittings are handled sensibly and with care, for the operatives safety as well as for the protection of the pipe and fittings.

Pipes and fittings should not be dropped or thrown from vehicles, or dragged across rough ground which may cause scoring. Pipe with scoring in excess of 10% of wall thickness should be clearly marked as damaged and discarded.

Polyethylene is unaffected by freezing conditions. Pipe can, however, become very slippery and extra care should be exercised during handling and installation. In general all protective packaging should remain in place as long as practicable before use.

All packaging should be disposed of sensibly according to the requirements of the site.

Storage

Pipe, whether bundles, coils or loose pipe must be stored in a manner which is both safe and which keeps the product free from damage. Pipe ends in particular should be protected, as distortion or damage may cause difficulties in jointing.

Pipe and fittings should be stored away from risk of damage from exhausts and other heat sources. Care is required to avoid any contact with solvents and oils, eg. spillage from site diesel tanks and exhausts.

Pipe and large fabricated fittings can be stored externally for up to a year. However for longer term storage cover should be provided to avoid UV damage. Electrofusion fittings should be stored under cover and kept dry. Fittings packaging must be kept intact up to the point of use.

Loose Pipes

Individual pipes should be stacked on level ground, free of stones and sharp objects, with timber batten supports at 1m centres. The pipe can be stored in pyramid fashion up to 1m high and should be securely staked to avoid collapse. See Figure 32.

Pipe strung out on site should be protected from damage, eg coned off or within a barrier system and pipe end caps should be left in place to prevent the ingress of dirt, vermin etc.

Figure 32. Loose Pipe Storage

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Bundled Pipe

Pipe bundles should be stored on level ground and can be stored up to 3m high.

Small Diameter Coils

Small diameter coils, which are film wrapped and delivered on pallets, should remain on the pallet and stored on flat ground until required. Individual film wrapped coils should be stored flat on level ground. Again ensure there are no large stones or sharp objects, which may damage the pipe.

Free Standing Coils

Free standing coils (FSC's) up to 180mm diameter can potentially cause injury if handled in the wrong manner, therefore FSC's should be stored flat on battens up to a maximum of 2.5 metres high. Timber battens should also be placed between coils to enable fork truck access or for slinging purposes.

Transport

Pipe should be transported on a flat bed vehicle, which is free from any sharp objects, nails etc. Full loads direct from the factory can be offloaded with a vehicle mounted Hi-Ab crane and are often delivered direct to site.

Pipe bundles should be offloaded by crane or fork truck. With crane offloading the bundles can be lifted with wide band slings; chains, hooks or steel rope should not be used.

Fork truck and side loader offloading should be carried out by trained operators only; care is required to avoid damage by the metal fork blades.

Free standing coils (FSC's) are delivered on dedicated caged vehicles and off-loaded by Hi-Ab crane. They should be handled on site by fork truck or crane with slings for lifting into the trailer/dispensers.

FSC's are banded in individual layers to allow the pipe to be dispensed in a safe and controlled manner; particular care should be taken with pipe ends so that they are secured when pipe is released from the coil dispenser.

Handling & Storage

44

Safety Note

Drums

Fittings Information

Small Diameter Coils

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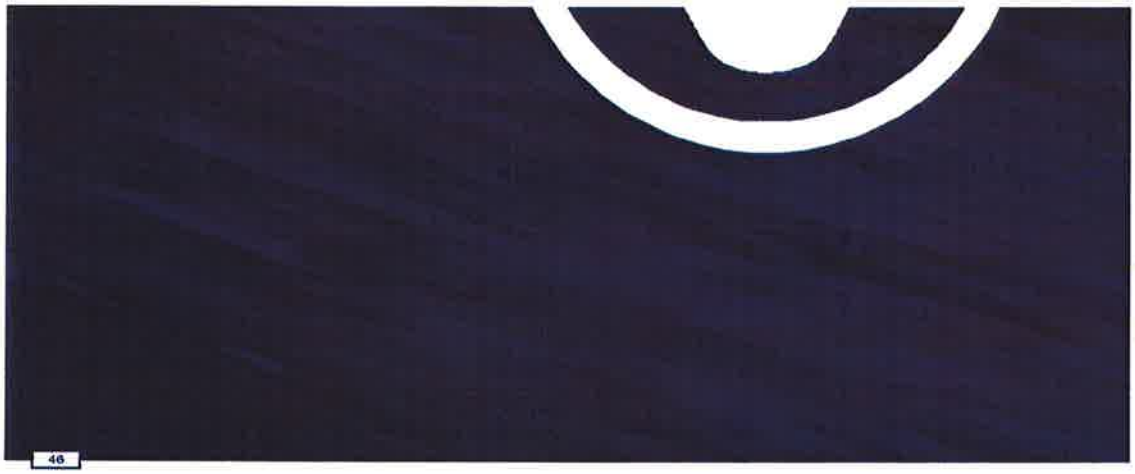
Health & Safety

Wavin have been involved in the manufacture and supply of plastics pipe systems to the Water Industry for 45 years and with polyethylene pipe products for over 25 years.

At all stages in the supply chain, from manufacturing through to transport and delivery to the customer's site, Wavin are committed to the safety of all personnel involved in the handling of their products, and actively promote safe practices throughout all of its operations.



Ingestion

Polyethylene is classified as chemically unreactive and regarded as being biologically inert. Ingestion of PE in any form should, however, be avoided.

Physical Contact

PE is not considered to be a skin irritant. However, when cutting or scraping PE, dust particles may cause eye irritation and appropriate protective eyewear should be used.

Inhalation

PE does not release harmful fumes at normal ambient temperatures. Inhalation of PE dust can irritate the respiratory system and where possible cutting or scraping operations should be carried out in well-ventilated areas.

Fire Hazards

Polyethylene will melt at 120 - 135°C and above 300°C will degrade to produce carbon dioxide, carbon monoxide, water and small amounts of various hydrocarbons and aldehydes. These gases may ignite and provide heat to accelerate the process. Burning, molten droplets of material may be released which could ignite adjacent materials.

Avoid inhalation of smoke or fumes as the combustion of PE may release toxic materials. Do not allow PE dust particles to accumulate as in extreme circumstances there can be a risk of dust explosion. All electrical equipment should be carefully sited and earthed, likewise with the siting of any potential heat sources. In the event of fire, any fire extinguisher may be used, powder extinguishers are very effective in quenching flames.

Water sprays are especially effective in rapidly cooling and damping down a fire but are not recommended.

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Handling

Polyethylene pipe and fittings should be handled in accordance with instructions in the Handling Section of this guide and also in accordance with the instructions in the WRc Polyethylene Manual.

Particular care should be observed when handling large diameter pipe and fittings and during cold frosty weather. Appropriate safety clothing and equipment should be used at all times when handling PE pipes and fittings.

Safety
Caution

When handling or dispensing coils or drummed PE pipe extreme care should be taken, especially with 90mm diameter and larger pipe where a coil-dispensing trailer must be used.

Operatives should be adequately trained and experienced in the use of large diameter coiled pipe.

Safety
in Jointing

Fusion welding of PE pipe and fittings produces molten PE and will adhere strongly to skin if allowed to come into contact and cause severe burns. Protective gloves should be worn during the jointing process and when handling hot equipment.

Jointing should always be carried out in well-ventilated areas. Fusion welding procedures produce small quantities of fumes and inhalation of fumes should be avoided or minimised.

The Electrofusion jointing process can cause the ejection of molten material if the joint assembly is incorrectly carried out. Operatives should wear safety gloves and goggles during jointing and avoid standing directly over the joint area.

Environment

Polyethylene is biologically inert and is not considered to be dangerous to the environment.

Waste polyethylene material can be reprocessed into new pipe products or other products and there is a growing market for such waste materials.

For further details on re-cycling of waste polyethylene please contact the Wavin Technical Services Helpdesk.

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