Hart Engineering Corporation

SUBMITTAL:
11310-02

PROJECT: 9900. - Veolia/Taunton WWTF Phase 1 Improvements **DATE: 05/03/2022**

SUBMITTAL: 11310-02 - Sanitary Pump O&M Manual
REVISION: 0
STATUS: Eng
SPEC #: 11310

TO:
Michael Andrus
Beta Group Inc.
6 Blackstone Place
Lincoln, RI 02865
MAndrus@BETA-Inc.com

FROM:
Ryan Murphy
Hart Engineering Corporation
800 Scenic View Drive
Cumberland, RI 02864
rmurphy@hartcompanies.com

Item	Revision	Description	Status	Date Sent	Date Returned
11310-02	0	Sanitary Pump O&M Manual	Eng	05/03/2022	
Notes:					

Additional Notes:

Status Codes
1-APP – No Exceptions Taken
2-ANR – Make Corrections Noted
3-R&R – Revise and Resubmit
4-REJ – Rejected
5-IPO – For Information Purposes Only
6-NRR – Not Required for Review
ENG – Submitted to Engineer

Sincerely,
Hart Engineering Corporation

_____ DATE: 05/03/2022

PRELIMINARY O & M MANUAL

ORDER INFORMATION

JOB NAME: TAUNTON WWTF PHASE 1 IMPROVEMENTS SANITARY SEWER PUMPS
JOB NUMBER: SO19712
HIDROSTAL SCREW CENTRIFUGAL PUMP: D3K-M2+D2M1-X
SERIAL #: TBD
QUANTITY: 2
REV: 0
DATE: 4/25/2022

CUSTOMER

HART ENGINEERING CORPORATION
800 SCENIC VIEW DRIVE
CUMBERLAND, RI 02864

MANUFACTURER

HIDROSTAL PUMPS
2225 WHITE OAK CIRCLE, SUITE 101
AURORA, IL 60502
PHONE: 630-948-3355
FAX: 630-948-3353

LOCAL REPRESENTATIVE FOR PARTS AND SERVICE

AQUA SOLUTIONS, INC.
154 WEST GROVE ST. UNIT D
MIDDLEBORO, MA 02346
PHONE: 508-947-5777
FAX: 508-861-0733

Revision	Date	Description

Table of Contents

Horizontal/Vertical End Suction Pump Start-Up Checklist

Project Information

Job Name: _____

Location (Address/City, State): _____

Engineer (Firm's Name): _____

Installing Contractor (Company's Name):_____

Start-Up (Company's Name): _____

Electrical Equipment Install & Setup (Company's Name): _____

Operating Manager (Person In Charge): _____

Contact Info (Email/Phone): _____

Health and Safety

Risk Assessment Methodology Reviewed (If Applicable): _____

Work Permits Issued and Reviewed (If Applicable): _____

Site Safety and Personal Protective Equipment Plans Reviewed: _____

Access and Emergency Exiting Plan Reviewed: _____

Equipment Information

Installation Date: _____

Start-Up Date: _____

Pump Model Number: _____

Pump Serial: _____

Pump Size: _____

Driver Manufacture & Serial Number: _____

Driver Type, HP, RPM: _____

Drive Manufacture & Model: _____

Drive Type and Size: _____

Equipment Condition Checklist

☐ Yes ☐ No Check that equipment arrived in good condition?

☐ Yes ☐ No Check that all items were received?

☐ Yes ☐ No Was equipment stored for a period of time? (If Yes, Length of Storage :_____)

☐ Yes ☐ No Has equipment been protected from the elements?

☐ Yes ☐ No Was equipment subject to flooding?

☐ Yes ☐ No Where the storage instructions followed?

Installation Checklist

☐ Yes ☐ No Does the impeller turn freely by hand?

☐ Yes ☐ No Check if impeller rotates in the direction indicated on volute?

Pump must operate in the direction indicated by the arrow on the pump casing; serious damage can result if the pump is operated with incorrect rotation. Always check rotation each time the motor leads have been disconnected.

☐ Yes ☐ No Check all connections to motor and starting device with wiring diagram?

☐ Yes ☐ No Check all that Operations & Maintenance Instructions where received and reviewed?

☐ Yes ☐ No Check impeller adjustment?

☐ Yes ☐ No Check that the pump is full of liquid?

☐ Yes ☐ No Check if the unit is grouted?

☐ Yes ☐ No Check that the grout sound (free of voids and cracks)?

☐ Yes ☐ No Check if anchor bolts are tight?

☐ Yes ☐ No Check if the unit is free from piping strains and bending moments being transmitted to the pump flanges from piping?

☐ Yes ☐ No Check if the piping is properly supported?

☐ Yes ☐ No Check if piping is free of scale, dirt and foreign matters?

☐ Yes ☐ No Check and locate emergency stop locations?

☐ Yes ☐ No Check and locate gauge access locations?

Alignment

COUPLING OR V-BELT DRIVE

- The pump and drive have been checked at the factory to determine that field alignment dimensionally can be made. It is mandatory that the unit is field aligned.
- The baseplate needs to lay flat and level on grout without stress and strain put on by anchoring.

A flexible coupling never compensates for misalignment. In all cases a coupling must be in alignment for continuous operation. Where a non-flexible coupling is used, proper alignment is indispensable to the proper functioning of pump and driver. Premature pump failure will occur without proper alignment.

ALIGNMENT PROCEDURE

- See instruction manual for the pump being aligned with coupling or v-belt drive. Coupling alignments should be made with dial indicator. Manual used: _____
  - Parallel_____T.I.R.
  - Angular_____T.I.R.
  - ☐ Yes ☐ No Belt drive tension checked?
  - ☐ Yes ☐ No All safety guards and labels in place?

Mechanical Seal/Stuffing Box Checklist

- If the pump is fitted with mechanical seal, bleed air from seal chamber especially in a vertical application. Make sure the chamber is full of liquid before turning on the pump.
  - Seal water pressure should be 10 to 20 psi above the discharge of the pump is recommended for **cartridge seals**. (Seal water pressure) _____PSI
  - Make sure that the oil chamber pressure never exceeds 14 psi in a **tandem mechanical** seal arrangement.
- If the pump is fitted with packing, make sure the gland is loose enough to allow the water to leak freely at the initial start, then one to two drops per second for the initial break in and then tighten gland down to no less than a minimum of 30 drips per minute. (Packing leakage) _____ Drips/minute
- Lubrication type: ☐ Internal ☐ External ☐ Grease

☐ Yes ☐ No Seal chamber/stuffing box chamber full of liquid?

☐ Yes ☐ No Seal water lines properly installed?

☐ Yes ☐ No Are all accessory items, RTD's, bearing temp detectors, vibration sensors, ect., mounted and properly installed?

Start-Up

PRIMING

- If the pump is installed with a positive head on the suction, it can be primed by opening the suction valve and allowing the liquid to enter the casing. At the same time, openvent until all air is out of casing.
- If the pump is installed with a suction lift, priming must be done by other methods such as foot valves, ejectors or by manually filling the casing and suction line.

Pump must be completely filled with liquid before starting. Never allow pump to run dry in the hope it will prime itself. Serious damage to the pump, packing or mechanical seal may result.

STARTING

- Close drain valves and valve in discharge line.
- Open fully all valves in the suction line.
- Prime the pump.
    - If the pump does not prime properly, or loses prime during start-up, it should be shut down and the condition corrected before the procedure is repeated.
- Make sure suction valve is fully open.
- Make sure discharge vale is 25% open. (Open to 100% within 10 seconds of start-up)
- Start the pump driver.

On start-up with the discharge valve closed, pump must not be run against closed valve for more than 30 seconds.

OPERATING CHECKS

- Check the pump and piping for leaks.
- Check and record pressure gauge reading for future reference.
    - Suction_____PSIG/KPa
    - Discharge_____PSIS/KPa
- Check and record flow_____USGPM
- Check and record well level_____FEET

- Check and record voltage, amperage per phase and kilowatts (of available).
  - Voltage_____/_____/_____Volts _____
  - Amperage_____/_____/_____Amps _____
  - Hertz _____

SHUTDOWN

- When stopping pump always close the discharge valve first if check valve is not in installed.
- Pump should never run for any length of time with both suction and discharge valves closed due to the danger of building up pressures and temperatures.

MAINTENANCE

- Have you instructed user's supervisory and maintenance personnel on the correct operation of this equipment?
- Do maintenance personnel have instruction books for these specific units?

Comments:

_____

_____

_____

_____

I certify this report to be accurate (Please Print and Sign by start-up person):

_____

Date: _____

Others present during Start-Up: _____

_____

This report is designed to insure the customer that customer service and a quality product are the number one priority.
Please answer the following questions completely and as accurately as possible. Please email this form to the sales@hidrostalpumps.com

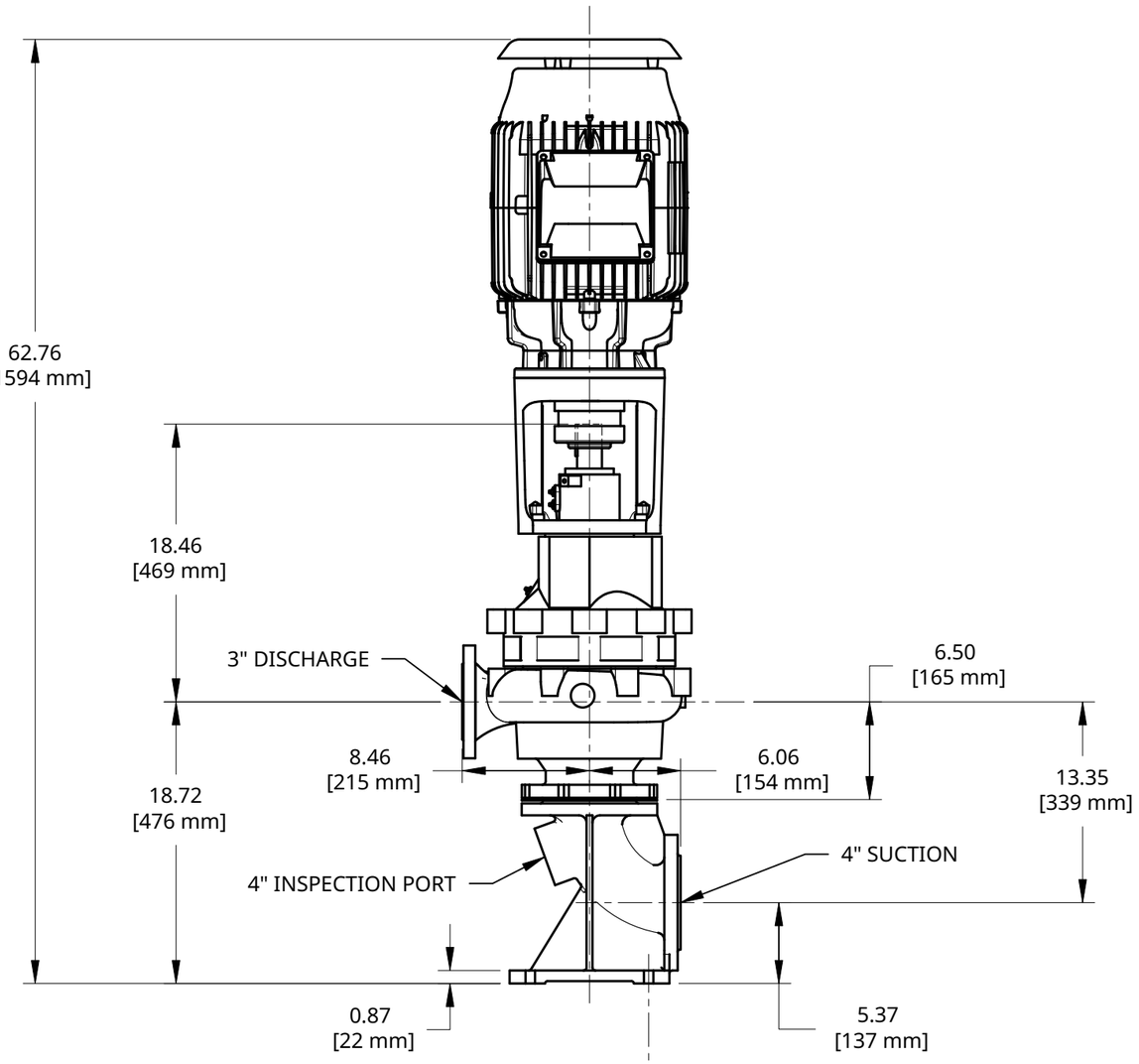
Bill to	HART ENGINEERING CORPORATION 800 SCENIC VIEW DRIVE CUMBERLAND, RI 02864
Sales number	SO19712

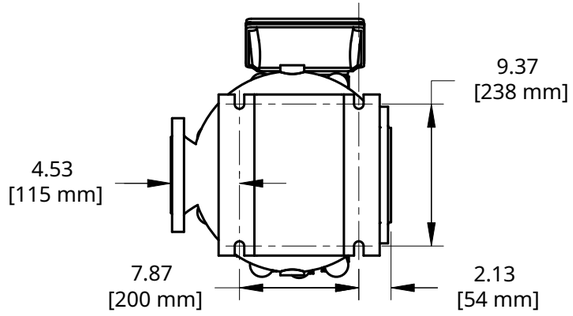
QTY	DESCRIPTION
2	D3K-M2+D2M1-X HVES PUMP ASSEMBLY
2	D3K-M2+D2M1-X MATERIAL: DUCTILE IRON IMPELLER AND HI-CHROME LINER CONDITIONS: 150 GPM @ 50 FT SPEED: 2305 RPM CW VIEWED FROM TOP OF THE MOTOR
2	VERTICAL SUPPORT ELBOW ASSEMBLY - D-FLEX COUPLING
2	15 HP MOTOR 3600 RPM, 208-230/460V 3 PHASE 60 HZ TEFC, NEMA FRAME: 254HP TEFC
2	7-POINT PERFORMANCE TEST PER HI 3B
2	HYDROSTATIC TEST
2	PAINT SYSTEM TENEMEC N69

SERIAL NUMBER	TBD

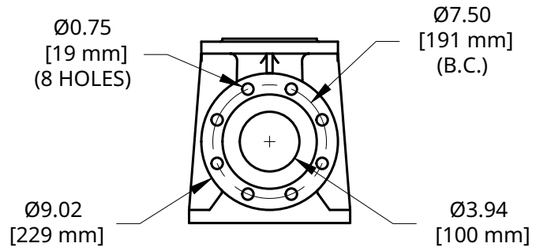
Item	Quantity	Description	Material	Weight
1	1	PUMP D3K-M2+D2M-X	PER ORDER	190 lbs
2	1	MOTOR, NEMA 254/6HP	PER ORDER	250 lbs
3	1	D-FLEX 7 COUPLING	STEEL	15 lbs
4	1	MOTOR SUPPORT BRACKET	CAST-IRON	25 lbs
5	1	VERTICAL SUPPORT ELBOW	CAST-IRON	69 lbs

NOTES:
1. DIMENSIONS ARE NOT FOR INSTALLATION PURPOSES UNLESS CERTIFIED.
2. PUMP AND ACCESSORIES ARE DESIGNED FOR CONTINUOUS DUTY.
3. PUMP SIZE, MODEL AND SERIAL NUMBER MUST BE SPECIFIED WHEN ORDERING SPARE PARTS.
4. CLOCKWISE ROTATION VIEWED FROM SHAFT END; CCW IS NOT AVAILABLE.
5. SUCTION AND DISCHARGE FLANGE MATE WITH CLASS 125 ANSI FLANGES.
6. PUMP CAN BE ROTATED; CONSULT INS-VERTICAL ARRANGEMENTS FOR DETAILS.

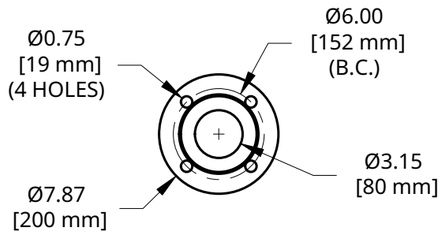




ANCHOR PATTERN
(VERTICAL SUPPORT ELBOW)



4" SUCTION FLANGE
(VERTICAL SUPPORT ELBOW)



3" DISCHARGE FLANGE
(PUMP)

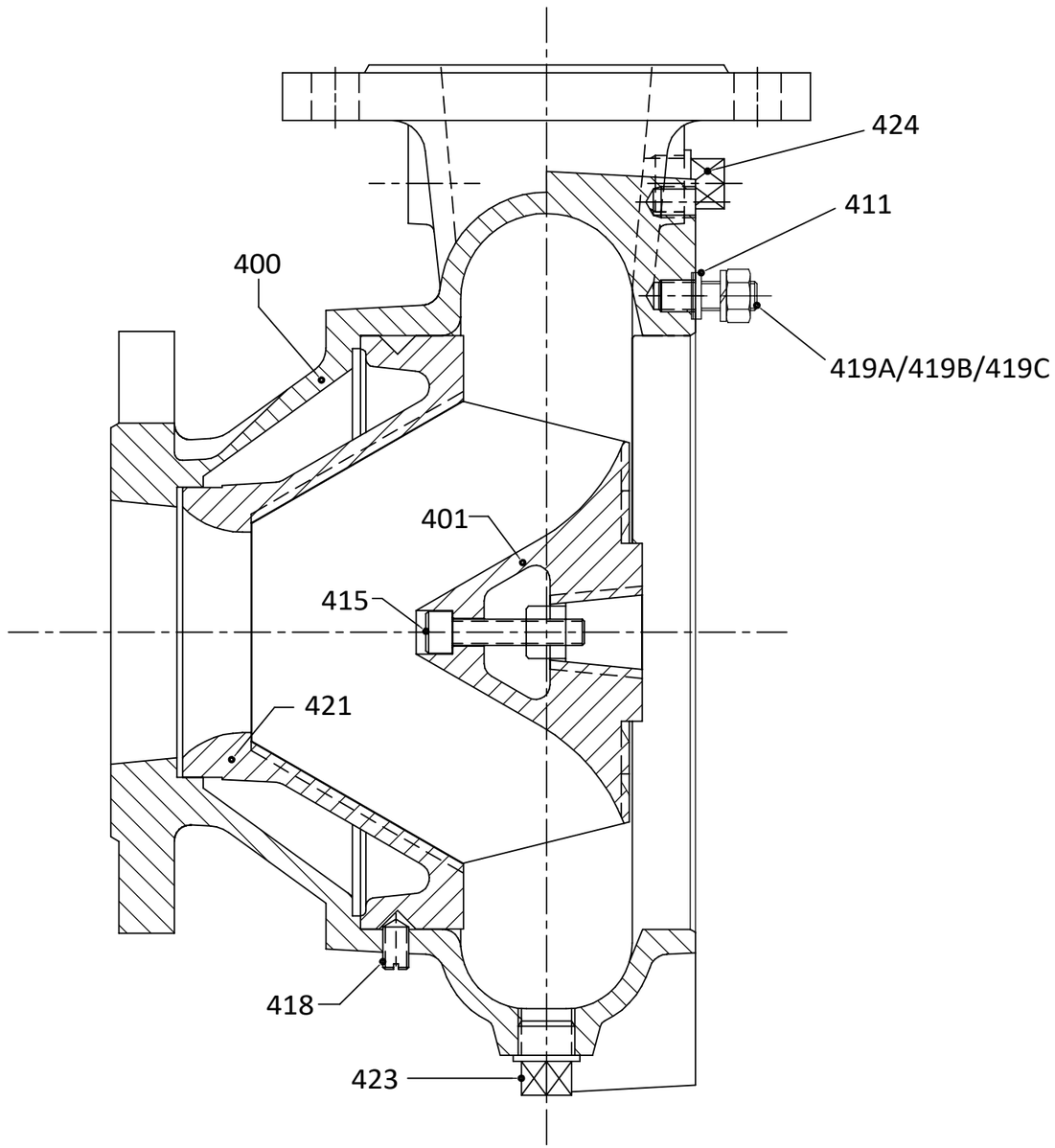
		NAME	DATE
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES .XX = ±.02 ◎ .005 TIR .XXX = ±.005 ⊥ .005 TIR .XXXX = ±.0005 // .005 TIR 125 RMS ⌭ .005 TIR ANGULAR = ±.5° FRACTIONAL = ±1/32	DRAWN	MICKEY HYLAND	01/10/2022
	CHECKED		
	APPROVED	MICKEY HYLAND	01/12/2022
DO NOT SCALE DRAWING			
BREAK ALL SHARP EDGES AND REMOVE BURRS			
THIRD ANGLE PROJECTION	MATERIAL	FINISH	

HIDROSTAL North America

TITLE
INSTALLATION
D3K+D2M, VERTICAL END SUCTION
VERTICAL SUPPORT ELBOW (HVES-VSE)

SIZE	DWG NO.	REV.
B	INS-SO19712-HVES-D3K-VSE	.

SCALE	WEIGHT	SHEET
1:10		1 of 1



ITEM	DESCRIPTION
400	CASING VOLUTE, D3K-L, -M, -H, -S
401	IMPELLER, D3K-H
	IMPELLER, D3K-L
	IMPELLER, D3K-M
	IMPELLER, D3K-S
411	SHIM SET
415	SCREW, CAP M10 x 40
418	SCREW, SET SOC HD CONE PNT M12 x 20
419A	STUD, TAP END M12 x 1.75 x 40
419B	NUT, HEX M12 x 1.75
419C	WASHER, LOCK M12
421	LINER, D3K-H, L, M
	LINER, D3K-S
423	PLUG, PP SQ. HD 1/2 NPTM
424	PLUG, PP SQ. HD 1/2 NPTM

D3K ™
D3K-L ™
D3K-M ™
D3K-H ™
D3K-S ™

HIDROSTAL PUMPS
North America

DESCRIPTION:

WET END CROSS SECTION
D3K
NON-REGULABLE

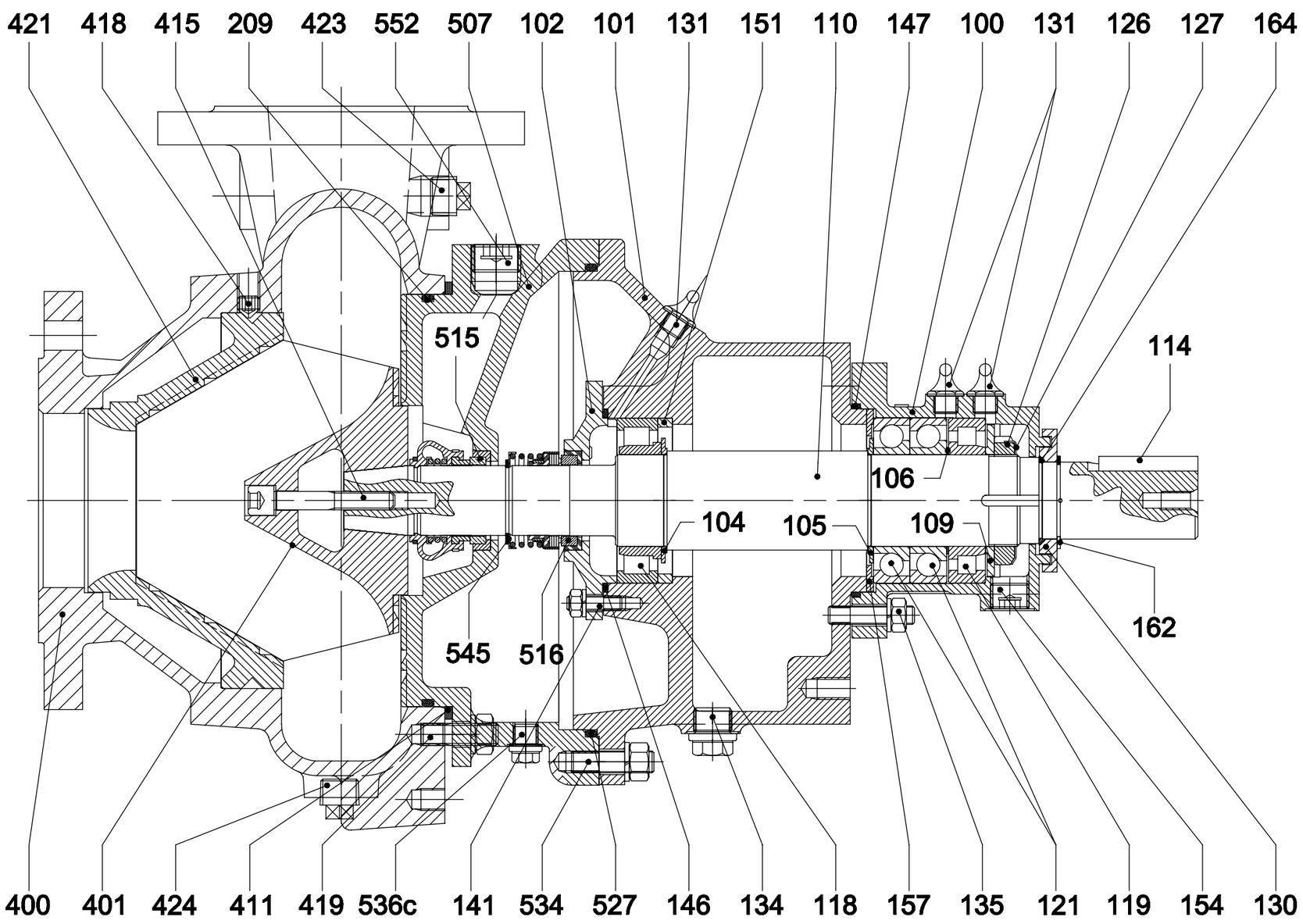
REV	DATE	ZONE	DESCRIPTION	APPROVED
.				

STANDARD MACHINE TOLERANCES UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS IN INCHES

// .005 TIR	⌿ .005 TIR	.XX ±0.02	BREAK OUTSIDE EDGES .005-.035
⊥ .005 TIR	∠ ± .5°	.XXX ±0.005	INSIDE CORNER R .035 MAX
◎ .005 TIR	▽ 125 RMS	X/X ±1/32	ALL DRILL & TAP DEPTHS ±0.06

DO NOT SCALE DRAWING
THIRD ANGLE PROJECTION

MODEL:		**SALES ORDER:**	**DRAWING NUMBER:** CRO-D3K-WE-NR
DRAWN BY: TES		**DATE:** 01/26/16	**WEIGHT:** / **SCALE:**
CHECKED BY:		**DWG. SIZE:** B	**SHEET** 1 OF 1 / **REV.**



D3K ™
D3K-L ™
D3K-M ™
D3K-H ™
D3K-S ™

Hidrostal Pumps ™ Hidrostal LLC North America

DESCRIPTION:
CROSS SECTION
BEARING FRAME & WET END SECTION
D3K-H, D3K-L, D3K-M & D3K-S
(D2M BEARING FRAME, NON-REGULABLE)

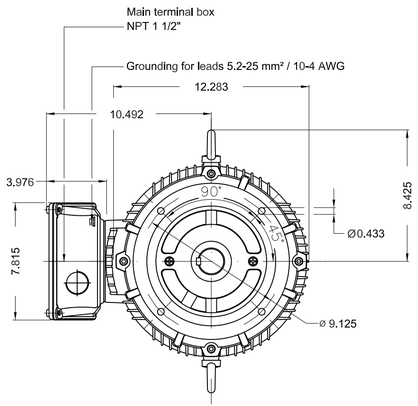
REV	DATE	ZONE	DESCRIPTION	APPROVED
.				

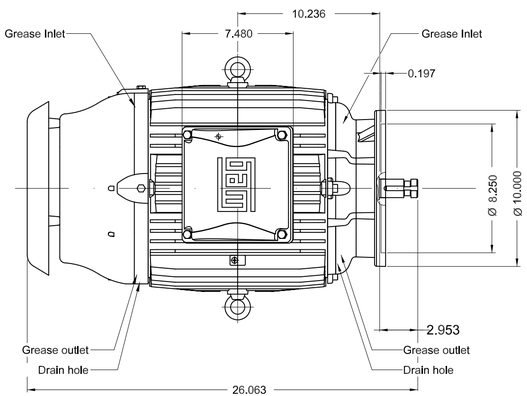
STANDARD MACHINE TOLERANCES UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS IN INCHES

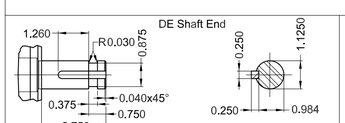
// .005 TIR	⌿ .005 TIR	.XX ±0.02	BREAK OUTSIDE EDGES .005-.035
⊥ .005 TIR	∠ ± .5°	.XXX ±0.005	INSIDE CORNER R .035 MAX
◎ .005 TIR	▽ 125 RMS	X/X ±1/32	ALL DRILL & TAP DEPTHS ±0.06

DO NOT SCALE DRAWING
THIRD ANGLE PROJECTION

MODEL:	SALES ORDER:	DRAWING NUMBER: CRO-HVES-D3K-D2M-NR	
DRAWN BY: TES	DATE: 10/19/15	WEIGHT:	SCALE:
CHECKED BY:	DWG. SIZE: B	SHEET 1 OF 2	REV.







Color RAL 5009	
Painting plan 203A	
Mounting NEMA W-6	
Mounting V1	

15 HP 02 Poles 60 Hz | A

ECM	LOC	SUMMARY OF MODIFICATIONS	EXECUTED	CHECKED	RELEASED	DATE	VER

EXECUTED	PIRWBUSER	THREE PH. MOTOR W22 P. BASE PREM. EFF.	PREVIEW	
CHECKED		FRAME 254HP IP55 TEFC	WDD	
RELEASED				
REL DT.		WMO Jaragua do Sul Product Engineering	SHEET 1 / 1	

Dimensions in inches

XME A3

MAINTENANCE SUMMARY FORM

1. Equipment Item	D3K-M2+D2M1-X
2. Manufacturer	Hidrostal Pumps 2225 White Oak Circle, St 101 Aurora, 60502. 630-948-3355
3. Equipment identification numbers	SERIAL #'S TBD
4. Total weight	APPROX. 549 LBS. EACH
5. Nameplate data (HP, Voltage, Speed, etc	15 hp, 60 hz, 208-230/460 V 3600 rpm Duty 150 gpm @ 50 ft
Manufacturer local representative	AQUA SOLUTIONS, INC. 154 WEST GROVE ST. UNIT D MIDDLEBORO, MA 02346 PHONE: 508-947-5777

6. MAINTENANCE REQUIREMENT

Maintenance operation List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable.	Frequency List required frequency of each maintenance operation.	Lubricant (if applicable) Refer by symbol to lubricant list required	Comments
Note: after 50 hours of operation, pull the pump and retighten all fasteners. Repeat at 1000 hrs., and then every 6 months thereafter when checking the oil in the seal chamber			
Check moisture probe device	Weekly	-----	See page
Check oil seal chamber	After 1000 hrs. and every 6 months thereafter	-A-	See page
Bearing major overhaul*	By Hidrostal approved motor repair shop	-A-	
Adjust clearance liner / impeller	Annually		See page

*Major overhaul by UL listed and Hidrostal approved repair shop.
Contact factory for critical motor repair manuals and data.

7. Lubricant List

Reference symbol	Shell	BP	Total	Mobil	
-A- seal chamber	Tellus S2V 15	Bartran HV 15	Equivis ZS 15	DTE 16 M	

8.Recommended spare parts

The following are our recommendation regarding what spare parts, if any, should be kept on the job

Quantity	Description
1 set	Mechanical seal
1 set	o-rings

2225 White Oak Circle, Suite 101
Aurora, Il 60502

REPRESENTATIVE FOR PARTS & SERVICES

AQUA SOLUTIONS, INC.
154 WEST GROVE ST. UNIT D
MIDDLEBORO, MA 02346
PHONE: 508-947-5777
FAX: 508-861-0733

JOB NAME:	1486 WEST SALEM WWTP
CUSTOMER ORDER NUMBER:	9900.115
HIDROSTAL ORDER NUMBER:	SO19712

SPARE PARTS ORDERING INSTRUCTIONS

1. Using the general assembly drawing(s) in this operation and maintenance manual, locate the part (s) with the item number(s) show in the drawing(s). record the serial number of the pumps(s) from which this information was obtained for all the parts needed

2. Contact your local Hidrostal representative, given above, to obtain price and availability of the parts(s). You will need to give them ALL the information you recorded in no. 1 above

3. Once a quotation has been provided, your local Hidrostal representative will be pleased to accept your purchase order for the parts(s)

SO19712 PARTS LIST TBD

DATA SHEET

Three Phase Induction Motor - Squirrel Cage

Customer	:

Product line	: W22 P Base NEMA Premium Efficiency Three-Phase	Product code :	13016536
		Catalog # :	01536ET3E254HP-W22

Frame	: 254HP	Locked rotor time	: 45s (cold) 25s (hot)
Output	: 15 HP (11 kW)	Temperature rise	: 80 K
Poles	: 2	Duty cycle	: Cont.(S1)
Frequency	: 60 Hz	Ambient temperature	: -20°C to +40°C
Rated voltage	: 230/460 V	Altitude	: 1000 m.a.s.l.
Rated current	: 34.4/17.2 A	Protection degree	: IP55
L. R. Amperes	: 230/115 A	Cooling method	: IC411 - TEFC
LRC	: 6.7x(Code G)	Mounting	: W-6
No load current	: 10.6/5.30 A	Rotation[1]	: Both (CW and CCW)
Rated speed	: 3530 rpm	Noise level[2]	: 72.0 dB(A)
Slip	: 1.94 %	Starting method	: Direct On Line
Rated torque	: 22.3 ft.lb	Approx. weight[3]	: 288 lb
Locked rotor torque	: 220 %		
Breakdown torque	: 270 %		
Insulation class	: F		
Service factor	: 1.25		
Moment of inertia (J)	: 1.26 sq.ft.lb		
Design	: B		

Output	25%	50%	75%	100%
Efficiency (%)	89.2	89.5	91.0	91.0
Power Factor	0.53	0.77	0.85	0.88

Foundation loads	
Max. traction	
Max. compression	

		Drive end	Non drive end
Bearing type	:	6311 C3	6209 C3
Sealing	:	V'Ring	V'Ring
Lubrication interval	:	7000 h	11000 h
Lubricant amount	:	18 g	9 g
Lubricant type	:	Mobil Polyrex EM	

Notes
USABLE @208V 38.0A SF 1.15 SFA 43.7A

This revision replaces and cancel the previous one, which must be eliminated.
(1) Looking the motor from the shaft end.
(2) Measured at 1m and with tolerance of +3dB(A).
(3) Approximate weight subject to changes after manufacturing process.
(4) At 100% of full load.

These are average values based on tests with sinusoidal power supply, subject to the tolerances stipulated in NEMA MG-1.

Rev.	Changes Summary	Performed	Checked	Date

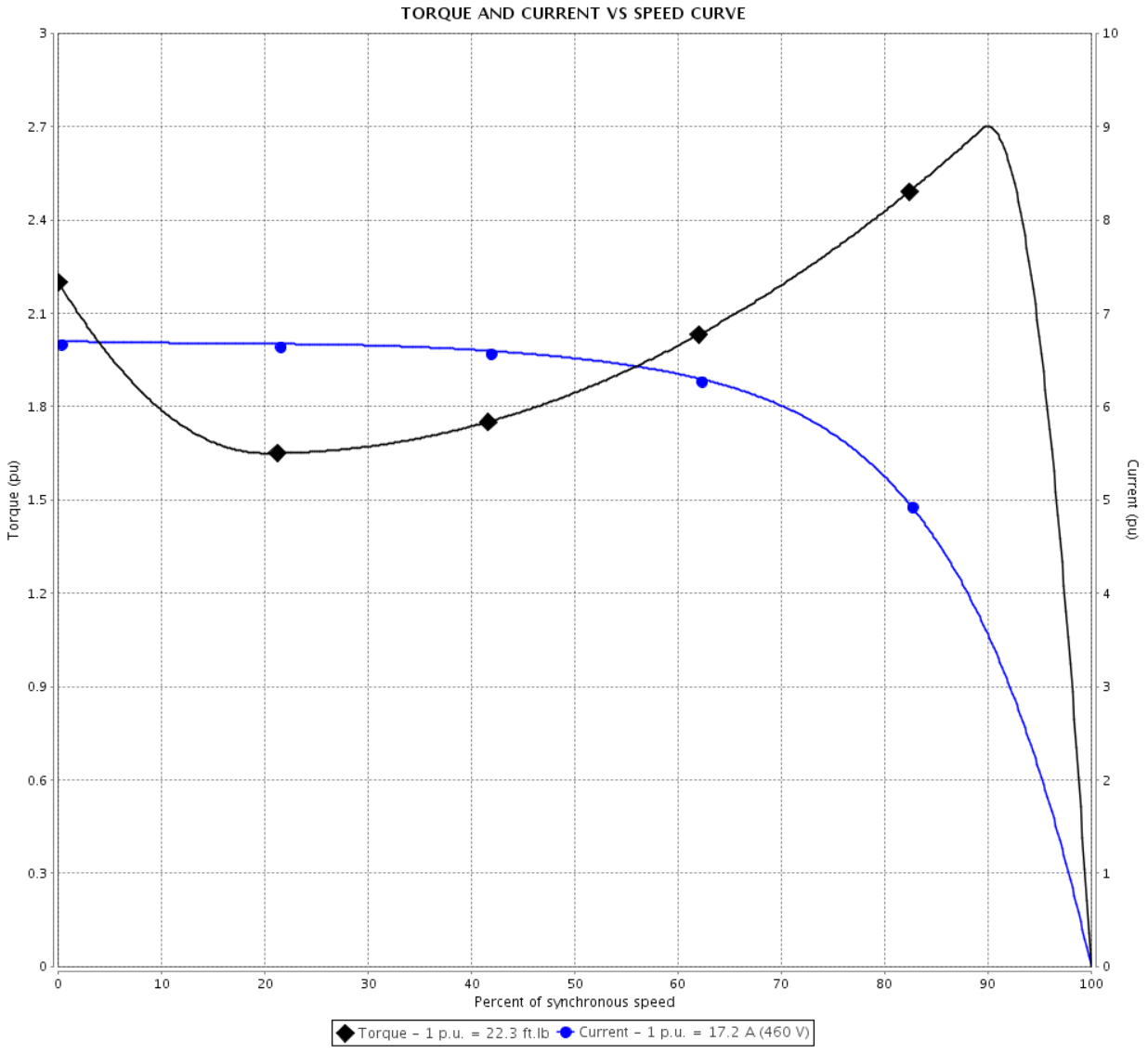
Performed by			
Checked by			Page 1 / 1
Date	11/01/2022		Revision 1/12/2022

TORQUE AND CURRENT VS SPEED CURVE

Three Phase Induction Motor - Squirrel Cage

Customer	:

Product line	: W22 NEMA Premium Efficiency Three-Phase	Product code :	11620543
		Catalog # :	01536ET3ER254TC-W22



Performance	: 230/460 V 60 Hz 2P

Rated current	: 34.4/17.2 A	Moment of inertia (J)	: 1.26 sq.ft.lb
LRC	: 6.7	Duty cycle	: Cont.(S1)
Rated torque	: 22.3 ft.lb	Insulation class	: F
Locked rotor torque	: 220 %	Service factor	: 1.25
Breakdown torque	: 270 %	Temperature rise	: 80 K
Rated speed	: 3530 rpm	Design	: B

Locked rotor time	: 45s (cold) 25s (hot)

Rev.	Changes Summary	Performed	Checked	Date

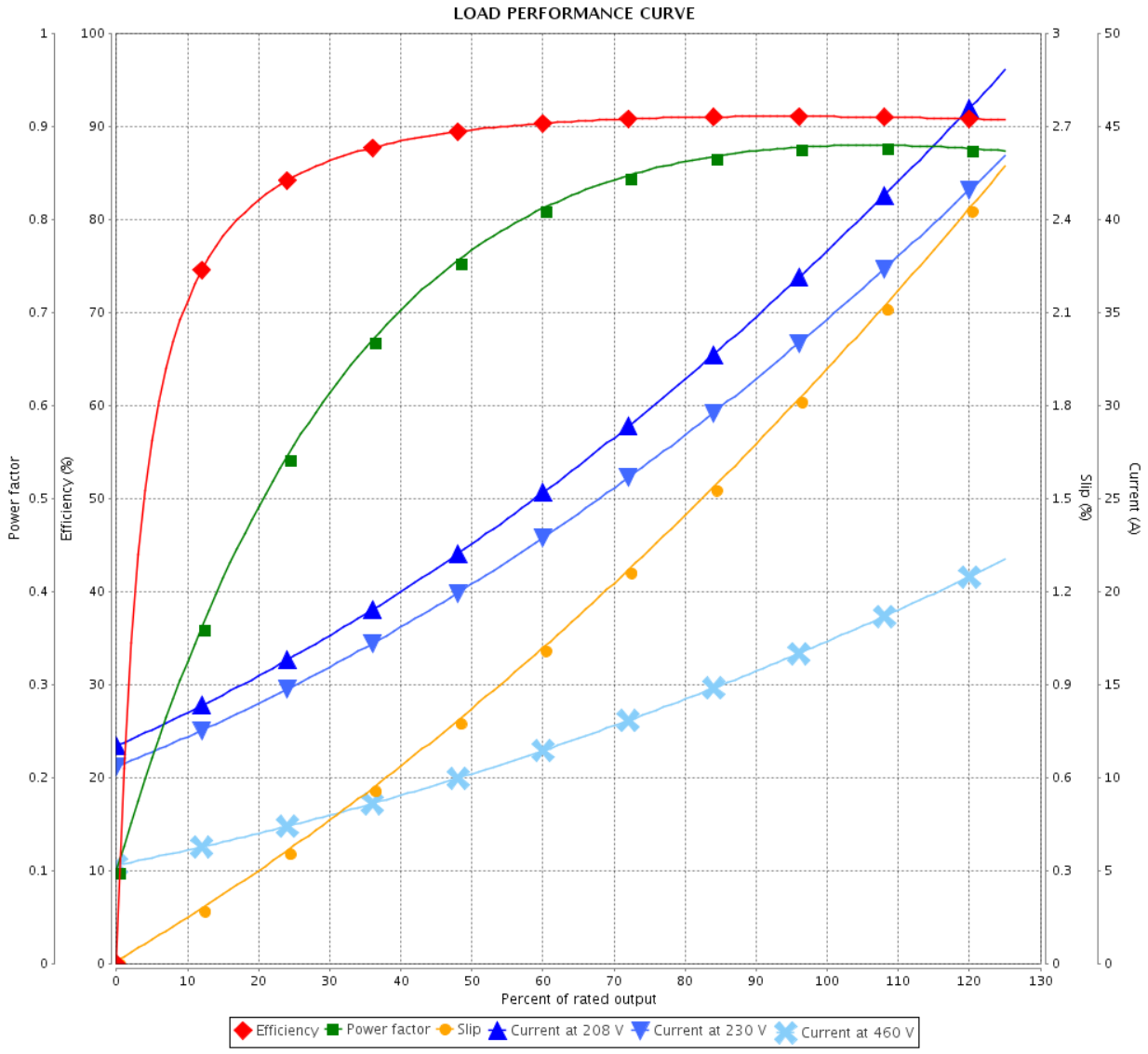
Performed by				
Checked by			Page	Revision
Date	11/01/2022		2 / 6	35 | Page 1/12/2022

LOAD PERFORMANCE CURVE

Three Phase Induction Motor - Squirrel Cage

Customer	:

Product line	: W22 NEMA Premium Efficiency Three-Phase	Product code :	11620543
		Catalog # :	01536ET3ER254TC-W22



Performance	: 230/460 V 60 Hz 2P

Rated current	: 34.4/17.2 A	Moment of inertia (J)	: 1.26 sq.ft.lb
LRC	: 6.7	Duty cycle	: Cont.(S1)
Rated torque	: 22.3 ft.lb	Insulation class	: F
Locked rotor torque	: 220 %	Service factor	: 1.25
Breakdown torque	: 270 %	Temperature rise	: 80 K
Rated speed	: 3530 rpm	Design	: B

Rev.	Changes Summary	Performed	Checked	Date

Performed by			
Checked by			Page 3 / 6 36 | Page Revision 1/12/2022
Date	11/01/2022		

THERMAL LIMIT CURVE

Three Phase Induction Motor - Squirrel Cage

Customer	:

Product line	: W22 NEMA Premium Efficiency Three-Phase	Product code :	11620543
		Catalog # :	01536ET3ER254TC-W22

Performance	: 230/460 V 60 Hz 2P

Rated current	: 34.4/17.2 A	Moment of inertia (J)	: 1.26 sq.ft.lb
LRC	: 6.7	Duty cycle	: Cont.(S1)
Rated torque	: 22.3 ft.lb	Insulation class	: F
Locked rotor torque	: 220 %	Service factor	: 1.25
Breakdown torque	: 270 %	Temperature rise	: 80 K
Rated speed	: 3530 rpm	Design	: B

Heating constant	
Cooling constant	

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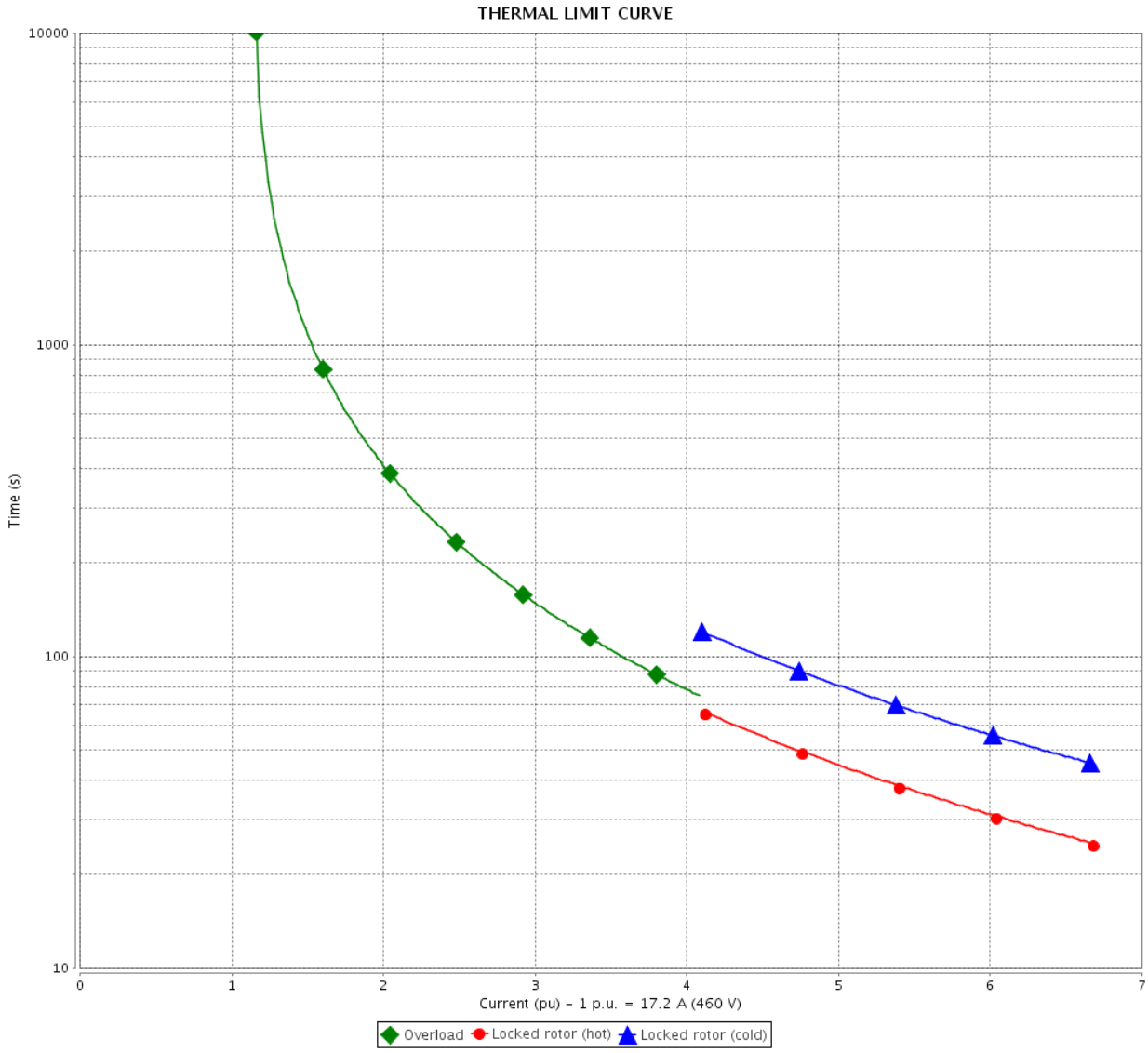
Performed by				
Checked by			Page	Revision
Date	11/01/2022		4 / 6	

THERMAL LIMIT CURVE

Three Phase Induction Motor - Squirrel Cage

Customer :



Rev.	Changes Summary	Performed	Checked	Date

Performed by			
Checked by			Page Revision
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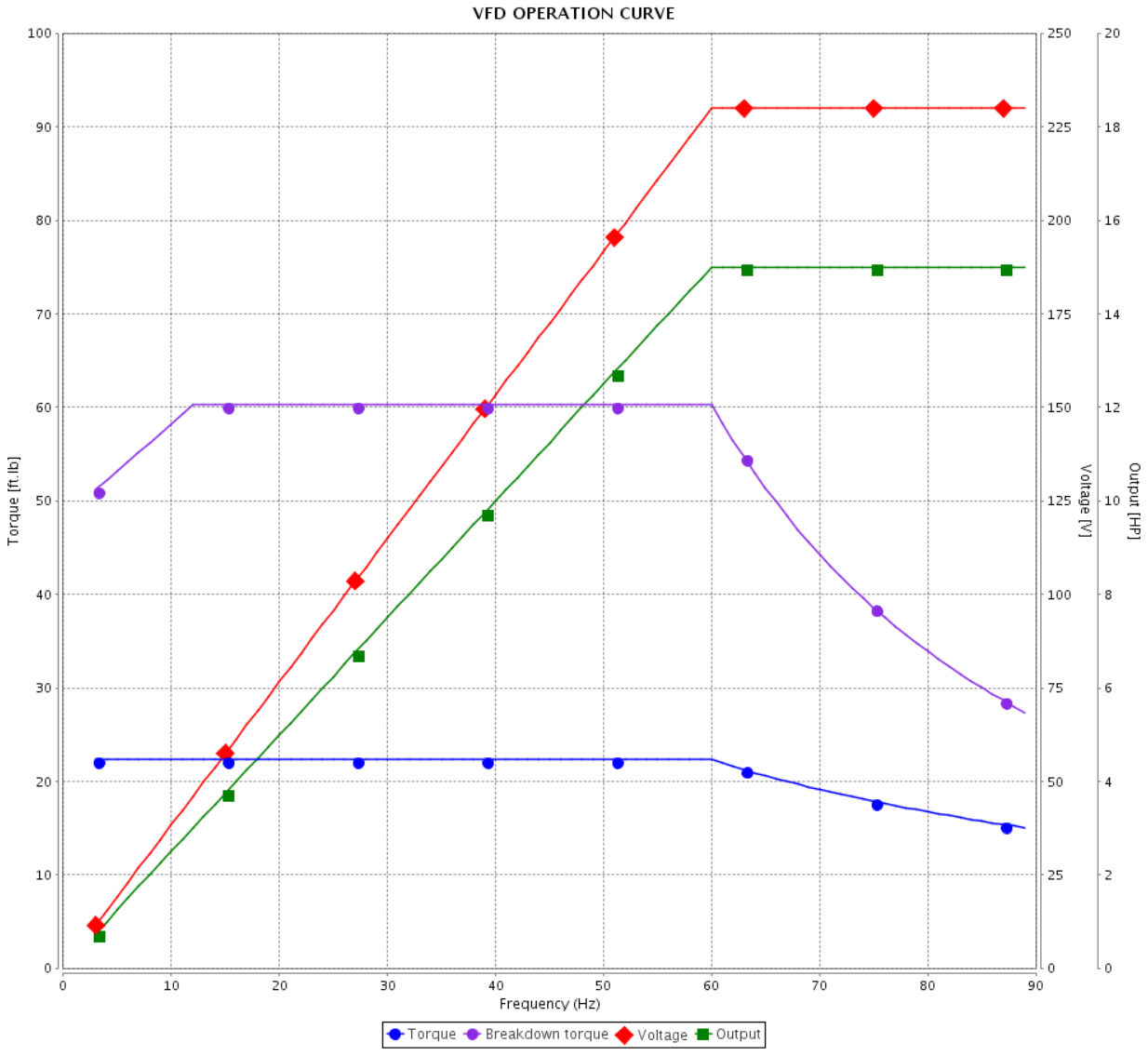
VFD OPERATION CURVE

Three Phase Induction Motor - Squirrel Cage

Customer	:		
Product line	: W22 NEMA Premium Efficiency Three-Phase	Product code :	11620543
		Catalog # :	01536ET3ER254TC-W22



Performance	: 230/460 V 60 Hz 2P		
Rated current	: 34.4/17.2 A	Moment of inertia (J)	: 1.26 sq.ft.lb
LRC	: 6.7	Duty cycle	: Cont.(S1)
Rated torque	: 22.3 ft.lb	Insulation class	: F
Locked rotor torque	: 220 %	Service factor	: 1.25
Breakdown torque	: 270 %	Temperature rise	: 80 K
Rated speed	: 3530 rpm	Design	: B

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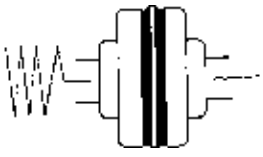
SO19712 TEST RESULTS TBD

D-FLEX ELASTOMERIC SLEEVE COUPLINGS

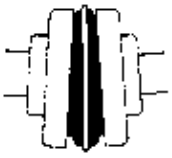
Flexibility and versatility accommodate shock-load, vibration, and misalignment. An economical solution for a wide variety of coupling applications.

The DODGE D-FLEX™ coupling features molded, non-lubricated, interchangeable elastomeric sleeves of EPDM, Neoprene, or Hytrel. Its four-way flexing action accommodates axial, angular, and parallel misalignment, as well as torsional wind-up. Plus, D-FLEX has a torque capacity up to 72,480 in-lbs. and horsepower range up to 2,000 HP at 1800 RPM.



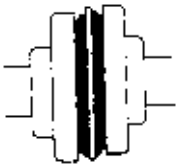
TORSIONAL

Torsionally flexible to accommodate shock, wind-up, and vibration



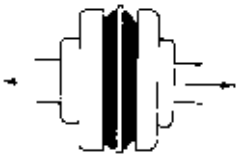
ANGULAR

Absorbs angular misalignment



PARALLEL

Minimizes radial bearing loads, absorbs parallel misalignment with less wear & energy loss



AXIAL

Allows for shaft end-float

D-FLEX Coupling Specifications

- Sizes: 3 to 16
- Bore Range: .375” to 6”
- O.D. Range: 2.06” to 18.88”
- Misalignment Capability*:
  0.125° to 1° angular
  0.01” to 0.062” parallel
  0.03” to 0.125” axial

*Depending on size and design

BALDOR®

Economical Type J-Flanges Offered in Four Sizes

- Bored-to-size, die-cast flanges
- Accommodate applications through 10 HP at 1750 RPM
- Available with EPDM or Neoprene sleeves
- Shaft attachment with two setscrews; one over the keyway and one at 65° for better shaft grip

Type S Couplings Feature Off-The-Shelf AGMA 9 Balanced Flanges

- High-strength, cast-iron flanges bored-to-size for clearance fit and balanced to AGMA 9 Standards
- Available as a reborable option
- Available with EPDM, Neoprene, or Hytrel sleeves
- Shaft attachment with two setscrews; one over the keyway and one at 65° for better shaft grip

Type B Couplings Offered With Standard QD Bushing

- Constructed from high-strength cast iron
- Available for use with EPDM or Neoprene sleeves
- Utilize QD bushings for shaft attachment

Type SC Spacer Couplings Satisfy Standard Spacing Requirements For Pump Applications

- Accommodate a wide range of shaft spacing
- Flanges dynamically balanced to AGMA Class 9 Standards
- Drop-out center for easy equipment maintenance
- Available with EPDM, Neoprene, or Hytrel sleeves
- H and HS shaft hubs bored-to-size for a slip fit or with a plain bore for reboring
- Shaft attachment with two setscrews; one over the keyway and one at 65° for better shaft grip
- Flattened design of the shaft hubs helps hold the shaft stationary while loosening or tightening Grade 8 bolts

D-FLEX RATINGS

Element Size	Max. Bore				Max RPM	EPDM & Neoprene		Hytrel	
	Straight Bore			Bushed		HP/100	Rated Torque (in-lbs)	HP/100	Rated Torque (in-lbs)
	STD Type J	STD Type S	Spacer Type SC	Type B					
3	7/8	–	–	–	9200	0.10	60	–	–
4	1	–	–	–	7600	0.19	120	–	–
5	1-1/8	1-1/4	1-1/8	–	7600	0.38	240	–	–
6	1-3/8	1-7/8	1-3/8	1-3/16	6000	0.71	450	2.90	1,800
7	–	1-7/8	1-5/8	1-3/16	5250	1.20	725	4.60	2,875
8	–	2-3/8	1-7/8	1-5/8	4500	1.80	1,135	7.20	4,530
9	–	2-7/8	2-1/8	1-15/16	3750	2.80	1,800	11.40	7,200
10	–	3-3/8	2-3/8	2-1/2	3600	4.60	2,875	18.00	11,350
11	–	3-7/8	2-7/8	2-13/16	3600	7.20	4,530	28.60	18,000
12	–	3-15/16	2-7/8	3-1/2	2800	11.40	7,200	50.00	31,500
13	–	4-1/2	3-3/8	3-15/16	2400	18.00	11,350	75.00	47,268
14	–	5	3-7/8	3-15/16	2200	28.60	18,000	115.00	72,480
16	–	6	–	4-1/2	1500	75.00	47,250	–	–

D-FLEX COUPLING SLEEVES

	EPDM RUBBER	NEOPRENE	HYTREL (1)
One-Piece Solid Construction	JE	JN	H
One-Piece Split Construction	JES	JNS	–
Two-Piece Construction	E	N	HS
Sizes Offered	3 - 10 JE, JES	3 - 10 JN, JNS	6 - 12 H, HS
	4 - 16 E	4 - 14 N	
Temperature Range	-30°F to +275°F	0°F to +200°F	-65°F to +250°F
Max Angular	1°	1°	1/4°
Max Parallel (2)	.010" -.062"	.010" - .062"	.010" -.035"
Axial End-Float (2) (3)	.03" -.125"	.03" -.125"	.06" -.125"
Torsional Flexibility	15° Wind Up	15° Wind Up	7° Wind Up
Application Use	General	Good Oil Resistance	Downsizing For Use Of Smaller Couplings

(1) Do not use with J or B flanges or as a replacement for other sleeves
(2) Depends on coupling size
(3) Increase the E dimension by this amount to accommodate end float

D-FLEX FLANGE / SLEEVE COMPATIBILITY

Flange Style	EPDM		Neoprene		Hytrel	
	JE/JES	E	JN/JNS	N	H	HS
	1 Piece	2 Piece	1 Piece	2 Piece	1 Piece	2 Piece
Type J	✓	✓	✓	✓		
Type S	✓	✓	✓	✓	✓	✓
Type B Bushed	✓	✓	✓	✓		
SC Spacer	✓	✓	✓	✓	✓	✓

BALDOR

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Baldor - Dodge
6040 Ponders Court, Greenville, SC 29615-4617 U.S.A., Ph: (1) 864.297.4800, Fax: (1) 864.281.2433
www.baldor.com

TNEMEC

PRODUCT DATA SHEET

HI-BUILD EPOXOLINE® II SERIES N69

PRODUCT PROFILE

GENERIC DESCRIPTION Polyamidoamine Epoxy

COMMON USAGE An advanced generation epoxy for protection and finishing of steel and concrete. It has excellent resistance to abrasion and is suitable for immersion as well as chemical contact exposure. Contact your local Tnemec representative for a list of chemicals. This product can also be used for lining storage tanks that contain demineralized, deionized or distilled water.

COLORS Refer to Tnemec Color Guide. **Note:** Epoxies chalk with extended exposure to sunlight. Lack of ventilation, incomplete mixing, miscatalyzation or the use of heaters that emit carbon dioxide and carbon monoxide during application and initial stages of curing may cause yellowing to occur.

FINISH Satin

COATING SYSTEM

SURFACER/FILLER/PATCHER Series 215, 217, 218

PRIMERS **Steel:** Self-priming or Series 1, 27, 27WB, 37H, 66, L69, L69F, N69F, V69F, 90E-92, 90-97, H90-97, 90G-1K97, 90-98, 91-H_2O, 94-H_2O, 135, 161, 394, V530
Galvanized Steel and Non-Ferrous Metal: Self-priming or Series 66, L69, L69F, N69F, V69F, 161
Concrete: Self-priming or Series 27WB, 130, 1254
CMU: Self-priming or 130, 1254

TOPCOATS Series 22, 27WB, 46H-413, 66, L69, L69F, N69, N69F, V69, V69F, 72, 73, 104, 113, 114, 118, 141, 156, 157, 161, 180, 181, 262, 265, 287, 446, 740, 750, 1026, 1028, 1029, 1070, 1070V, 1071, 1071V, 1072, 1072V, 1074, 1074U, 1075, 1075U, 1077, 1078, 1078V, 1080, 1081, 1094, 1095, 1096, 1224. **Note:** The following recoat times apply for Series N69: Immersion Service—Surface must be scarified after 60 days. Atmospheric Service—After 60 days, scarification or an epoxy tie-coat is required. When topcoating with Series 740 or 750, recoat time for N69 is 21 days for atmospheric service. Contact your Tnemec representative for specific recommendations.

SURFACE PREPARATION

STEEL **Immersion Service:** SSPC-SP10/NACE 2 Near-White Blast Cleaning or ISO Sa 2 1/2 Very Thorough Blast Cleaning with a minimum angular anchor profile of 1.5 mils.
Non-Immersion Service: SSPC-SP6/NACE 3 Commercial Blast Cleaning or ISO Sa 2 Thorough Blast Cleaning with a minimum angular anchor profile of 1.5 mils. **Note:** Commercial Blast Cleaning generally produces the best coating performance for this exposure. If conditions will not permit this, in moderate exposures Series N69 may be applied to SSPC-SP2 or SP3 Hand or Power Tool Cleaned surfaces (SSPC Rust Grade Condition C).

GALVANIZED STEEL & NON-FERROUS METAL Surface preparation recommendations will vary depending on substrate and exposure conditions. Contact your Tnemec representative or Tnemec Technical Services.

CAST/DUCTILE IRON All external surfaces of ductile iron pipe and fittings shall be delivered to the application facility without asphalt or any other protective lining on the exterior surface. All oils, small deposits of asphalt paint, grease, and soluble deposits should be removed and uniformly abrasive blasted using angular abrasive in accordance with NAPF 500-03-04: External Pipe Surface condition. When viewed without magnification, the exterior surfaces shall be free of all visible dirt, dust, loose annealing oxide, rust, mold coating and other foreign matter. Any area where rust reappears before application shall be reblasted. The surface shall contain a minimum angular anchor profile of 1.5 mils (38.1 microns) (Reference NACE RP0287 or ASTM D 4417, Method C).

CONCRETE Allow new cast-in-place concrete to cure a minimum of 28 days at 75°F (24°C). Verify concrete dryness in accordance with ASTM F 1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride" (moisture vapor transmission should not exceed three pounds per 1,000 square feet in a 24 hour period), F 2170 "Standard Test Method for Determining Relative Humidity in Concrete using in situ Probes" (relative humidity should not exceed 80%), or D 4263 "Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method" (no moisture present). Prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Abrasive blast, shot-blast, water jet or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide an ICRI-CSP 2-3 surface profile. Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer.

CMU Allow mortar to cure for 28 days. Level protrusions and mortar spatter.

PAINTED SURFACES **Non-Immersion Service:** Ask your Tnemec representative for specific recommendations.

PRIMED SURFACES **Immersion Service:** Scarify the Series N69 prime coat surface by abrasive-blasting with a fine abrasive before topcoating if: (a) the Series N69 prime coat has been in exterior exposure for 60 days or longer and Series 66, 46H-413, L69, L69F, N69, N69F, V69, V69F or 161 is the specified topcoat; (b) the Series N69 prime coat has been in exterior exposure for 14 days or longer and Series 104 is the specified topcoat; (c) the Series N69 prime coat has been in exterior exposure for 7 days or longer and Series 262 or 265 is the specified topcoat.

ALL SURFACES Must be clean, dry and free of oil, grease, chalk and other contaminants.

TECHNICAL DATA

VOLUME SOLIDS 67.0 ± 2.0% (mixed) †

RECOMMENDED DFT 2.0 to 10.0 mils (50 to 255 microns) per coat. **Note:** The number of coats and thickness requirements will vary with substrate, application method and exposure. Contact your Tnemec representative.

HI-BUILD EPOXOLINE® II | SERIES N69

CURING TIME AT 5 MILS DFT

Without 44-700 Accelerator

Temperature	To Handle	To Recoat	Immersion
90°F (32°C)	5 hours	7 hours	7 days
80°F (27°C)	7 hours	9 hours	7 days
70°F (21°C)	9 hours	12 hours	7 days
60°F (16°C)	16 hours	22 hours	9 to 12 days
50°F (10°C)	24 hours	32 hours	12 to 14 days

Curing time varies with surface temperature, air movement, humidity and film thickness. **Note:** For faster curing and low-temperature applications, add No. 44-700 Epoxy Accelerator; see separate product data sheet for cure information.

VOLATILE ORGANIC COMPOUNDS

Unthinned: 2.40 lbs/gallon (285 grams/litre)
Thinned 10% (No. 4 Thinner): 2.80 lbs/gallon (334 grams/litre)
Thinned 10% (No. 60 Thinner): 2.80 lbs/gallon (335 grams/litre)

HAPS

Unthinned: 2.40 lbs/gal solids
Thinned 10% (No. 4 Thinner): 3.25 lbs/gal solids
Thinned 10% (No. 60 Thinner): 2.40 lbs/gal solids

THEORETICAL COVERAGE

1,074 mil sq ft/gal (26.4 m²/L at 25 microns). See APPLICATION for coverage rates. †

NUMBER OF COMPONENTS

Two: Part A (amine) and Part B (epoxy) — One (Part A) to one (Part B) by volume.

PACKAGING

	Part A	Part B	Yield (mixed)
Large Kit	5 gallon pail	5 gallon pail	10 gallons (37.9 L)
Small Kit	1 gallon can	1 gallon can	2 gallons (7.6 L)

NET WEIGHT PER GALLON

13.67 ± 0.25 lbs (6.10 ± .11 kg) (mixed) †

STORAGE TEMPERATURE

Minimum 20°F (-7°C) Maximum 110°F (43°C)

TEMPERATURE RESISTANCE

(Dry) Continuous 250°F (121°C) Intermittent 275°F (135°C)

SHELF LIFE

Part A: 24 months; Part B: 12 months at recommended storage temperature.

FLASH POINT - SETA

Part A: 82°F (28°C) Part B: 93°F (34°C)

HEALTH & SAFETY

Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product.
Keep out of the reach of children.

APPLICATION

COVERAGE RATES

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m²/Gal)
Suggested (1)	6.0 (150)	9.0 (230)	179 (16.6)
Minimum	2.0 (50)	3.0 (75)	537 (49.9)
Maximum	10.0 (250)	15.0 (375)	107 (10.0)

Dense Concrete & Masonry: From 100 to 150 sq ft (9.3 to 13.9 m²) per gallon.
CMU: From 75 to 100 sq ft (7.0 to 9.3 m²) per gallon.
(1) Note for Steel: Roller or brush application requires two or more coats to obtain recommended film thickness. Also, Series N69 can be spray applied to an optional high-build film thickness range of 8.0 to 10.0 dry mils (205 to 255 dry microns) or 11.5 to 14.5 wet mils (209 to 370 wet microns). Allow for overspray and surface irregularities. Film thickness is rounded to the nearest 0.5 mil or 5 microns. Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance. †

MIXING

Start with equal amounts of Series N69 Parts A and B. Power mix contents of each container separately, making sure no pigment remains on the bottom. Pour a measured amount of Part B into a clean container large enough to hold both components. If Series 44-700 is not being used, proceed with mixing and add an equal volume of Part A to Part B while under agitation. Continue agitation until the two components are thoroughly mixed. **Note:** Both components must be above 50°F (10°C) prior to mixing. For optimum mixing and application properties, the material should be above 60°F (16°C).

If using Series N69 accelerator, slowly add four (4) fluid ounces of 44-700 per gallon to Series N69 Part A material while under agitation and proceed with adding Part B. **Note:** The use of more than the recommended amount of 44-700 will adversely affect performance.

Thin by volume and thoroughly mix. Failure to thoroughly mix the Part A and Part B components prior to thinning can affect product's gloss and performance. Do not use mixed material beyond pot life limits. **Note:** For application of the unaccelerated version to surfaces between 50°F to 60°F (10°C to 16°C) or the accelerated version to surfaces between 35°F to 50°F (2°C to 10°C), allow mixed material to stand 30 minutes and restir before using.

THINNING

Use No. 4 or No. 60 Thinner. For air spray, thin up to 10% or 3/4 pint (380 mL) per gallon. For airless spray, roller or brush, thin up to 5% or 1/4 pint (190 mL) per gallon.

POT LIFE

Without 44-700: 6 hours at 50°F (10°C) 4 hours at 75°F (24°C) 1 hour at 100°F (38°C)
With 44-700: 2 hours at 50°F (10°C) 1 hour at 75°F (24°C) 30 minutes at 100°F (38°C)

SPRAY LIFE

Without 44-700: 1 hour at 75°F (24°C) With 44-700: 30 minutes at 75°F (24°C)
Note: Spray application after listed times will adversely affect ability to achieve recommended dry film thickness.

APPLICATION EQUIPMENT

Air Spray ‡

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss JGA	E	765 or 704	5/16" or 3/8" (7.9 or 9.5 mm)	3/8" or 1/2" (9.5 or 12.7 mm)	50-80 psi (3.4-5.5 bar)	10-20 psi (0.7-1.4 bar)

Low temperatures or longer hoses require higher pot pressure.

Airless Spray ‡

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.015"-0.019" (380-485 microns)	3000-4800 psi (207-330 bar)	1/4" or 3/8" (6.4 or 9.5 mm)	60 mesh (250 microns)

Use appropriate tip/atomizing pressure for equipment, applicator technique and weather conditions.
‡ Spray application of first coat on CMU should be followed by backrolling. **Note:** Application over inorganic zinc-rich primers: Apply a wet mist coat and allow tiny bubbles to form. When bubbles disappear in 1 to 2 minutes, apply a full wet coat at specified mil thickness.
Roller: Use 3/8" or 1/2" (9.5 mm or 12.7 mm) synthetic woven nap roller cover. Use longer nap to obtain penetration on rough or porous surfaces.
Brush: Recommended for small areas only. Use high quality natural or synthetic bristle brushes.

SURFACE TEMPERATURE

Minimum 50°F (10°C) Maximum 135°F (57°C) The surface should be dry and at least 5°F (3°C) above the dew point. Coating will not cure below minimum surface temperature.

CLEANUP

Flush and clean all equipment immediately after use with the recommended thinner or MEK.
† Values may vary with color.

TABLE OF CONTENTS

Part 0

Part I

0. GENERAL DIRECTIONS

0.1 GENERAL SAFETY DIRECTIONS

0.1.1 SAFETY AND WARNING DIRECTIONS

The following symbols and names will be used in this manual as safety and warning directions:

WARNING TO A PLACE OF DANGER!
If the handling instructions, with this symbol, are not strictly adhered to then serious injuries or even fatal accidents could occur.

Warning symbols must be **strictly observed**.

ATTENTION!
If the handling instructions, with this symbol, are not strictly adhered to then serious damage to the machine and/or other equipment could occur.

Directions marked with "Attention" must be **strictly observed**.

DIRECTION!
Work will be more effective if these instructions are followed. Directions make the work easier.

EXPLOSION PROOF DIRECTIONS IN RELATION TO THE PRODUCT

WARNING TO EXPLOSIVE ATMOSPHERE

WARNING TO DANGEROUS ELECTRICAL VOLTAGE

ISOLATE BEFORE STARTING TO WORK

LEGAL DIRECTIONS

1.0 PUMP CODE EXPLANATION

The pump-code is a combination of joined-together in series construction groups. The **"plus sign"** is the separation between these groups, and the **"dash"** is the separation between general and specific description of each construction group.

PUMP CODE

CONSTRUCTION GROUPS

	Group 1		Group 2		Group 3
EXAMPLES:	F10K-HD1R	+	FE4S4-MNGK	+	N3B4-10
	D04Q-L010E	+	DNXT2-MXEQ	+	X2B1-15
	F10D-L01	+	FE3Z7-CNEK	+	N2E1-10
			A2QR2-CC3	+	A01-10
	F150-S03R	+	FFM1O-XM.Q		
	H06F-M01	+	H2S10-L		
	E05K-M01	+	EDM1F-MM.K		
	Hydraulic		Hidrostal-Motor or Bearing Frame		Cable Set

1.1 DELIVERY

§ **HIDROSTAL** will not assume responsibility for damage to the pump that has been caused due to not following instructions in this manual, nor for consequential damages of any kind.

1.1.1 RECEPTION OF PUMP UNIT

Inspect the shipment for shortages or damage. Report any discrepancies to the carrier, note them on the shipping documents and sign them with date together with the carrier.

1.1.2 NAMEPLATE DATA

Each pump is equipped with a nameplate showing all technical data of the pump. It is essential to give the complete data when enquiring about parts or service.

An explanation of the meaning of this code can be found under Section 1.0 “Pump Code Explanation”.

1.1.3 STORAGE

If the unit is not to be installed immediately, note:

- Store in a dry and clean place without extreme changes in temperature (storage room temperature -10° to +40°C (14° to 104°F).
- Rotate the shaft by turning the impeller once every two weeks to ensure positive coating on the lubricated surfaces and to prevent sticking of surfaces due to rust or oxidation.
- Do not store in a location where the pump would be subject to vibrations, otherwise brinelling of the bearings could occur.

1.2 INSTALLATION

The pump should be placed as near to the liquid source as possible, and as low as possible, to provide the maximum possible suction head, avoiding elbows and excessive pipe lengths wherever possible.

Provide adequate ventilation of pump room.

WARNING:
If the pump can be exposed to temperatures at or below the freezing point of the media, the pump should be drained when not in use (formation of ice within the pump can cause cracking and other damage to the construction.

1.2.1 MOUNTING

- General:
  The pump can be mounted in a horizontal or vertical position.

- Fastenings:
  When mounted horizontally pumps should be mounted using the feet provided on the volute or use a bracket attached to the rear of the volute.

  When mounted vertically the pump can be stood using a special suction elbow on its suction flange or using a bracket bolted to the volute casing.

1.3 PIPING

The suction and discharge piping should be independently supported near the pump and be installed in such a manner so as not to impose stresses and strains on the pump casing.

1.3.1 SUCTION PIPING

To obtain maximum available suction head, the suction line should be as direct and as short as possible, avoiding elbows. If elbows must be used, a long radius type is preferred. It is important to avoid any sagging in a suction line in which air may accumulate and cause loss of prime. For the same reason, it is important to have the suction line airtight when suction lift exists.

The suction pipe must be such that no air pockets can form, and must slope upward to the pump intake.

1.3.2 SIZING OF SUCTION PIPEWORK

The losses of the suction side should be kept to a minimum, the pipework should never be less than the suction diameter of the pump and preferably be one pipe size larger. When larger diameter pipework is required the transition should be made close to the pump using flat-topped tapers (Fig. 1 + 3). Concentric tapers should never be used, as air pockets could result (Fig. 2 + 4).

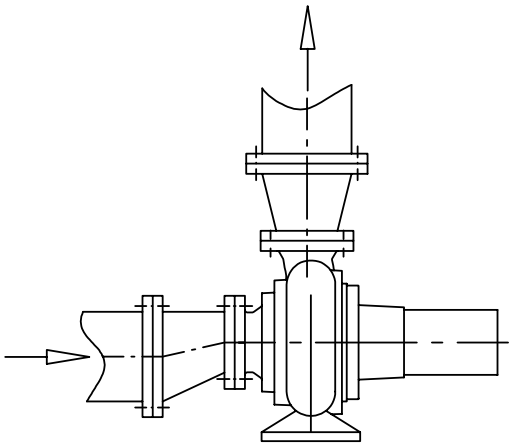

Fig. 1

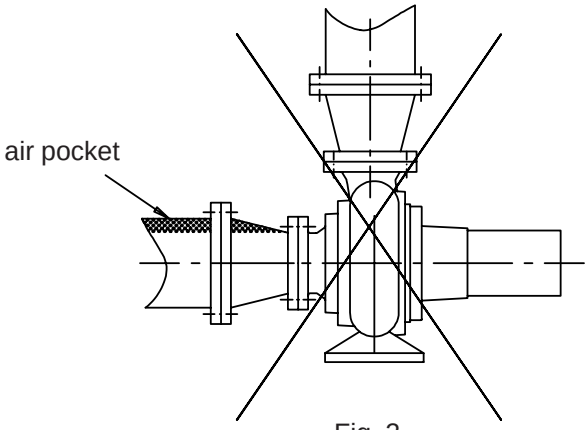

Fig. 2

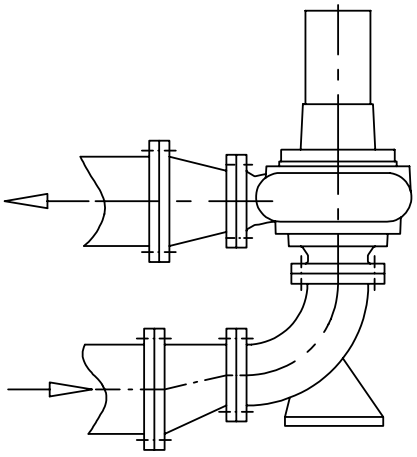

Fig. 3

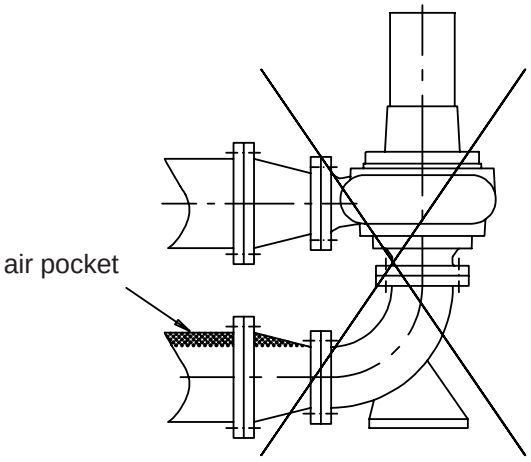

Fig. 4

Unusual suction conditions such as high liquid temperature, altitude above sea level and high specific gravity or viscous liquids should be compensated for, by proper engineering of a sufficiently sized suction pipe.

WARNING:
The pump should not operate on a suction lift when pumping liquids with entrained air or gas. Non-return valves should not be used in the suction line. Gate valves should preferably be installed with the spindle horizontal to prevent trapping air or gas. Suction valves must be fully open during operation.

1.3.3 DISCHARGE PIPING

Use as few fittings as possible and when elevating to any height, go vertically upward from the pump, **then** horizontal to the point of discharge.

When using non return valves in the discharge line it is important the maximum permitted velocity specified by the manufacturer is not exceeded. For single-flap valves operating on dirty liquids a typical maximum velocity is 3.5 m/second.

If these values are exceeded shock waves can result when the valve closes, which may cause the face of mechanical seals to open and allow material to become trapped between the faces resulting in premature seal failure and contamination/loss of the seal oil.

WARNING:
Does the pump work with closed or blocked up suction or discharge piping, there is a danger of over-heating in the volute casing. It is possible to dry out the medium occluding gas bubbles. They could cause damages on person or machine if they will be eliminated inexpert.

1.3.4 CONNECTION OF PIPING

This should only be undertaken after the grout (if used) has thorough set and holding down bolts have been tightened.

The pipework should be connected to the pump flanges with gaskets in place and the bolts properly tightened. Make sure the pipe flanges are parallel and in line.

WARNING:
For all pumps in cast iron, great care must be used in connecting these flanges. Tighten evenly and adjust to a snug fit. Under no circumstances should the casing be subjected to piping strains. Such strains could result in structural failure leading to operator injury.

1.4 SPECIAL APPLICATIONS

If the pump is used for production or further processing of **food**, please check the following points:

- Observe the relevant guidelines.
- Replace the coolant and sealing liquids mentionned in the manuals by a media, allowable with the requested characteristics for food.
  (e.g. vegetable oil)
- Pay attention to extremely cleanness.
  (Evacuating and cleaning of pump and systems)
- After cleaning pay attention to the correct mounting of pump and systems.

1.5 USE IN POTENTIALLY EXPLOSIVE ATMOSPHERE

Pumps with Ex-proof are to be installed for handling non-combustible liquids.

Explosion proof class: CE Ex **II 2G EEx d IIB T4** **resp.** CE Ex **II 2G EEx d [ib] IIB T4**

(for Hidrostal pumps with electrical motor)

or CE Ex **II2G C T4** (for Hidrostal pumps with bearing frame)

1.6 OPERATING INTERRUPTION

If the machine is not in operation for more than 14 days, the pump must be drained completely. This is to avoid seizure of the pump due to corrosion.

The machine must be turned every 14 days (by hand or by a switching pulse) to lubricate the mechanical seal faces.

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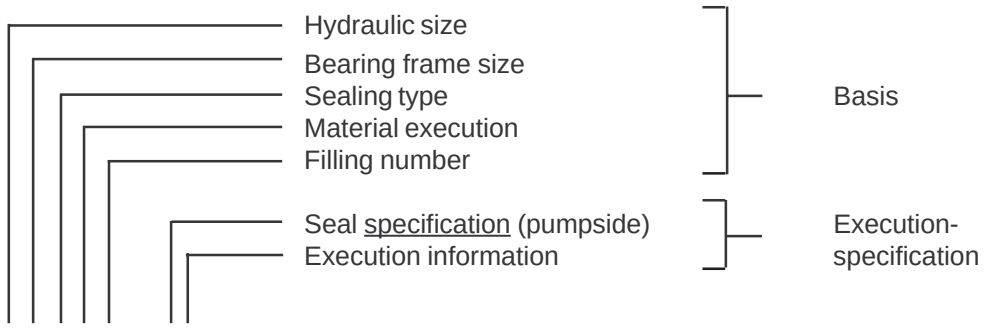
Part II

2.0 TYPE CODE EXPLANATION



S	=	Special construction/execution
0	=	Without mech. seal (Pos. 515) / without packing (seal / packing specified by customer)
C G M X		Pump side mechanical seal specification (for bearing frame with mechanical seal, details see page 3)
L	=	Packing standard (only for bearing frame with stuffing box)
0	=	Filling number
F	=	Fish pump
1	=	Normal, for hydraulic material 1, 2 and 3
5	=	Wetted parts stainless steel, for hydr. mat. 5
S	=	Bearing frame with stuffing box
M	=	Bearing frame with mechanical seal
0	=	smalest size
2	=	larger than 0
4	=	larger than 2
7	=	larger than 4

See type code explanation Hydraulic code

Pump side mechanical seal Pos. 515 type

C = Fitted with Carbon-ceramic seal faces. Recommended for handling water, activated sludge and non-abrasive liquids.
G = Silicon carbide seal faces, rubber bellows with external spring.
M = Tungsten carbide - silicon carbide seal faces, rubber bellows with internal spring. For sludges, slurries and abrasive liquids.
X = Tungsten carbide - silicon carbide seal faces, stainless steel shell for higher pump pressures and/ or higher motor speeds.

2.1 FLUSHING WATER CONNECTION

Pumps are supplied with a flushing water connection (service connection "F", Fig. 1).
For normal sewage application this connection is not used. However, in special cases when pumping high concentrations of sludge or mud, it should be connected. It will conduct cleaning water between impeller and lower mechanical seal (515), providing periodic removal of accumulated solids.

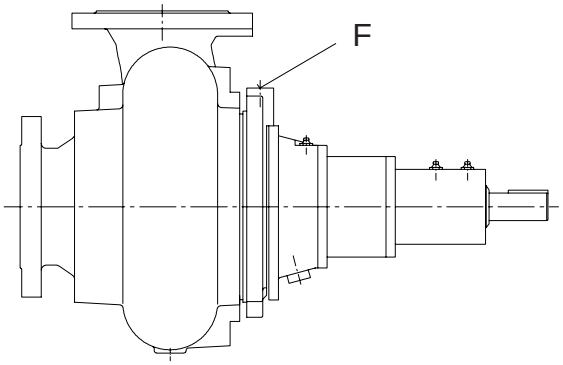


Fig. 1

Flushing water must be pressure-regulated between 0,5 to 1 bar (7 to 14 psi) above pump discharge pressure. Water is controlled by a solenoid valve on a time clock. Adequate duration of each flushing is 60 seconds; frequently of flushing must be established for each different installation.

The quantity of flushing water varies according to pumpsize and application: in most cases, flow rates of 6-8 litres per minute will be sufficient.

2.2 DIRECTION OF ROTATION

Before start up the pump, power connections must be made as indicated in section 2.4. Check that the direction of rotation is correct by giving the unit a starting impulse for one second and noting impeller rotation.

Rotation must be counter-clockwise viewed from suction end, and clockwise viewed from driving side.

WARNING:
If rotation is not correct on multi-speed or multi-pump installations, **only change the cable leads of the pump or speed with wrong rotation at its starter in the control panel. DO NOT** change the primary power leads coming into the control panel: This would change the rotation of all pumps or speeds.

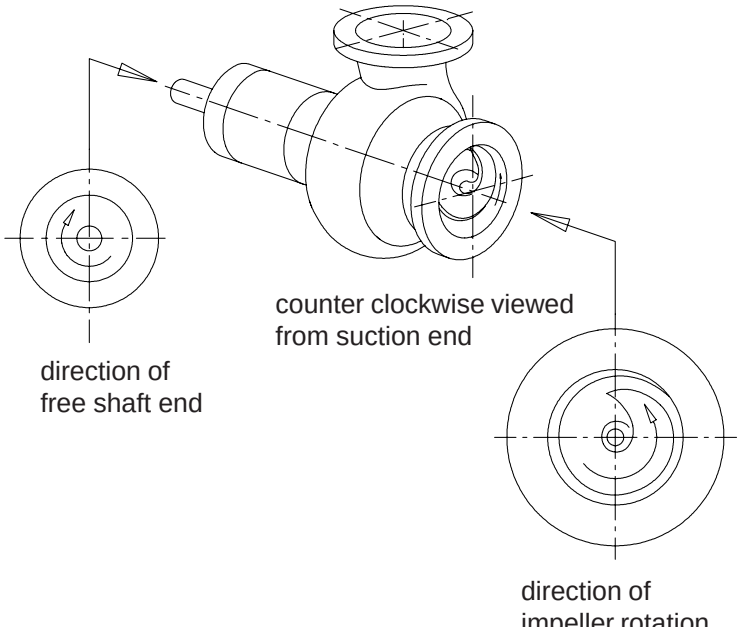


Fig. 2

2.3 LEVEL CONTROL SYSTEM

Prior to any work on the pump, the power supply must be disconnected either by means of a locked isolator or by removing the fuses from the panel. It is not safe enough to switch off the control switch. A wiring mistake or a control system malfuction could put the motor back into operation.

2.3.1 LEVEL SWITCHES

- For the on and off levels, use control systems that are appropriate for the pumped liquid.
- Use a floating-ball type switch for the high-level alarm, even when there is another type used for the pump control (this has proven to be the most fail-safe type).
- The floating ball for the alarm should be placed at a reasonable distance above the highest pump start level to avoid false alarms.

2.3.2 LEVEL CONTROL

"ON" and "OFF" levels must be set in such a way as to provide sufficient sump capacity between "ON" and "OFF" so that the pump cannot be switched on more than 10 times per hour. Higher starting frequency may damage the motor control devices in the panel and will cause excessive power consumption. The following formula will calculate the required minimum sump capacity:

$$V = \frac{0.9 \times Qp}{Z}$$

V = sump capacity or volume, between on and off levels (in cubic meters)
Qp = pump flow for one pump, in litres/second
Z = number of starts per hour (Z = 10, maximum)

2.4 START - UP

Prior to starting, check that:
- Electrical connections of the motor are according to name plate
- Level controls are correctly set
- Off-level is sufficiently high to prevent air entrance to the pump suction
- Suction and discharge gate valves are completely open
- Flood pump sump

STARTING OF PUMP

Never start pump **against closed valves** (except non-return valves).

Start the pump using manual operation. **Measure the amperage** drawn on each phase leg. Record and **verify** these **readings** with the **nameplate ratings**. If amperage is more than 5 % higher, stop unit and check probable causes according to "Operating Troubles" chart, Section 2.5.

Once preliminary checks are complete, place the pump into automatic operation. Cycle the system through several wetwell pumpdowns to observe that level controls are properly set and functioning correctly. **Observe** that the **alarm system** and change over switch (if included in control panel) **are working properly.**

Log date and hours meter reading, and set pump for automatic operation. Perform maintenance according to Section 2.6.

GENERAL OPERATING CONDITIONS

The pump should not be allowed to operate continuous-duty outside of performance curve: high discharge pressures with low flow or low discharge pressure with high flow. Bearing life is shortened and abrasive wear is accelerated in these operating conditions.

2.5 OPERATING TROUBLES

POSSIBLE REASONS / TROUBLE		No flow	Flow not sufficient	Head not sufficient	Reduction of flow or head after start up	Vibrations	Motor overloaded	Noise	Bearing temperature > 90° C
1.	Pump not fully filled with water, not vented	X							
2.	RPM too low	X		X					
3.	RPM too high					X	X	X	
4.	Air entrance into suction line	X	X		X	X		X	
5.	Discharge line clogged / valve closed	X				X	X		
6.	Air or gas in pumped liquid	X	X	X	X	X		X	
7.	TDH too high (higher than calculated)	X	X			X			
8.	Suction head too high				X	X		X	
9.	Insufficient suction head on hot liquids		X			X		X	
10.	Insufficient submergence of suction	X	X	X	X	X		X	
11.	Sludge concentration higher than assumed		X	X			X		
12.	Specific weight of medium higher than assumed						X		
13.	Impeller or suction line clogged	X	X			X			
14.	Wrong direction of rotation	X	X	X					
15.	Impeller clearance too high		X	X					
16.	Damaged impeller		X	X		X			
17.	Motor damage					X	X	X	
18.	Unsuitable lubrication								X
19.	Attachments loose					X		X	
20.	Pump and motor not aligned					X	X	X	
21.	Bearings worn out					X			X
22.	Impeller out of balance					X			
23.	Impeller too small			X					
24.	Impeller dragging against suction cover					X	X	X	
25.	Thick sludge and tight impeller clearance						X		
26.	Air or gas on impeller backside	X			X				

2.6 MAINTENANCE AND SERVICE

2.6.1 GENERAL

Before doing any work on the pump unit, switch off main isolator switch and remove fuses from panel.

The following checks can be done in the field. When a repair is indicated, send the pump unit to the nearest authorized Hidrostal service station.

2.6.2 VISUAL CHECKS OF PUMP UNIT

- Check pump and motor for possible mechanical damage.
- If pump volume or pressure are not acceptable, check impeller clearance (see manual for hydraulic).
- Check overload relay, fuses and time relays (if any) for correct setting.
- Check correct function of level control.
- Check alignment of coupling according Section 2.9.

2.6.3 SERVICE CONNECTIONS

The service connections that are built into all pumps as standard are listed below. Please refer to sectional drawings and Fig. 3.

552 Seal Flushing Connection "F"
Alternatively or even in addition to the function described in section 2.1, this connection may be used to manually bleed the air from the casing prior to start-up, if there is no other place for air to escape through the discharge piping. In most cases the connection 552 will be closed and flushing water mixes with product pumped. In cases where the solids accumulate, could form lumps or be fibrous, flushing out via 552 would be the preferred solution. Connection 552 also permits complete draining of horizontal units if required.

536a Connection "OIL IN"
Opening to refill seal oil.

536b/536c Connection "OIL OUT"
Opening to remove seal oil.

DIRECTION:
SEE SECTION DESCRIBING "OIL CHECKING" (2.6.4) AND "OIL CHANGE" (2.6.5) FOR DETAILED INFORMATION.

131a/131b/131c Greasing point (G1,G2,G3)
Greasing instructions see Section 2.7.

134 Plug G.O.
Possibility to remove old, excessive grease.

163 Plug
Closed, if no greasing necessary.

Connection D:
At this connection (only for bearing frames I1M / I4M / L1M / L4M) any leakage through the inboard mechanical seal (516) will be noted. Thus preventing contamination of bearing grease and premature failure of bearing.

This drain must be left open. As soon as excessive leakage (more than 0,1 l per year) via "D" is noted in the collecting basin the pump should be removed for inspection.

On horizontal units: Connection "D" must always be at the bottom of the bearing frame. The factory build pumps with drain "D" on the opposite side to pump discharge flange, as most horizontally mounted pumps have the discharge flange vertically. If it is in any other position the bearing frame must be unbolted from the hydraulic end and re-positioned so drain is vertically down.
On vertical units the drain can be in any position relative to the discharge nozzle.

When installed in dry environment, the drain can be left open. In a situation where water could spray onto the bearing frame, i.e. when washing down, an elbow can be fitted to prevent ingress of water.

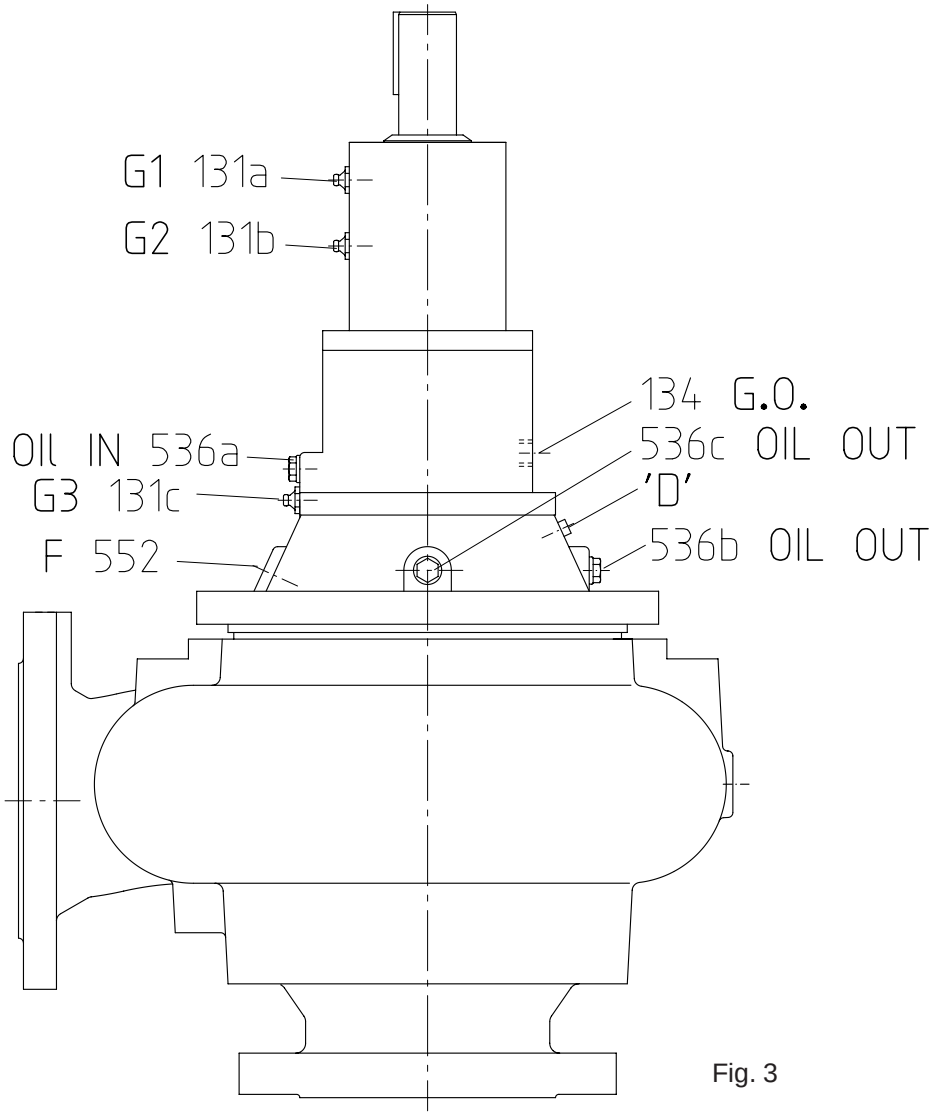


Fig. 3

2.6.4 SEAL-OIL CHECKING ON BEARING FRAME PUMPS

This is a direct indication of the condition of the pump side mechanical seal (515).

An oil condition check must be made after the first 1,000 hours of operation and once a year thereafter.

Immediately before checking the oil, run the pump for a few minutes to distribute any impurities through the oil.

ATTENTION: Before proceeding with the oilcheck, carefully clean the area around the screw plugs 536a, 536b and 536c (if existing).

OIL CONDITION	ACTION	EXECUTION
Clean	Top up to correct level if necessary *	PUMP IN-SITU
Milky	Drain completely, separate oil from water, top up to correct level * CHECK AGAIN AFTER 500 HOURS	PUMP IN-SITU
Slightly dirty	Small amount of water in oil, drain completely, flush out and top up to correct level * CHECK AGAIN AFTER 500 HOURS	PUMP IN-SITU
Very dirty	Large amount of water and dirt in oil, replace pump side mechanical seal (515)	IN AUTHORISED WORKSHOP

* SEE SECTION OIL CHANGE 2.6.5.

DIRECTION: When re-installing screw plugs 536a and 536b always use a new copper sealing washer. It will be softened as follows:

Heat until red and quench immediately in cold water.

SEAL OIL QUANTITIES

To refill oil the following oil quantities can be used as a guide:

Type	Oil quantity
D0M.0 / D2M.0 E2M.0	4 litres
F2M.0 / F4M.0	5,2 litres
H2M.0 / H4M.0	14 litres
I1M.0 / I4M.0	22 litres
L1M.0 / L4M.0	34 litres

2.6.5 OIL CHANGE

2.6.5.1 FOR HORIZONTAL AND VERTICAL MOUNTED PUMPS

For horizontally installed pumps the oil can be drained through opening 536b or 536c.

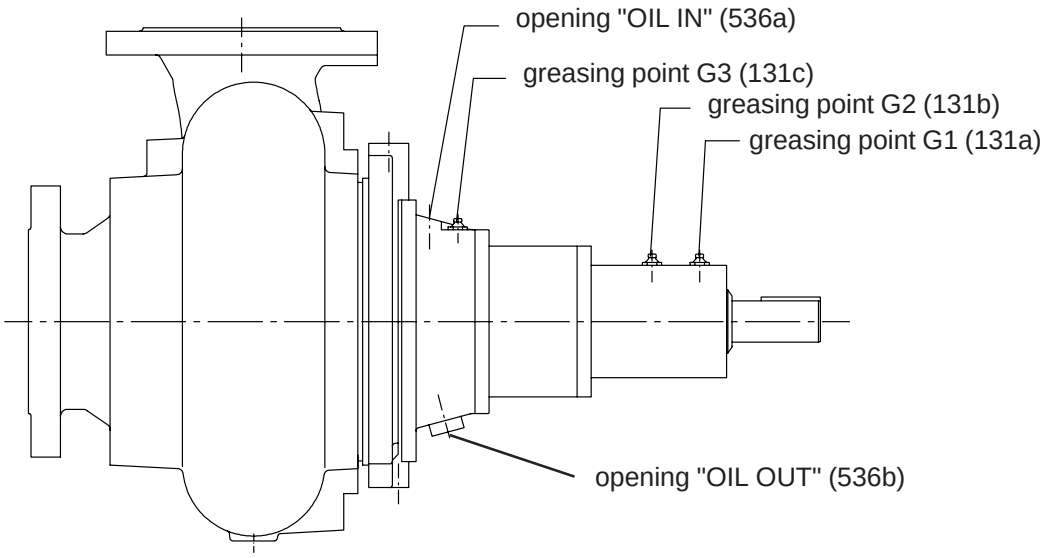


Fig. 4

If there is no opening 536c or for vertical pumps, the remaining oil could be removed by either using a rubber tube as a syphon or by employing some form of suction device. This best undertaken after removing screw plug 536a.

Having removed all the old oil, flush with a little clean oil and refill with clean oil up to the level of opening 536b.

ATTENTION:
To refill the oil use opening 536a. Correct level is at the bottom of opening 536a. At this level the chamber is approximately 90% full and leaves the required air space.

Re-install screw plugs 536 using a new softened copper seal ring. Continue to monitor seal oil condition by visual inspection.

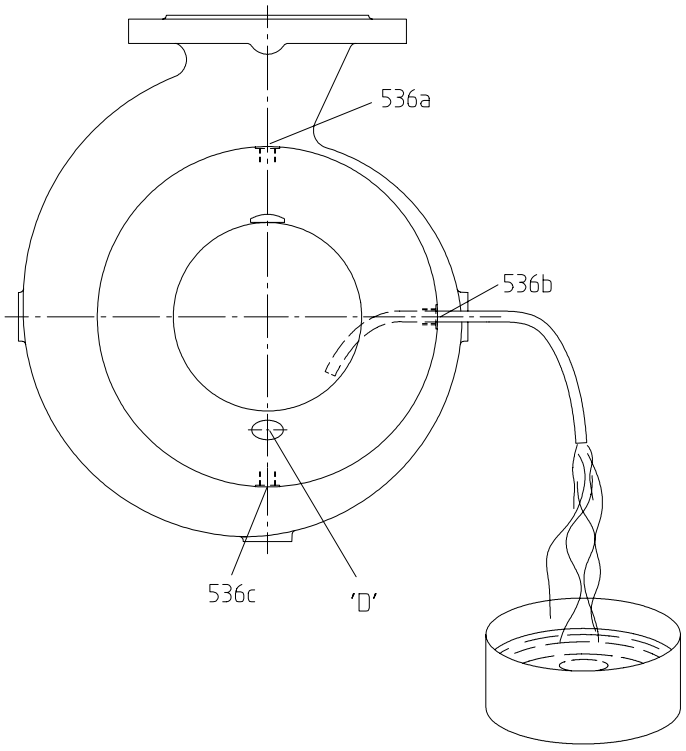


Fig. 5

SEAL OIL SPECIFICATIONS

General

The factory fill the seal oil chamber on bearing frame pumps with low viscosity oil.

TYPICAL ANALYSIS

Specific gravity at 20°C	0.812	g/ml
Viscosity at 40°C	3.5	mm^2/s (cst)
Solidification point	-38.0	°C
Flash point	132.0	°C
Burning Point	142.0	°C
Evaporation energy	251.0	kJ/kg
Solubility in water	none	

For installations which are exposed to temperatures below freezing point (e.g. outdoor installations), the solidification point is very important.

IMPORTANT FEATURES FOR APPLICATION OF SEAL OIL IN PUMPS

If another oil or even another liquid will be used, the following features must be considered:

- Check the consistency with the used elastomers
- The viscosity may not be higher than indicated by ISO VG.
- Emulsification with water is not acceptable, as water penetration could not be detected.
- Corrosion resistance and non-aging quality are required.
- Following temperatures must be considered:
  - Solidification point and lowest surrounding temperature
  - Boiling point and highest temperature of pumped liquid.
- If bearing frame is equipped with moisture probe, it is important that the liquid has good electric insulation qualities.

2.7 GREASING INSTRUCTIONS

Hidrostal use bearings which are grease lubricated. For regreasing see bearing lubrication chart (Section 2.7.1).

For regreasing we recommend:

STABURAGS NBU 8 EP by Kluber-Lubrication.

This grease is of a mineral oil base containing a barium complex as thickener.

Typical characteristics:

Colour	beige	
Apparent dynamic visco. (approx.)	6000	mPas
Operating temperature range	-30..150	° C
Max. temperature (short time)	170	° C
Consistency class (NLGI)	2	
Penetration DIN ISO 2137 (0.1 mm)	280	
Dropping point DIN ISO 2176	> 220	° C
Corrosion protection DIN 51802	0	
RPM-parameter (n x d m)	5×10^5	

For greasing of bearings use greasing point 131.

2.7.1 BEARING LUBRICATION CHART

CONNECTION 131

The following bearing frames require periodic greasing according to table below:

BEARING FRAME	RPM MAX HOURS	LUBRICATION INTERVAL	AMOUNT OF GREASE (GRMS) G1 *	G2 *	G3 *
D0M.0	1500 1800	- -	- -	- -	- -
D2M.0	3000	500	3	3	3
E2M.0	1500 1800	500	2 2	2 2	3 2
F2M.0	1500 1800	500	2 5	2 5	3 4
H2M.0	1200 1500	500	1 2	1 2	3 4
H4M.0	1500 1800	500	4 7	4 7	4 6
I1M.0	1000	500	2	2	3
I4M.0	1200	500	3	3	10
L1M.0	650	500	1	1	2
L4M.0	900	500	2	2	5

* for horizontal installation: use G2 and G3
for vertical installation: use G3 and G1

2.8 REPLACEMENT OF MECHANICAL SEAL

2.8.1 REMOVAL OF PUMP SIDE MECHANICAL SEAL (515)

a) Exposed-spring seal - type "C"
(Fig. 6)

Remove snap ring (546, Seeger), then remove spring. Make sure that the shaft is free of burrs and has no sharp edges so that the rubber parts of the seal cannot be damaged as they are removed. Oil the shaft for ease of disassembly. Now the seal rotating parts can be pulled off the shaft by hand.

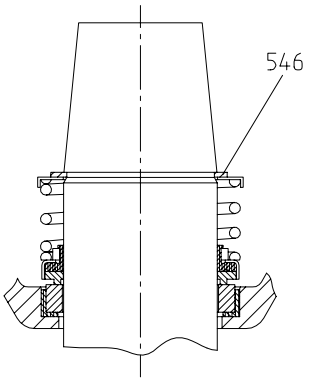


Fig. 6

b) Rubber-bellows seal, internal spring - type "M"
(Fig. 7)

Remove retaining ring "A" from the rubber bellows of the seal by gently prying with two screwdrivers on opposite sides, between the rubber bellows and the retaining ring (Fig. 8).

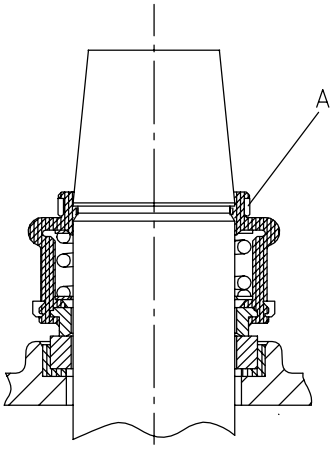


Fig. 7

WARNING:
Use only dull-edged screwdrivers since sharp edges could cut the rubber bellows. Do not twist screwdriver, as this can puncture rubber bellows.

Rather, lay some convenient object onto back cover or sealing plate, to act as a fulcrum for each screwdriver, and pry ring directly up away from rubber bellows (Fig. 8).

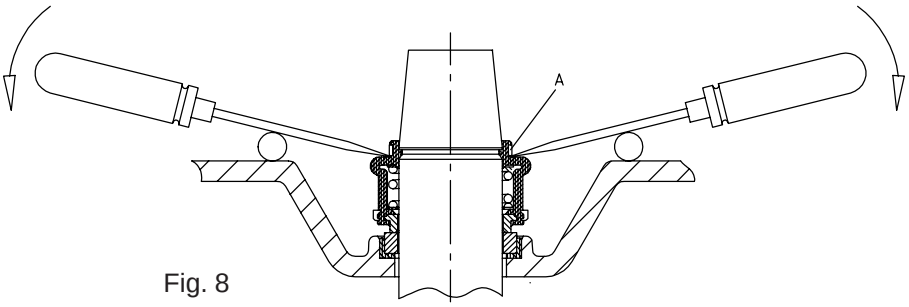


Fig. 8

Make sure that the shaft is free of burrs and has no sharp edges so that the rubber parts of the seal cannot be damaged as they are removed. Oil shaft and bellows for ease of disassembly. Gently insert a screwdriver between the shaft and the rubber bellows. By lifting and turning the screwdriver around the shaft, the lip of the rubber bellows can be lifted out of the shaft groove. Once the bellows is free of the groove, the entire rotating part of the seal with bellows can be pulled off the shaft. If necessary, use two screwdrivers deep into the seal to pry the seal face loose (Fig. 9).

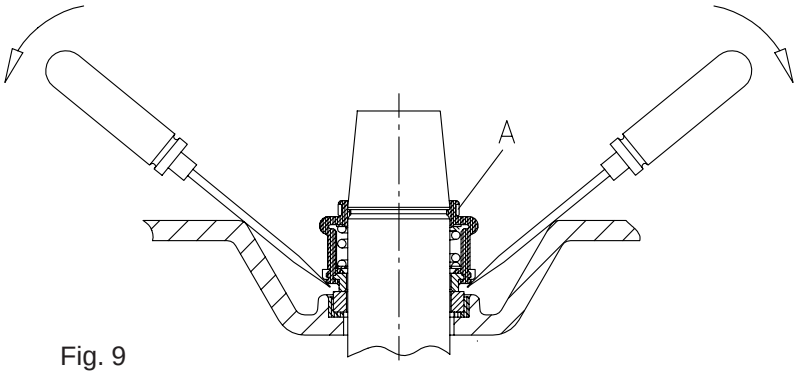


Fig. 9

c) Rubber-bellows seal, external spring - type "G" (Fig. 10)

Remove snap ring (546), if existing. Pull out the removable part (A) by hand.

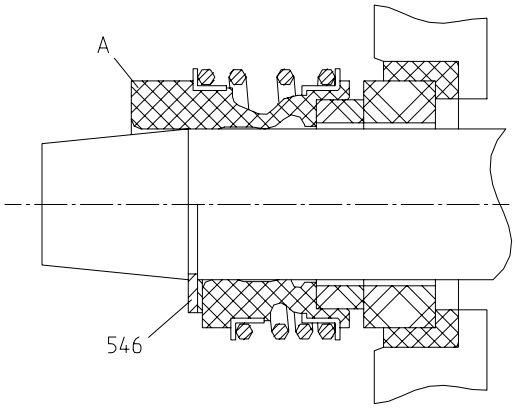


Fig. 10

d) Stainless-steel-shroud seal - type "X" (Fig. 11)

Remove all three small setscrews from outer body of rotating part. Remove snapring (546). Oil the shaft for ease of disassembly. Now the seal rotating part can be pulled off the shaft by hand.

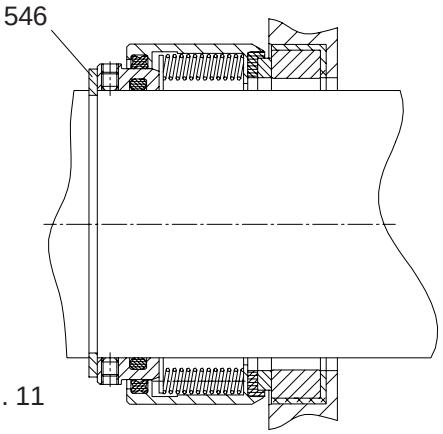


Fig. 11

e) Stationary seat (all types) (Fig. 12)

Remove static part of the mechanical seal as follows:

Unfasten nuts (534) and carefully remove back cover (507) from bearing support. Make sure that the static part of the seal (515) does not hit the shaft so that it can't be damaged.

Now the static part of the seal can be carefully pushed out of the chamber from the back side.

Some HIDROSTAL seals can be repolished or repaired (Consult nearest service center). When sending a seal for inspection or repair, it is important to thoroughly protect the seal faces to prevent damage during transportation.

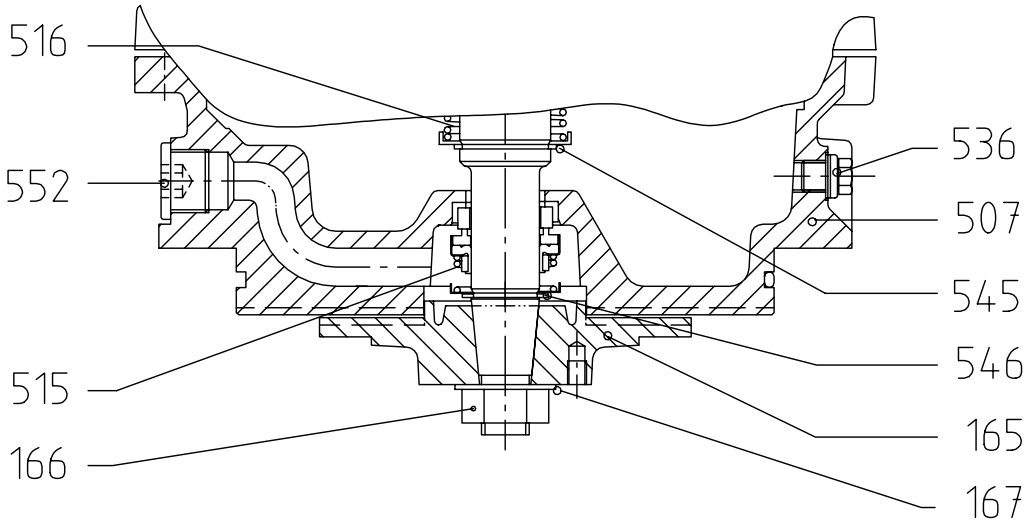


Fig. 12

2.8.2 MAINTENANCE OF MOTOR SIDE MECHANICAL SEAL (516)

If increased leakage via connection "D" is noted (see Section 2.6.3), eventually the mechanical seal (516) has to be replaced.

2.8.3 ASSEMBLY OF BACK COVER

Cleanliness is of utmost importance for this assembly work! All parts must be washed in solvent before assembly. All machined mating surfaces must be clean and free from burrs. All grooves and seatings for "O"-rings and other static seals must be inspected for nicks or scratches. All threads must be clean especially those in holes for studs. **All "O"-rings MUST be replaced with new ones and they should be lubricated with light oil prior to assembly.**

ATTENTION:
Never use "O"-rings glued from "O"-ring stock. Our experience is that this glue joint will inevitably leak.

Place a new "O"-ring (527) on the bearing support (101). Carefully assemble back cover (507) to the bearing support and fasten with fastening set (534).

2.8.4 ASSEMBLY OF PUMP SIDE MECHANICAL SEAL

a) Stationary seat (all types)

Lubricate the rubber circumference of the static mechanical seal part and carefully press all the way into its seat in the back cover (507). The ring must fit tightly in place. Protect the seal face during this operation. Examine gap between shaft and inner diameter of seal face; when face is correctly installed, gap will be uniform all the way around.

ATTENTION:
The seal face is very brittle, and can easily snap unless pressure is uniform during installation. We suggest pushing in with special tool (Fig. 13).

Make sure that the shaft is free of burrs and has no sharp edges, so that the rubber part or the mechanical seal cannot be damaged. File groove edges if necessary.

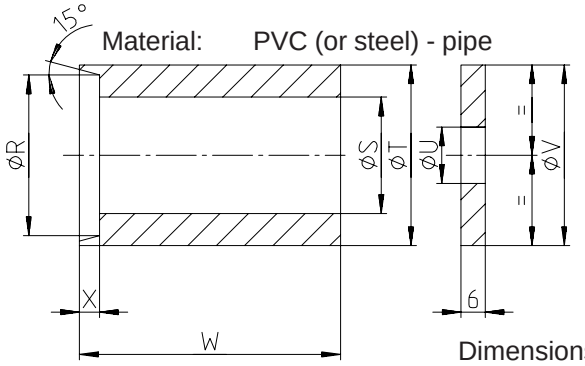


Fig. 13

Dimensions in mm

Seal size	ϕ R	ϕ S	ϕ T	ϕ U	ϕ V	W	X	Bolt size
1 1/8"	40 +/-1	29 +1/-0	45 +/-1	12	50	65	5	M10
1 1/2"	50 +/-1	39 +1/-0	55 +/-1	16	60	75	5	M12
2"	65 +/-1	51 +1/-0	70 +/-1	18	80	95	5	M16
3"	92 +/-1	77 +1/-0	100 +/-1	29	110	170	5	M27
100	110 +/-1	102 +1/-0	120 +/-1	38	130	350	5	M36

b) Exposed-spring seal - type "C"

Remove spring and spring retaining ring of mechanical seal. **Seal surfaces must be absolutely clean!** Place a few drops of light oil on the rotating (carbon) face of the mechanical seal, then lubricate inner bore of rubber part of the seal with oil and put a small amount of oil onto shaft. Install rotating face (with its rubber part) over shaft, and press gently down length of exposed shaft until carbon face touches stationary face. It may help to use a small wood "pusher" or a plastic pipe mandrel only slightly larger than shaft diameter, to push directly on the rubber part of the seal (Fig. 13). Be sure rubber part sits uniformly on shaft, and has *NOT* rolled out from under the metal part of the seal. Put on seal spring, and spring retaining ring.

Install snap ring (Seeger, 546) and turn shaft by hand to check for free running.

c) Rubber-bellows seal, internal spring - type "M"

Lubricate the rotating part of the mechanical seal, position the retaining ring "A" on the rubber bellows (Fig.14). Push the whole assembly by hand over the shaft as far as possible. Mount the special tool over the shaft tip (Fig. 15), and compress the mechanical seal until the lip of the rubber bellows is engaged in the shaft groove. Remove special tool. Turn the shaft by hand and watch that the retaining ring turns perfectly in line with the rubber bellows and that it is not cocked. Then try to pull the rubber bellows off shaft by hand to make sure that the lip has reliably engaged in the shaft groove.

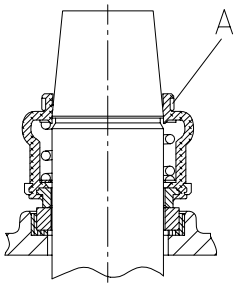


Fig. 14

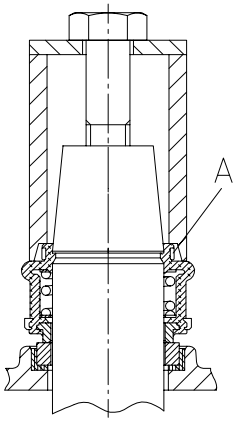


Fig. 15

d) Rubber-bellows seal, external spring - type "G" (Fig. 16)

Wet the rotating part of the mechanical seal with soapy water. Push the whole assembly by hand over the shaft as far as possible. Secure with snap ring (546).

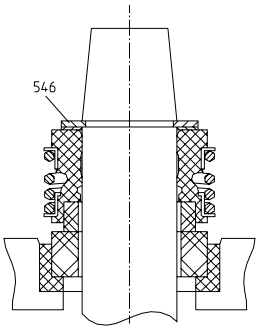


Fig. 16

e) Stainless-steel-shroud seal - type "X"

Lubricate inner rubber O-rings of seal and put a small amount of oil onto shaft. Install entire seal over shaft, and press gently down shaft until rotating face touches stationary face. Now install snapring over shaft, and push until it snaps into its groove. If necessary use the special tool (Fig. 13). Then re-install the three small setscrews into the seal rotating part, and tighten firmly.

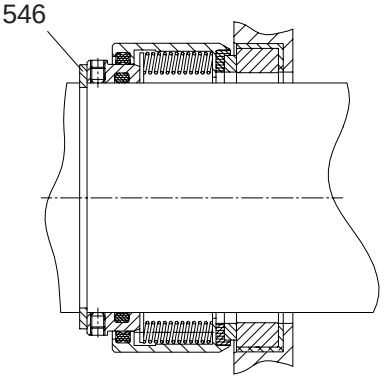


Fig. 17

2.8.5 LEAKAGE TEST FOR PUMP SIDE MECHANICAL SEAL (All Types)

Remove plug "OIL" (536) and drain the oil from the bearing frame. Connect dry compressed air source such as bicycle tyre pump to the opening. Use a pressure reducing valve and relief valve set to 0.5 bar (7 psi).

WARNING:

- Make sure that the pressure never exceeds 1 bar. This could displace the seal.
- **DO NOT IMMERSE THE MOTOR AND BEARING FRAME INTO WATER**. Only the back cover or seal plate up to connection "D" have to be checked under water for continuously escaping bubbles. This would indicate leakage passed the seal or associated "O"-ring.
- Correct failure if leakage has been found. After finishing test remove pressure connection hose and fill with oil according to Section 2.6.5.

2.9 ALIGNMENT AND MOUNTING OF THE PUMP ON BASE PLATE

The motor, if supplied, is correctly aligned on the baseplate at the factory. However, a certain amount of misalignment is possible during transit, and it is therefore necessary to check the alignment between the pump and the driver before putting the unit in operation. The pump shaft should be checked for angular and for parallel alignment (Fig. 18). Inaccurate alignment results in vibration and excessive wear on bearings and mechanical seals. The check for angular alignment must be made by inserting a taper gauge at four points 90° apart, between the coupling faces. The variance in readings must not exceed 0,3 mm. To check for parallel alignment, place a straight edge across the coupling rim at the top, bottom and sides. The unit will be in parallel alignment when a straight edge rests evenly on the coupling rim at all positions.

2.9.1 MOUNTING OF BASE PLATE

The permissible ground load has to be compared with the total weight of the pump. The concrete foundation must correspond to the guidelines of the strength of foundation and the resistance to pressure.
Foundation screws: ***HIDROSTAL AG*** recommends the use of chemical anchor screws which are secured with a 2-part Epoxy resin.

Align pump and base plate horizontally and check the correct position!

ATTENTION:
The base plate has to be supported on all 4 edges. If necessary, differences of dimension could be compensated by 2–part flow concrete epoxy resin (self leveling epoxy grout)!

Mark and drill the holes for the foundation screws. Place the foundation screws. Pay attention to the correct length of the threaded rod. Allow the required length of time for the epoxy to harden! Screw down the base plate.

ATTENTION:
Tighten the foundation screws with the prescribed torque according to specifications of producers! Check this torque during operation occasionally!

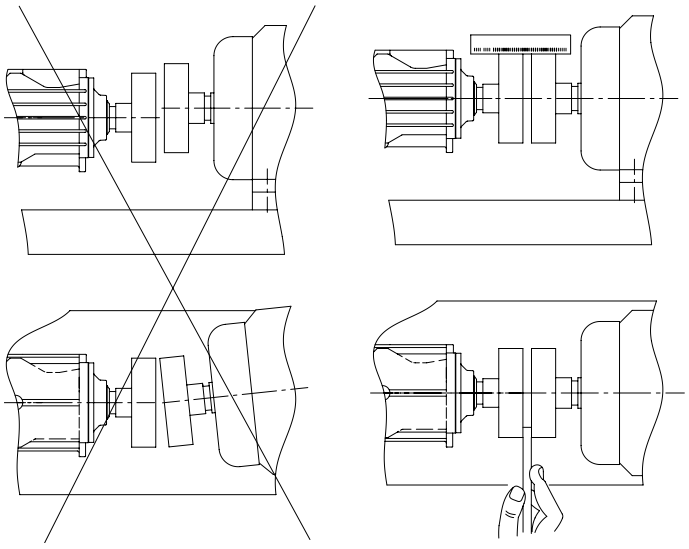


Fig. 18

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Part III

3.0 TYPE CODE EXPLANATION

The type code is found on the first line of the pump name plate.

Example:

E05K-M010D

hydraulic code

HYDRAULIC CODE:

D 0 4 K - L 0 3 0 E
E 0 5 K - M L 3 R S
F 1 0 K - L L 3 R

- hydraulic size (C,D,E,F,H,I,L)
- discharge flange size (in inches)
- impeller type (K)
- impeller size
- material:
  - 1 = standard pump: all castings of grey iron (GG20), except impeller of nodular iron (GGG60).
  - 2 = Advanced wear resistance: liner of Hi-chrome, other parts as 1.
  - 3 = for improved wear resistance: casing and suction casing same as 1, impeller of stainless steel, liner and wear-ring of Hi-chrome.
  - 4 = for improved wear and corrosion resistance: same as 3, except with Hi-chrome impeller.
  - 5 = corrosion resistance: all wetted parts of stainless steel.
- R = "regulable" construction: impeller clearance adjustable by three external screws (Absence of "R" in code implies impeller clearance is adjustable by shims).
- S = special execution
- D = bigger or smaller cone size than standard (first digit of code) D < E etc.
  C = 20, D = 28, E = 38, F = 50 etc.

3.1 SERVICE CONNECTIONS

On Volute

These comprise of a gauge connection (424) on the discharge flange (see table).

When the pump is mounted horizontally with the discharge flange vertical, and drain plug (423) is provided at the lowest part of the volute casing.

When the pump is mounted horizontally with the discharge flange horizonal, additional drain plugs are possible on position "D".

Pos Type	423	424	D mm
C0CK	-	-	-
C03K	R 1/2"	R 1/4"	-
D0DK	-	-	-
D03K/D04K	R 1/2"	R 1/4"	35
E05K/E08K	R 1/2"	R 1/2"	50
F04K/F06K	R 1/2"	R 1/2"	50
F10K	R 1/2"	R 1/2"	35
H05K/H08K	R 1/2"	R 1/2"	35
H12K	R 1"	R 1/2"	60
I06K/I10K	R 1"	R 1/2"	60
I16K	R 1"	R 1/2"	60
L12K/L20K	R 1"	R 1/2"	60

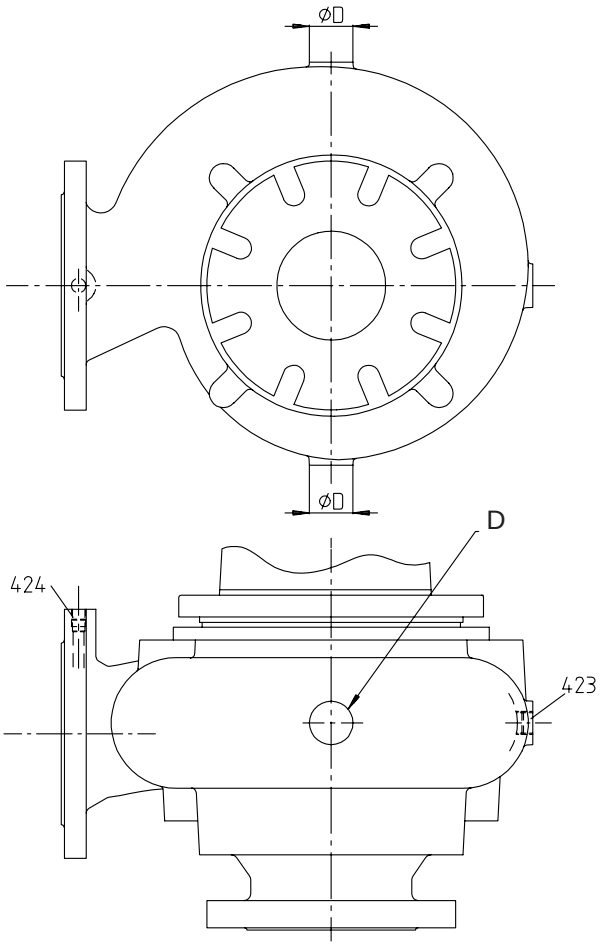


Fig. 1

3.2 IMPELLER CLEARANCE ADJUSTMENT FOR WEAR

- The impeller gap should be checked and readjusted whenever a significant decrease in pump performance is noticed, or at least once every year (until experience indicates how often this will be required).
- Excessive clearance can cause a drop in performance.
- Less clearance than the minimum listed can overload the motor and/or cause vibration due to a too great friction.
- When pumping thick sludges or high consistency material, it may be necessary to double the clearances in Figure 3.
- Regulable pumps are adjusted by means of a movable liner (421); its position is regulated by three external regulator nuts (422) found on the suction casing (416) or volute casing (400). These pumps include the letter "R" in the pump code (Section 3.0).
- Other pumps have a one-piece suction cover (402), or in pumps D03K and D04K, a fixed liner (421). These pumps are adjusted by changing the thickness of the shims (411) between the drive unit and the volute casing (400).

3.2.1 IMPELLER CLEARANCE ADJUSTMENT FOR "REGULABLE" PUMPS

Loosen and back off hex nuts (413) on end of each regulator nut (422). Now slowly and evenly screw in each large threaded regulator nut just until pump shaft cannot be turned (this will eliminate all clearance between the impeller and the liner). Be sure to take the same number of turns on each threaded regulator nut; this keeps the liner concentric to the impeller.

NOTE: If impeller tip is binding, see section 3.5.

Now back off the threaded regulator nut a bit. Holding each threaded regulator nut from turning, tighten the three hex nuts (413) (this pulls liner (421) away from impeller (401) the required clearance, and also locks the regulator nut in place).

With a feeler gauge, check the actual clearance between impeller and liner (reaching in through the suction of the pump). If the clearance "C" is significantly different to the table (Fig. 3), it is possible that the wear is excessive or not uniform: disassembly and inspection is recommended.

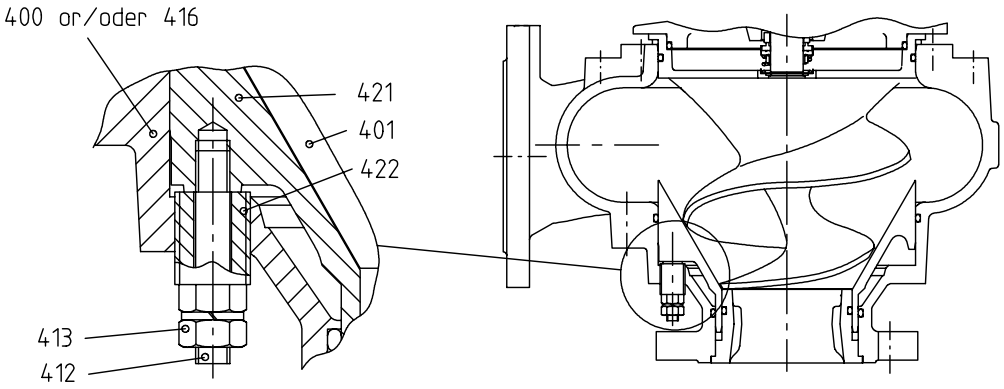


Fig. 2

3.2.2 IMPELLER CLEARANCE ADJUSTMENT FOR "NON-REGULABLE" PUMPS

For final assembly: Place the hydraulic (already built together) with the suction flange on a flat and hard underground. Lower the drive unit - impeller assembly into casing (400) by a suitable hoist.
For wear adjustment: Loosen all fasteners (419) between drive unit and volute casing. Remove shims.

General: To **estimate correct shim** (411) **thickness**, lower drive unit into casing just until impeller cannot be turned. Measure gap between drive unit and volute casing at several places and take average. Now add the distance "B" (Fig. 3) to the average gap measured; this will be approximate shim thickness required to obtain correct clearance "C" (Fig. 3).

NOTE: If impeller tip is binding, see section 3.5.

If necessary, loosen fasteners (419) again, lift drive unit as much as required to place shims of calculated thickness between drive unit and volute casing. Use washers of **uniform thickness**, or U-shaped shimstock. These must be placed under **each** fastener (419). Thin shims may be a single piece of steel wire (diameter = calculated thickness) wrapped all the way around drive unit, under the studs (419); ends can be bent outward around last studs (419), to avoid overlapping.

Tighten fasteners (419) again, and with a feeler gauge, check the actual clearance between impeller and liner (reaching in through the suction of the pump). If the clearance "C" is significantly different to the table (Fig. 3), it is possible that the wear is excessive or not uniform: disassembly and inspection is recommended.

If this adjustment procedure does not restore original pump performance, examine wear on impeller or suction cover/liner, and replace worn parts as necessary.

Pump size	Clearance	
	"C" mm	"B" mm
C	0.3	0.3 - 0.5
D	0.3	0.3 - 0.5
E	0.4	0.3 - 0.5
F	0.5	0.4 - 0.6
H	0.6	0.4 - 1.0
I	0.7	0.6 - 1.2
L	0.9	0.6 - 1.5
M	1.2	1.0 - 1.5

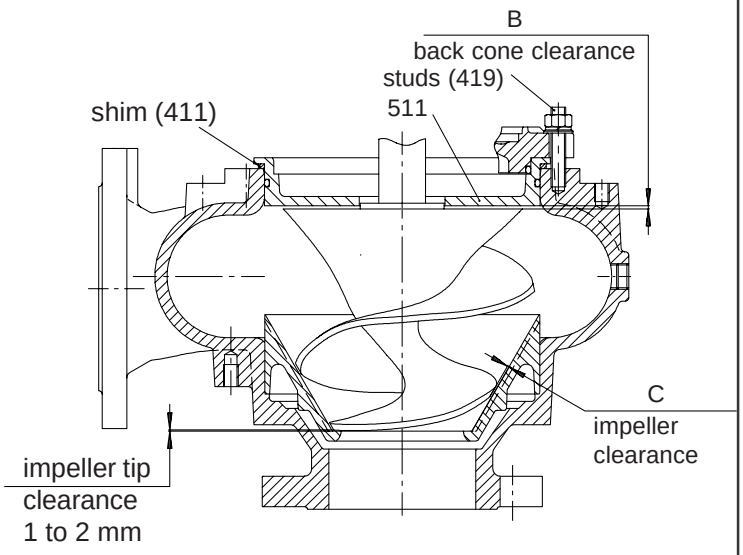


Fig. 3

NOTE:
Clearance "C" should be checked along entire impeller edge, and again after rotating impeller 1/4, 1/2 and 3/4 turns.

3.3 DISASSEMBLY OF HYDRAULIC PARTS

3.3.1 DISASSEMBLY FOR INSPECTION

Casing-suction cover assembly should be placed with the suction flange flat on the floor or workbench, and the drive unit-impeller assembly removed or lowered into place from above by a suitable hoist.

Remove nuts (419) around the flange. Lift the rotating assembly including impeller from the pump casing. Areas to be examined for wear will be the impeller surface (especially the edges) and the conical machined surface in the liner or suction cover. Uniform wear on any of these surfaces can be compensated by re-shimming or adjusting according to Section 3.2. However, excessive or uneven wear will require replacement of the worn parts.

3.3.2 REMOVAL OF IMPELLER

Hold the impeller (401) from turning by hand, or by a strap wrench, or by locking pliers clamped to the impeller. Inset a hexagonal key wrench into the impeller bolt (415) and with a hammer, tap the wrench counterclockwise to loosen the bolt.

FACTORY FITTED IMPELLER BOLTS		
SIZE	HEXAGON SW	TORQUE Nm
M8	6	17.5
M10	8	35.5
M12	10	61.5
M16	14	147.0
M27	19	380.0
M36	24	970.0

3.3.3 REMOVAL OF IMPELLER FLANGE (if existing)

If existing, disengage tabs on locking washer (167) and remove impeller nut (166) with coupling end of shaft secured from rotation. Remove impeller flange (165) by either levering with two screw drivers between impeller flange and back cover (507) or seal plate (511) or tapping with a rubber mallet at 90° intervals. Or, it may be required to use a gear puller. Remove Woodruff key (112).

Hydraulic size	Cone size	Impeller nut size	Impeller nut wrench size	Thread size "M"
E	28	-	-	M12
E	38	M28	41 mm	M12
F	50	M35	46 mm	M12
H	50	M35	46 mm	M16
H/I/L	75	M56	70 mm	M16
I/L	100	-	-	M16

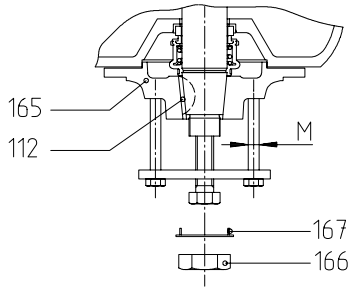


Fig. 4

3.3.4 REMOVAL OF LINER OR SUCTION COVER

a) For D03K / D04K

These pumps have a non-adjustable liner (421) held in a fixed position inside a one-piece volute casing. It can be pressed out of the casing after loosening of fastening set (418) (Fig. 5).

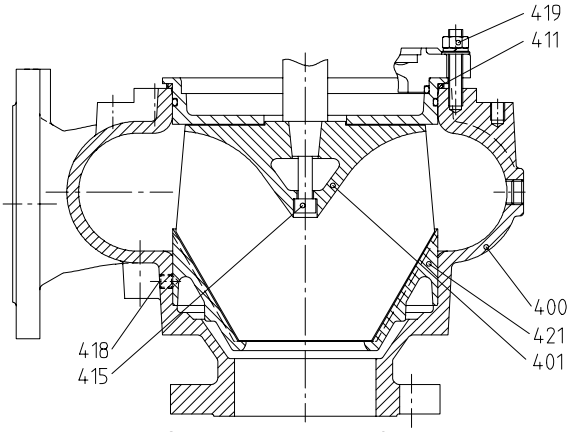


Fig. 5: D03K / D04K

b) For all other pumps without "regulable" feature

These pumps have a one-piece suction cover (402) which is bolted to the volute casing (400) by studs and nuts (417). Adjustment of clearance is by shims (411) between the volute casing and the drive unit.

NOTE:
Certain models may have a spacer ring (414) between mating surfaces of the suction cover and the volute casing. When there is excessive wear on the conical surface, the suction cover (402) should be replaced (Fig. 6).

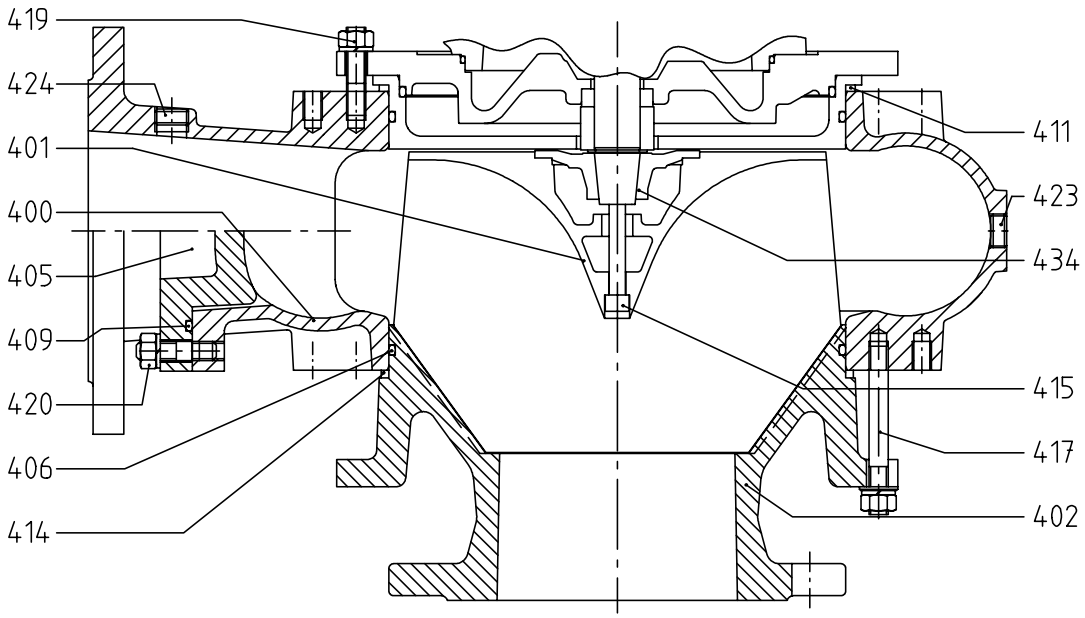


Fig. 6: E05K - L20K

c) For all other pumps with "regulable" feature

These pumps have an externally-adjustable liner (421), held in place by the volute casing (400) or the suction casing (416) which is bolted to the volute casing (400) by studs and nuts (417). This construction can be recognized by the presence of three large regulator nuts (422).

If the conical surface is worn, the liner need be replaced. It can be removed while the volute casing or suction casing remain attached to the piping. Alternately, the suction casing may be removed by removing nuts (417).

Removing of liner: completely remove nuts (413). To force the liner out, push the three studs through the holes in the large regulator nuts (422), or the large regulator nuts can be turned all the way into the casing. **Do not yet disassemble the regulator studs (412)! They are loctited in place, and must be heated with a torch to break the locktite bond after removing of the liner.**

The wear ring (408) should only be removed from suction casing or volute casing if badly damaged. Therefore heat the mating surfaces with a torch to destroy the special adhesive between these two parts. Then press out suction ring with a hydraulic press (Fig. 7).

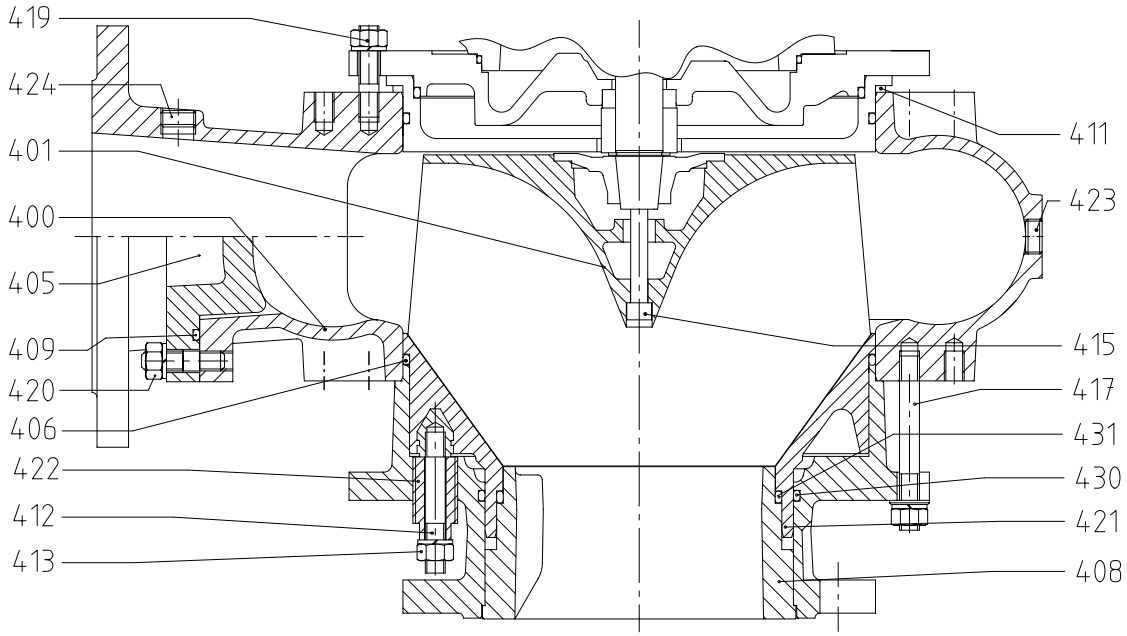


Fig. 7: E05K - L20K regulable

3.4 ASSEMBLY OF HYDRAULIC PARTS

3.4.1 ASSEMBLY OF IMPELLER FLANGE (if existing)

If existing, put in Woodruff key (112), coat the shaft taper with an anti-rust paste, put on the impeller flange (165), the locking washer (167) and the nut (166). The nut must be tightened to 120 Nm (90 ft-lbs) by using torque wrench. Bend over locking washer tab.

3.4.2 ASSEMBLY OF IMPELLER

If impeller (401) with impeller flange (165) is used, mount it so that the pin (410) on back of impeller will fit in the corresponding hole on flange. Before fitting a new impeller or a new impeller bolt, length "L" of impeller bolt should be checked as follows:

By measuring of the impeller and the impeller bolt, it must be secured that:

1. thread reach "L" is 1.25 x thread diameter, e.g. M16:
   16 x 1.25 = 20 mm.

2. end of thread "G1" on impeller bolt is sufficient (re-cut the thread).

3. end of thread "G2" in the shaft is sufficient (shorten impeller bolt, see point 1.).

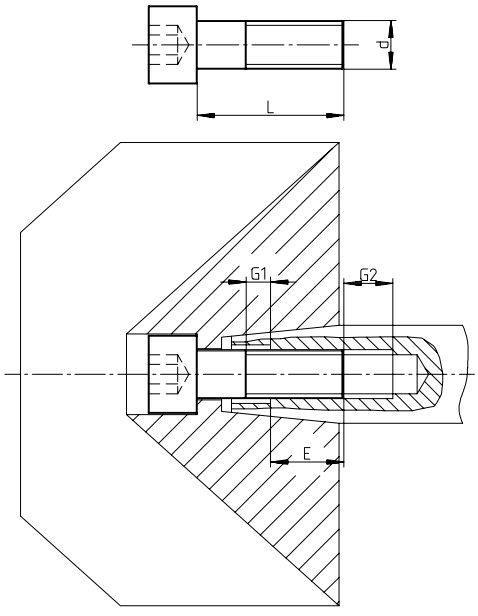


Fig. 8

ATTENTION:
Oil shaft taper slightly with a shred. **NEVER use thick oil, grease or anti-size compound!** Install impeller directly onto shaft. Coat the impeller bolt thread with grease or anti-size compound. Tighten screw with torque according table 3.3.2.

NOTE:
If torque wrench not available, torque can be approximated with an extension pipe and weight.

3.4.3 ASSEMBLY OF LINER OR SUCTION COVER

a) For D03K / D04K (Fig. 5)

Carefully position liner (421) into one-piece casing (400); tap into place with lead hammer, and fix it with screws (418). Seal the thread to avoid a possible leakage (no O-rings are used between liner and casing).

b) For all other pumps without "regulable" feature (Fig. 6)

Place spacer ring (414) over spigot of suction cover (402), then grease and install O-ring (406) into groove on suction cover.

Install suction cover into down side of the volute casing with fastening set (417).

ATTENTION:
Since up-side and down-side of the volute casing are machined identically in some models, it is potentially possible to assemble the pump in a wrong way. Form of the volute casing see Fig. 1.

c) For all other pumps with "regulable" feature (Fig. 7)

Glue three regulation screws (412) into liner (421).

Thoroughly grease O-ring (430) and install into grove in suction casing (416). This groove is nearly hidden by the wear ring in some pump models.

If wear ring (408) was removed, glue it firmly back into place. Tap wear ring into suction casing with a lead hammer, until wear ring is flush with flange surface.

Grease the external threaded portion of large regulator nuts (422), and install these into the suction casing (416), hex-side toward the outside, direction to the suction flange. Screw these into the suction casing until they are flush with the inside.

Now grease O-ring (431) and install it into groove of wear ring (408, if there is no wear ring, this O-ring is not used).

Now place liner into suction casing or volute casing, engaging the three stud bolts into the holes through the three regulator nuts.

NOTE:
The three stud bolts are not spaced evenly around the liner, so there is only one orientation of the liner where the bolts will correctly fit through the regulator nuts.

Install suction casing into down-side of the volute casing with fastening set (417).

ATTENTION:
Since up-side and down-side of the volute casing are machined identically in some models, it is potentially possible to assemble the volute casing in a wrong way. Form of the volute casing see Fig. 1.

3.5 FINAL ASSEMBLY

When ONLY a new impeller is fitted, the following clearance check must be done: install drive unit-impeller assembly into volute casing.

If the tip of the impeller touches the wear ring (408) or the lip in the liner (or suction cover) or if there is less than 1 mm clearance between the tip and the lip (the spiral edge of the impeller is firmly seated against the conical taper inside the liner or suction cover), then the impeller tip must be ground off, parallel to the suction flange, until 1 to 2 mm clearance is obtained (Fig. 9).

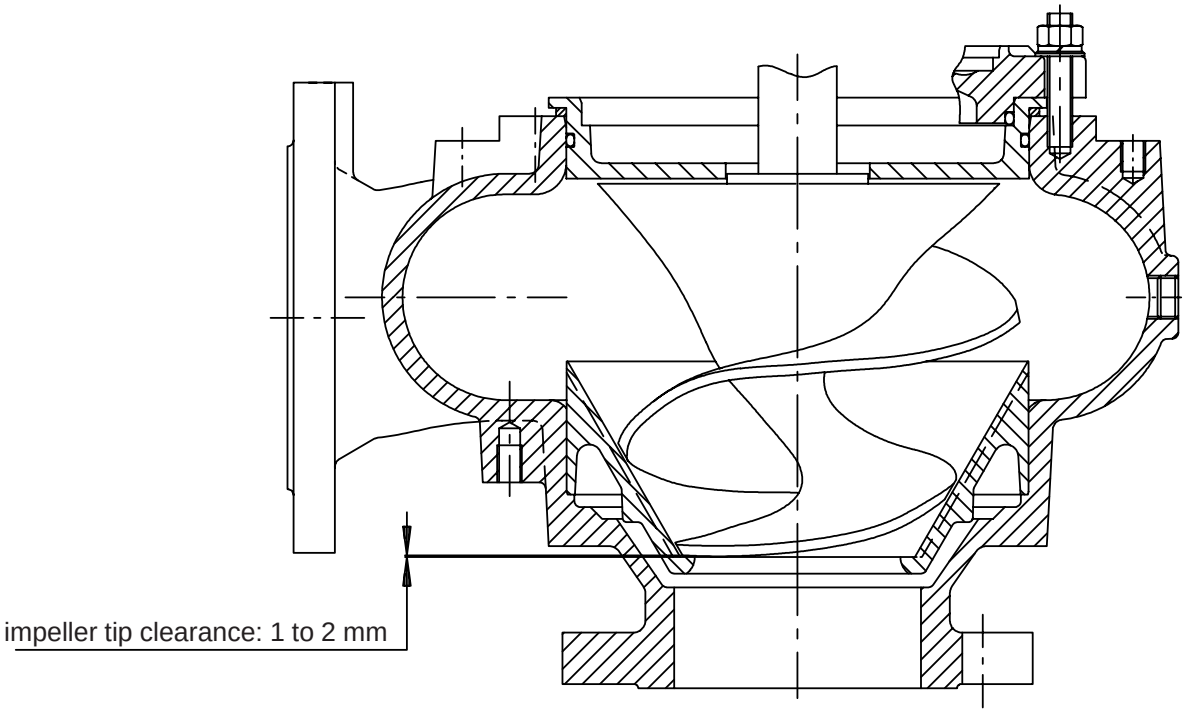


Fig. 9

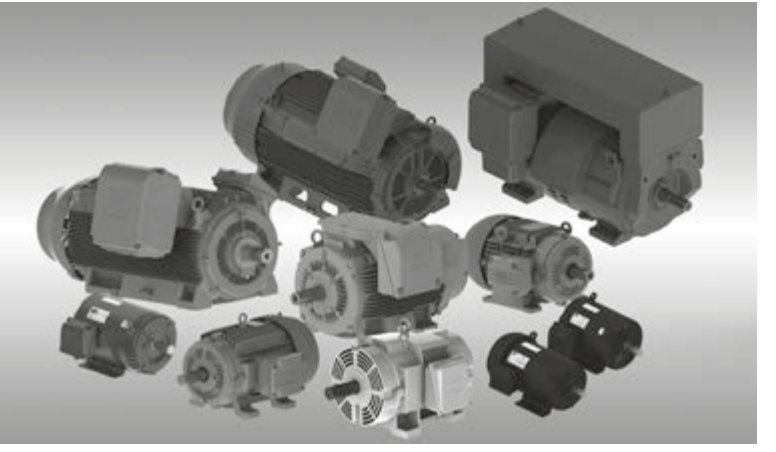
If (411) is a spacer ring in lieu of shims place it over the spigot of the drive unit.

Grease O-ring (209) and place into groove on spigot of the drive unit.

Now install drive unit-impeller assembly into volute casing. Install and tighten nuts (419).

See Section 3.2 for correct setting of regulator nuts, or for placement of shims (411) for final adjustment of impeller clearance.

More languages see website www.weg.net



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The manufacturer declares under sole responsibility that:

WEG electric motors and components used for following motor lines:
W01, W11, W21, W22, W40, W50, HGF, Roller Table, W22 Magnet and W22 Quattro
……

when installed, maintained and used in applications for which they were designed, and in compliance with the relevant installation standards and manufacturer's instructions, comply with the provisions of the following relevant European Union harmonisation legislation, wherever applicable:

Low Voltage Directive 2006/95/EC* (valid until April 19th, 2016)
Low Voltage Directive 2014/35/EU* (valid from April 20th, 2016)
Regulation (EC) No 640/2009* and Regulation (EU) No 4/2014*
Directive 2009/125/EC*
Machinery Directive 2006/42/EC**
EMC Directive 2014/30/EU (electric motors are considered inherently benign in terms of electromagnetic compatibility)

The fulfilment of the safety objectives of the relevant European Union harmonisation legislation has been demonstrated by compliance with the following standards, wherever applicable:

EN 60034-1:2010 + AC:2010/ EN 60034-2-1:2007/ EN 60034-5:2001 + A1:2007/ EN 60034-6:1993/ EN 60034-7:1993 + A1:2001/ EN 60034-8:2007 + A1: 2014/ EN 60034-9:2005 + A1:2007/ EN 60034-11:2004/ EN 60034-12:2002 + A1:2007/ EN 60034-14:2004 + A1:2007/ EN 60034-30:2009/ EN 60204-1:2006 + A1:2009 + AC:2010 and EN 60204-11:2000 + AC:2010

CE marking in: **1996**
* Electric motors designed for use with a voltage rating higher than 1000V are not considered under the scope.
** Low voltage electric motors are not considered under the scope and electric motors designed for use with a voltage rating higher than 1000V are considered partly completed machinery and are supplied with a

Declaration of Incorporation:

The products above cannot be put into service until the machinery into which they have been incorporated has been declared in conformity with the Machinery Directive.
A Technical Documentation for the products above is compiled in accordance with part B of annex VII of Machinery Directive 2006/42/EC.
We undertake to transmit, in response to a reasoned request by the national authorities, relevant information on the partly completed machinery identified above through WEG authorised representative established in the European Union. The method of transmission shall be electronic or physical method and shall be without prejudice to the intellectual property rights of the manufacturer.

Jaraguá do Sul, February 26th, 2016

Signed for and on behalf of the manufacturer:
Milton Oscar Castella
Engineering Director

ENGLISH

1. INTRODUCTION

The installation, operation and maintenance of the motor must be always performed by qualified personnel using proper tools and methods and following the instructions contained in the documents supplied with the motor.

The instructions presented in this document are valid for WEG motors with the following characteristics:
- Three-phase and single-phase induction motors (squirrel cage rotor);
- Three-phase permanent magnet motors;
- Three-phase hybrid motors (squirrel cage rotor + permanent magnets);

The objective of this manual is to provide important information, which must be considered during the shipment, storage, installation, operation and maintenance of WEG motors. Therefore, we advise to make a careful and detailed study of the instructions contained herein before performing any procedures on the motor. The noncompliance with the instructions informed in this manual and others mentioned on the website ***www.weg.net*** voids the product warranty and may cause serious personal injuries and material damages.

Electric motors have energized circuits and exposed rotating parts which may cause injuries to people.

2. SHIPMENT, STORAGE AND HANDLING

Check the conditions of the motor immediately upon receipt. When any damage is noticed, this must be reported in writing to the transportation company, and immediately communicated to the insurance company and to WEG. In this case, no installation job can be started before the detected problem has been solved.
Check if the nameplate data matches the invoice data and the environmental conditions in which the motor will be installed. If the motor is not immediately installed, it must be stored in a clean and dry room protected against dust, vibrations, gases and corrosive agents, and with relative humidity not exceeding 60%.
In order to prevent water condensation within the motor during the storage period, it is recommended to keep the space heater ON (where provided). In order to prevent oxidation of the bearings and ensure an even distribution of the lubricant, rotate the motor shaft at least once a month (at least five turns), always leaving it in a different position. For bearings with oil mist lubrication systems, the motor must be stored horizontally, independently from the mounting configuration, with ISO VG 68 oil in the bearing, (the amount is indicated in the motor manual available on the website ***www.weg.net***) and the shaft must be turned weekly. If the motors are stored for more than two years, it is recommended to change the bearings, or to remove, wash, inspect and relubricate them before the motor is started. After this storage period, it is also recommended to change the start capacitors of single-phase motors since they loss their operating characteristics.

Handle the motor always carefully in order to prevent impacts and damages to the bearings and always install the shaft transportation/locking device (if supplied) when transporting the motor. Use only the eyebolts to lift the motor. However these eyebolts are designed for the motor weight only. Thus never use these eyebolts to lift the motor with additional loads coupled to it. The lifting eyebolts of the terminal box, fan cover, etc., are intended to handle only these parts when disassembled from the motor. For multimounting motors (with removable feet/base), the eyebolts must be positioned according to the motor mounting position so that the lifting angle is vertically aligned (lifting at 0°). Additional information regarding the maximum allowable angle-of-inclination is indicated in the general manual available on the website *www.weg.net*.

Periodically and mainly before the initial star-up, measure the insulation resistance of the motor winding. Check the recommended values and the measuring procedures in the website.

3. INSTALLATION

During the installation, the motors must be protected against accidental energization. Check the motor direction of rotation, turning it without load before it is coupled to the load.

Remove the transportation devices and shaft locking device (if supplied) before starting the motor installation. Motors must be only installed in places compatible with their mounting features and in applications and environments for which they are intended.
Those motors with feet must be installed on bases duly planned in order to prevent vibrations and assure perfect alignment. The motor shaft must be properly aligned with the shaft of the driven machine. Incorrect alignment, as well as improper belt tension, will certainly damage the bearings, resulting in excessive vibrations and even causing the shaft to rupture. The admissible shaft radial and axial loads indicated in the general manual of the website must be respected. Use flexible coupling whenever possible. When motors are fitted with oil lubricated bearings or oil mist lubrication systems, connect the cooling and lubrication tubes (where provided).
For oil lubricated bearings, the oil level must be in the center of the sight glass.

Only remove the corrosion protection grease from the shaft end and flange immediately before the motor installation.
Unless specified otherwise in the purchase order, WEG motors are dynamically balanced with "half key" and without load (uncoupled). The driving elements, such as pulleys, couplings, etc., must be balanced with "half key" before they are mounted on the shaft of the motors.
Observe the correct assembly position of the drains as indicated in the manual on the website ***www.weg.net***

Do not cover and block the motor ventilation openings. Ensure a minimum clearance of ¼ (25%) of the diameter of the air intake of the fan cover from the walls. The air used for cooling the motor must be at ambient temperature, limited to the temperature indicated on the motor nameplate.
Motors installed outdoors or in the vertical position require the use of additional shelter to protect them from water; for instance, use of a drip cover.
To prevent accidents, ensure that the grounding connection has been performed according to the applicable standards and that the shaft key has been securely fastened before the motor is started. Connect the motor properly to the power supply by means of safe and permanent contacts, always considering the data informed on the nameplate, such as rated voltage, wiring diagram, etc.

For power cables, switching and protection devices dimensioning, consider the rated motor current, the service factor, and the cable length, among others. For motors without terminal block, insulate the motor terminal cables by using insulating materials that are compatible with the insulation class informed on the nameplate. The minimum insulation distance between the non-insulated live parts themselves and between live parts and the grounding must be: 5.5 mm for rated voltage up to 690 V; 8 mm for voltages up to 1.1 kV; 45 mm for voltages up to 6.9 kV; 70 mm for voltages up to 11 kV and 105 mm for voltages up to 16.5 kV.

In order to assure the degree of protection, unused cable inlet holes in the terminal box must be properly closed with blanking plugs having and equal or higher degree of protection to that indicated on the motor nameplate.

The motor must be installed with overload protection devices. For three-phase motors, it is recommended to install a phase failure protection device. When motor is fitted with temperature-monitoring devices in the stator windings and/or bearings, they must be connected during the operation and even during tests. Ensure the correct operation of the accessories (brake, encoder, thermal protection, forced ventilation, etc.) installed on the motor before it is started.

Motors fitted with Automatic Thermal Protectors will reset automatically as soon as the motor cools down. Thus, do not use motors with Automatic Thermal Protection in applications where the auto-reseting of this device may cause injuries to people or damage to equipment. Motors fitted with Manual Thermal Protectors require manual reset after they trip. If the Automatic Thermal Protector or the Manual Thermal Protector trip, disconnect the motor from the power supply and investigate the cause of the thermal protector tripping. W22 Magnet motors must be driven by WEG variable frequency drives only.

For more information about the use of variable frequency drives, follow the instructions in the motor manual on the website ***www.weg.net*** and in the manual of the variable frequency drive.

4. OPERATION

During operation, do not touch the non-insulated energized parts and never touch or stay too close to rotating parts.
Ensure that the space heater is always OFF during the motor operation.

The rated performance values and the operating conditions are specified on the motor nameplate. The voltage and frequency variations of the power supply should never exceed the limits established in the applicable standards.
Occasional different behavior during the normal operation (actuation of thermal protections, noise level, vibration level, temperature and current increase) must always be assessed by qualified personnel. In case of doubt, turn off the motor immediately and contact the nearest WEG service center.
Do not use roller bearings for direct coupling. Motors fitted with roller bearings require radial load to ensure their proper operation.
For motors fitted with oil lubrication or oil mist systems, the cooling system must be ON even after the machine is OFF and until the machine is at complete standstill.
After complete standstill, the cooling and lubrication systems (if any exist) must be switched OFF and the space heaters must be switched ON.

5. MAINTENANCE

Before any service is performed, ensure that motor is at standstill, disconnected from the power supply and protected against accidental energization. Even when the motor is stopped, dangerous voltages may be present in space heater terminals.
If motors are fitted with capacitors, discharge them before any handling or service is performed.
Motor disassembly during the warranty period must be performed by a WEG authorized service center only.
For motors with permanent magnet rotor (lines W22 Quattro and W22 Magnet), the motor assembly and disassembly require the use of proper devices due to the attracting or repelling forces that occur between metallic parts. This work must only be performed by a WEG Authorized service center specifically trained for such an operation. People with pacemakers cannot handle these motors. The permanent magnets can also cause disturbances or damages to other electric equipment and components during maintenance.

Regularly inspect the operation of the motor, according to its application, and ensure a free air flow. Inspect the seals, the fastening bolts, the bearings, the vibration and noise levels, the drain operation, etc.
The lubrication interval is specified on the motor nameplate.

6. ADDITIONAL INFORMATION

For further information about shipment, storage, handling, installation, operation and maintenance of electric motors, access the website ***www.weg.net***.
For special applications and operating conditions (for example, smoke extraction motors, totally enclosed air over (TEAO), motors for high thrust applications, motors with brake) refer to the applicable manual on the website ***www.weg.net*** or contact WEG.
When contacting WEG, please, have the full description of the motor at hand, as well as the serial number and manufacturing date, indicated on the motor nameplate.

7. WARRANTY TERM

WEG Equipamentos Elétricos S/A, Motors Business Unit ("WEG"), offers warranty against defects in workmanship and materials for its products for a period of 18 months from the invoice date issued by the factory or distributor/ dealer, limited to 24 months from the date of manufacture.
Motors of the HGF Line are covered for a period of 12 months from the invoice date issued by the factory or distributor / dealer, limited to 18 months from the date of manufacture.
The paragraphs above contain the legal warranty periods.
If a warranty period is defined in a different way in the commercial/technical proposal of a particular sale, that will supersede the time limits set out above.
The warranty periods above are independent of the product installation date and the startup.
If any defect or abnormal occurrence is detected during machine operation, the customer must immediately notify WEG in writing about the occurred defect, and make the product available for WEG or its Authorized Service Center for the period required to identify the cause of the defect, check the warranty coverage, and perform the proper repairs.
In order for the warranty to be valid, the customer must be sure to follow the requirements of WEG's technical documents, especially those set out in the product Installation, Operation and Maintenance Manual, as well as the applicable standards and regulations in force in each country.
Defects arising from the inappropriate or negligent use, operation, and/or installation of the equipment, non-execution of regular preventive maintenance, as well as defects resulting from external factors or equipment and components not supplied by WEG, will not be covered by the warranty.
The warranty will not apply if the customer at its own discretion makes repairs and/or modifications to the equipment without prior written consent from WEG.
The warranty will not cover equipment, components, parts and materials whose lifetime is usually shorter than the warranty period. It will not cover defects and/or problems resulting from force majeure or other causes not imputable to WEG, such as, but not limited to: incorrect or incomplete specifications or data supplied by the customer; transportation, storage, handling, installation, operation and maintenance not complying with the provided instructions; accidents; defects in the construction works; use in applications and/or environments for which the machine was not designed; equipment and/or components not included in the scope of WEG supply.
The warranty does not include disassembly services at the buyer's premises, product transportation costs and travel, lodging and meal expenses for the technical staff of the Service Centers, when requested by the customer.
The services under warranty will be provided exclusively at WEG authorized Service Centers or at one of its manufacturing plants. Under no circumstances will the warranty services extend the equipment warranty period.
WEG's Civil Liability is limited to the supplied product; WEG will not be liable for indirect or consequential damages, such as losses of profit and revenue losses and alike which may arise from the contract signed between the parties.

1. INTRODUCCION

La instalación, operación y mantenimiento del motor debe llevarse siempre a cabo por personal cualificado, utilizando herramientas y métodos adecuados, y siguiendo los procedimientos indicados en los documentos suministrados con el motor.

Las instrucciones suministradas en este documento son válidas para motores WEG con las siguientes características:

- Motores de inducción trifásicos y monofásicos (con rotor de jaula)
- Motores trifásicos de imanes permanentes
- Motores trifásicos híbridos (con rotor de jaula + imanes permanentes)

El objetivo de este manual es aportar informaciones importantes que deben ser seguidas durante el transporte, almacenamiento, instalación, funcionamiento y mantenimiento de los motores WEG. Por ese motivo, recomendamos leer atentamente las instrucciones antes de realizar cualquier intervención en el motor. El incumplimiento de las instrucciones reflejadas en este manual, y demás instrucciones a las que se hace referencia en el sitio ***www.weg.net***, ocasionará la anulación de la garantía del producto, y puede ocasionar serios daños personales y materiales.

Los motores eléctricos tienen circuitos bajo tensión, y componentes giratorios que pueden causar daños a las personas.

2. TRANSPORTE, ALMACENAMIENTO Y MANIPULACION

Verifique la situación del motor al recibirlo. De encontrarse daños, estos deben ser informados por escrito a la agencia de transporte, y comunicarlos inmediatamente tanto a la empresa aseguradora como a WEG. En ese caso, no se debe iniciar ningún trabajo de instalación hasta que se haya solucionado el problema encontrado.

Los datos que aparecen en la placa de características, deben corresponder con los del pedido del producto y las condiciones ambientales de trabajo en el lugar donde el motor será instalado. En caso de que el motor no fuera instalado inmediatamente, se recomienda almacenarlo en lugar limpio y seco, libre de polvo, vibraciones, gases y agentes corrosivos, y con una humedad relativa del aire no superior al 60%.

Para evitar la condensación de agua en el interior del motor durante el período de almacenamiento, se recomienda mantener la resistencia de caldeo encendida (de estar incluida). Para evitar la oxidación de los rodamientos y asegurar una distribución uniforme del lubricante, gire el eje del motor por lo menos una vez por mes (dando, como mínimo, 5 vueltas) y dejándolo siempre en una posición diferente. Para rodamientos con sistema de lubricación tipo “oil mist”, el motor debe estar ubicado en posición horizontal, independientemente de su forma constructiva, con aceite ISO VG 68 en el rodamiento, con la cantidad indicada en el manual disponible en la página web, y el eje debe girarse semanalmente. En caso de que los motores queden almacenados por un periodo superior a 2 años, se recomienda cambiar los rodamientos, o como alternativa, desmontarlos, lavarlos, revisarlos y lubricarlos nuevamente antes de hacer trabajar el motor.

Tras este período de almacenamiento también se recomienda que los condensadores de arranque de motores monofásicos sean cambiados debido a posibles pérdidas de sus características de trabajo.

Toda manipulación del motor debe ser realizada con cuidado para evitar impactos y daños a los cojinetes, y con el dispositivo de transporte/bloqueo del eje (de ser suministrado) siempre instalado. Levante el motor siempre por los elementos de elevación, los cuales han sido diseñados para el peso del motor, y nunca deben utilizarse para levantar cargas adicionales acopladas. Los elementos de elevación de los componentes, como la caja de bornes, la tapa deflectora, etc., deben utilizarse solo para manipular estas piezas cuando estén desmontadas. Para motores multimontaje (con pies removibles), los elementos de elevácion deben ser posicionados de acuerdo con la posición de montaje del motor de manera que el ángulo de elevación está alineado verticalmente (elevación a 0°). En el manual general disponible en la página web, se podrá encontrar información adicional sobre los ángulos máximos de elevación.

Mida periódicamente la resistencia de aislamiento del motor y sobre todo, antes de la primera puesta en marcha. Verifique los valores recomendados y los procedimientos de medición en la página web.

3. INSTALACION

Durante la instalación, los motores deben estar protegidos contra puestas en marcha accidentales. Verifique el sentido de rotación del motor, haciéndolo funcionar en vacío antes de acoplarlo a la carga.

Elimine los dispositivos de transporte y de bloqueo del eje (en caso que existan) antes de iniciar la instalación del motor.
Los motores solo deben estar instalados en lugares compatibles con sus características constructivas y en las aplicaciones y ambientes para los cuales fueron proyectados.
Los motores con patas deben estar ubicados sobre bases debidamente proyectadas para evitar vibraciones y asegurar un perfecto alineamiento. El eje del motor debe estar adecuadamente alineado con el eje de la máquina accionada. Un alineamiento incorrecto, así como una tensión inadecuada de las correas de accionamiento, seguramente dañarán los rodamientos, resultando en excesivas vibraciones e incluso causar la ruptura del eje.
Se deben respetar las cargas radiales y axiales admisibles en el eje, las cuales se indican en el manual general disponible en la página web. Se recomienda el uso de acoplamientos flexibles.
En los motores con rodamientos cuya lubricación sea a base de aceite o un sistema de lubricación tipo “oil mist”, conecte los tubos de refrigeración y lubricación (caso de estar disponibles).
Para cojinetes con lubricación a aceite, el nivel de aceite debe permanecer en la mitad del visor de nivel.
Elimine la grasa de protección contra corrosión de la punta del eje y de la brida únicamente justo antes de la instalación del motor.
A no ser que se especifique lo contrario en el pedido de compra, los motores WEG se equilibran dinámicamente con “media chaveta” y en vacío (desacoplados). Los elementos de transmisión, como poleas, acoplamientos, etc., deben equilibrarse antes de ser instalados en el eje del motor.
Observe la correcta posición de montaje de los drenajes conforme lo indicado en el manual.

No cubra u obstruya la ventilación del motor. Mantenga una distancia libre mínimo de ¼ (25%) del diámetro de la entrada de aire de la deflectora en relación a la distancia de las paredes. El aire utilizado para la refrigeración del motor debe estar a temperatura ambiente, limitada a la temperatura indicada en la placa de características del motor.
Para motores instalados a la intemperie o montados en la posición vertical, se necesitará utilizar una protección adicional contra la entrada de líquidos y/o partículas sólidas, por ejemplo, el uso de un sombrerete.
Para evitar accidentes, con anterioridad al arranque del motor, se ha de asegurar que la puesta a tierra fue realizada conforme a las normas vigentes y que la conexión esté bien apretada.
Conecte el motor correctamente a la red eléctrica a través de contactos seguros y permanentes, siguiendo siempre los datos mostrados en la placa de características, como la tensión nominal, el esquema de conexionado, etc.

Para el dimensionamiento de los cables de alimentación y de los dispositivos de maniobra y protección se debe considerar la corriente nominal del motor, el factor de servicio, la longitud de los cables, entre otros.
Para motores sin placa de bornes, aísle los terminales del motor, utilizando materiales aislantes compatibles con la clase de aislamiento informada en la placa de características.
La distancia mínima de aislamiento entre partes vivas no aisladas entre sí y entre partes vivas y la tierra debe ser: 5.5 mm para tensiones nominales hasta 690 V; 8 mm para tensiones hasta 1.1 kV; 45 mm para tensiones hasta 6.9 kV; 70 mm para tensiones hasta 11 kV y 105 mm hasta 16.5 kV.

Las entradas de cables no utilizadas en la caja de conexiones deben estar debidamente tapadas con sistemas de cierre para garantizar el grado de protección indicado en la placa de características.

El motor debe ser protegido con dispositivos de protección contra sobrecarga. Para motores trifasicos se recomienda tambien la instalacion de sistemas de proteccion contra fallo de fase. En caso de que el motor posea dispositivos para control de temperatura en el devanado y/o cojinetes, los mismos deben estar conectados durante el funcionamiento, e inclusive, durante las pruebas.
Verifique el correcto funcionamiento de los accesorios (freno, encoder, protección térmica, ventilación forzada, etc.) instalados en el motor antes del arranque.

Los motores equipados con protectores térmicos del tipo Automático se reconectarán automáticamente cuando se alcance la temperatura adecuada para el motor. No utilizar motores con protección térmica del tipo automática en aplicaciones en donde el re-arranque automático pueda ser peligroso para personas o para el equipamiento.
Los motores equipados con protectores térmicos del tipo Manual, tienen que ser reconectados después del disparo.
En caso de que se active la protección térmica del tipo Automático o Manual, desconecte el motor de la red eléctrica y verifique la causa que provocó la actuación del protector térmico.
Los motores de la línea W22 Magnet deben ser accionados solamente por convertidores de frecuencia WEG.

Para más información sobre el uso del inversor de frecuencia es obligatorio seguir las instrucciones del manual del motor en ***www.weg.net*** y del manual del convertidor de frecuencia.

4. FUNCIONAMIENTO

Durante el funcionamiento, no toque las zonas con riesgo de contacto eléctrico, y nunca toque o permanezca muy cerca de partes giratorias.
Asegúrese de que la resistencia de caldeo esté desconectada durante el funcionamiento del motor.

Los valores nominales de trabajo y las condiciones de funcionamiento están especificados en la placa de características del motor. Las variaciones de la tensión y la frecuencia de alimentación nunca deben exceder los límites establecidos en las normas vigentes.
Posibles desvíos en relación al normal funcionamiento (actuación de las protecciones térmicas, aumento de los niveles de ruido y vibración, temperatura y corriente) deben ser evaluados por personal cualificado.
En caso de dudas, desconecte el motor inmediatamente, y entre en contacto con el servicio técnico autorizado WEG más próximo.
No se recomienda la utilización de rodamiento de cilindros para acoplamiento directo. Los motores equipados con estos rodamientos necesitan una carga radial mínima para garantizar su correcto funcionamiento.
Los sistemas de lubricación de los cojinetes de aceite u “oil mist” y de refrigeración tienen que permanecer conectados incluso tras el corte de alimentación, y hasta la parada total de la máquina.
Tras la parada del motor, los sistemas de refrigeración y de lubricación (de existir) deben desconectarse y se deben conectar las resistencias de caldeo.

5. MANTENIMIENTO

Antes de iniciar cualquier tipo de servicio en el motor, éste debe estar completamente parado, desconectado de la red de alimentación y protegido contra una posible reconexión. Aunque el motor estuviese parado, puede haber tensión en los terminales de las resistencias de caldeo.
En motores equipados con condensadores, descárguelos antes de manipularlos o realizar algún servicio.
El desmontaje del motor durante el período de garantía solamente debe ser realizado por un servicio técnico autorizado WEG.
En el caso de motores con rotor de imanes permanentes (lineas W22 Quattro y W22 Magnet), el montaje y desmontaje del motor requiere de la utilización de dispositivos adecuados debido a las fuerzas de atracción o de repulsión entre piezas metálicas. Este servicio solamente debe llevarse a cabo por un Servicio Técnico Autorizado WEG con formación específica para dicha operación.

Las personas que utilicen marcapasos no pueden manipular estos motores. Los imanes permanentes también pueden causar perturbaciones o daños en otros equipamientos eléctricos y componentes durante el mantenimiento.

Inspeccione periódicamente el funcionamiento del motor según su aplicación, asegurándose de que el aire fluya libremente.
Inspeccione los sellos, los tornillos de fijación, los cojinetes, los niveles de vibración y ruido, los drenajes, etc.
El intervalo de lubricación está especificado en la placa de identificación del motor.

6. INSTRUCCIONES ADICIONALES

Para informaciones adicionales sobre transporte, almacenaje, manipulación, instalación, funcionamiento y mantenimiento de motores eléctricos, entre en ***www.weg.net***.
Para aplicaciones y condiciones especiales de trabajo (ejemplo: motores de extracción de humos, *totally enclosed air over* (TEAO), motores para altas cargas radiales y axiales, motores con freno) se debe consultar el manual o entrar en contacto con WEG.
Al entrar en contacto con WEG, tenga a mano la denominación completa del motor, así como también su número de serie y fecha de fabricación indicados en la placa de características del mismo.

7. TERMINO DE GARANTIA

WEG Equipamentos Elétricos S/A, Unidad Motores ("WEG"), ofrece garantía contra defectos de fabricación o de materiales para sus productos por un período de 18 meses, contados a partir de la fecha de emisión de la factura de fábrica, o del distribuidor/revendedor, limitado a 24 meses de la fecha de fabricación.
Para motores de la línea HGF, la garantía ofrecida es de 12 meses, contados a partir de la fecha de emisión de la factura de fábrica, o del distribuidor/revendedor, limitado a 18 meses a partir de la fecha de fabricación.
El párrafo anterior cuenta con los plazos de garantía legal, no siendo acumulativos entre sí.
En caso de que un plazo de garantía diferenciado esté definido en la propuesta técnica comercial para un determinado suministro, éste prevalecerá por sobre los plazos definidos anteriormente.
Los plazos establecidos anteriormente no dependen de la fecha de instalación del producto ni de su puesta en operación.
Ante un desvío en relación a la operación normal del producto, el cliente debe comunicar inmediatamente por escrito a WEG sobre los defectos ocurridos, y poner a disposición el producto para WEG o su Asistente Técnico Autorizado por el plazo necesario para la identificación de la causa del desvío, verificación de la cobertura de garantía, y para su debida reparación.
Para tener derecho a la garantía, el cliente debe cumplir las especificaciones de los documentos técnicos de WEG, especialmente aquellas previstas en el Manual de Instalación, Operación y Mantenimiento de los productos, y las normas y regulaciones vigentes en cada país.
No poseen cobertura de garantía los defectos derivados de utilización, operación y/o instalación inadecuadas o inapropiadas de los equipos, su falta de mantenimiento preventivo, así como defectos derivados de factores externos o equipos y componentes no suministrados por WEG.
La garantía no se aplica si el cliente, por iniciativa propia, efectúa reparaciones y/o modificaciones en el equipo sin previo consentimiento por escrito de WEG.
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Jurisdicción de la Parroquia San
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2.8 REPLACEMENT OF MECHANICAL SEAL

2.8.1 REMOVAL OF PUMP SIDE MECHANICAL SEAL (515)

a) Exposed-spring seal - type "C"
(Fig. 6)

Remove snap ring (546, Seeger), then remove spring. Make sure that the shaft is free of burrs and has no sharp edges so that the rubber parts of the seal cannot be damaged as they are removed. Oil the shaft for ease of disassembly. Now the seal rotating parts can be pulled off the shaft by hand.

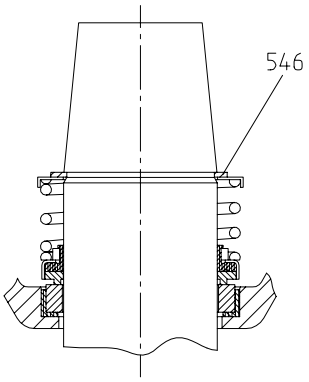

Fig. 6

b) Rubber-bellows seal, internal spring - type "M"
(Fig. 7)

Remove retaining ring "A" from the rubber bellows of the seal by gently prying with two screwdrivers on opposite sides, between the rubber bellows and the retaining ring (Fig. 8).

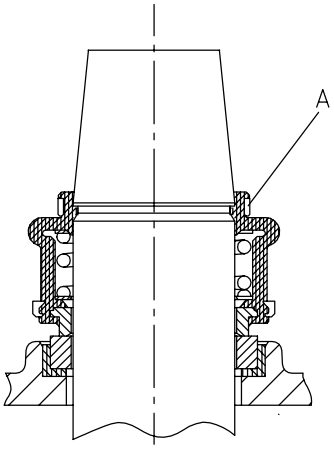

Fig. 7

WARNING:
Use only dull-edged screwdrivers since sharp edges could cut the rubber bellows. Do not twist screwdriver, as this can puncture rubber bellows.

Rather, lay some convenient object onto back cover or sealing plate, to act as a fulcrum for each screwdriver, and pry ring directly up away from rubber bellows (Fig. 8).

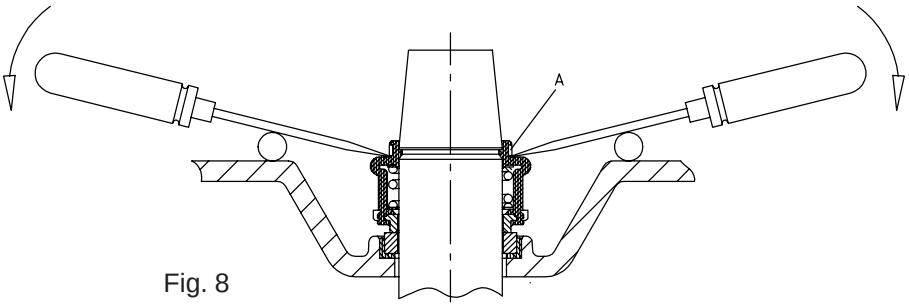

Fig. 8

Make sure that the shaft is free of burrs and has no sharp edges so that the rubber parts of the seal cannot be damaged as they are removed. Oil shaft and bellows for ease of disassembly. Gently insert a screwdriver between the shaft and the rubber bellows. By lifting and turning the screwdriver around the shaft, the lip of the rubber bellows can be lifted out of the shaft groove. Once the bellows is free of the groove, the entire rotating part of the seal with bellows can be pulled off the shaft. If necessary, use two screwdrivers deep into the seal to pry the seal face loose (Fig. 9).

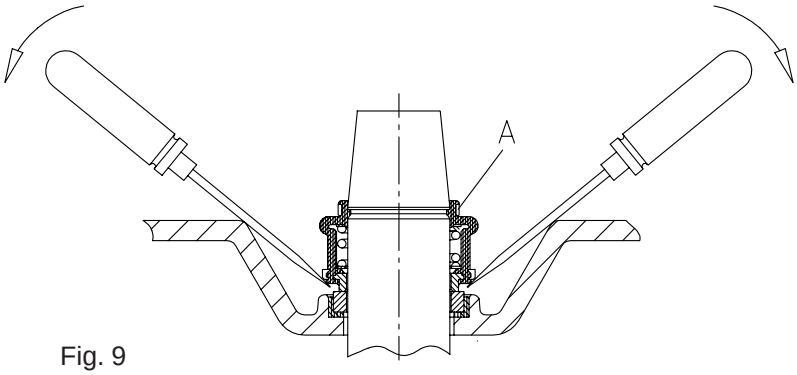

Fig. 9

c) Rubber-bellows seal, external spring - type "G" (Fig. 10)

Remove snap ring (546), if existing. Pull out the removable part (A) by hand.

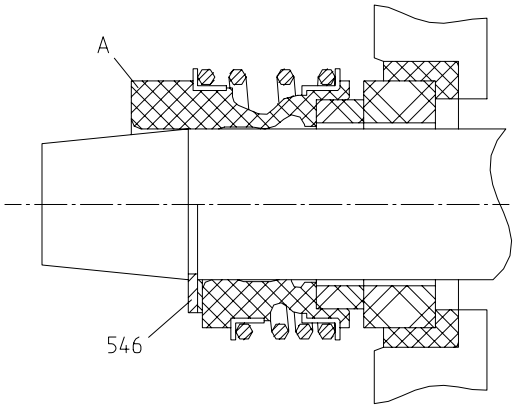

Fig. 10

d) Stainless-steel-shroud seal - type "X" (Fig. 11)

Remove all three small setscrews from outer body of rotating part. Remove snapring (546). Oil the shaft for ease of disassembly. Now the seal rotating part can be pulled off the shaft by hand.

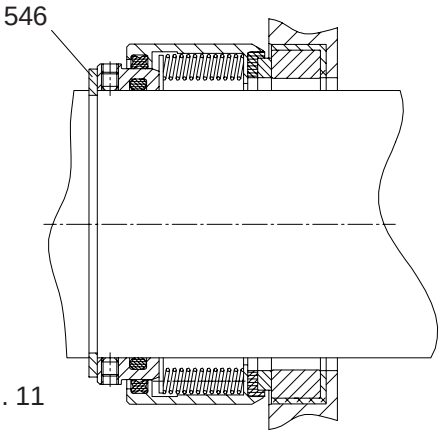

Fig. 11

e) Stationary seat (all types) (Fig. 12)

Remove static part of the mechanical seal as follows:

Unfasten nuts (534) and carefully remove back cover (507) from bearing support. Make sure that the static part of the seal (515) does not hit the shaft so that it can't be damaged.

Now the static part of the seal can be carefully pushed out of the chamber from the back side.

Some HIDROSTAL seals can be repolished or repaired (Consult nearest service center). When sending a seal for inspection or repair, it is important to thoroughly protect the seal faces to prevent damage during transportation.

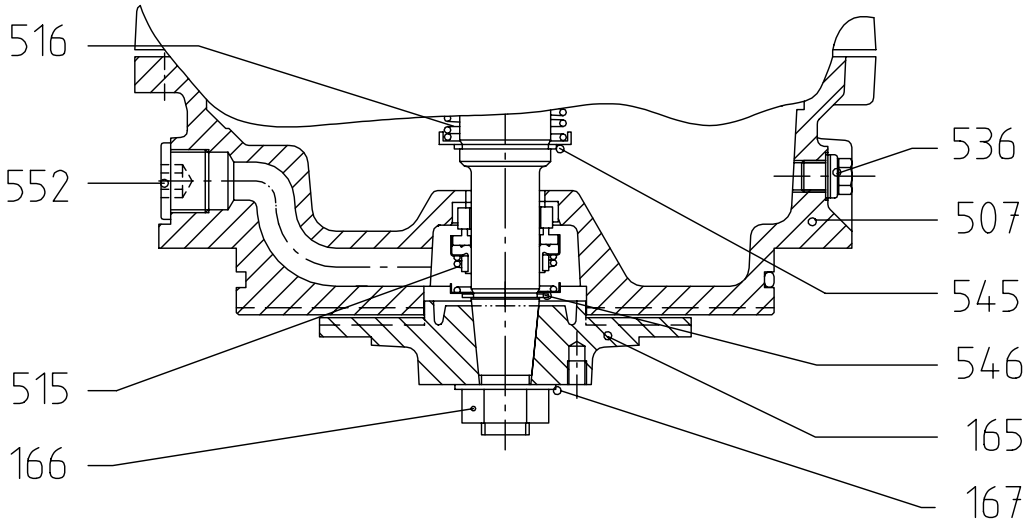

Fig. 12

2.8.2 MAINTENANCE OF MOTOR SIDE MECHANICAL SEAL (516)

If increased leakage via connection "D" is noted (see Section 2.6.3), eventually the mechanical seal (516) has to be replaced.

2.8.3 ASSEMBLY OF BACK COVER

Cleanliness is of utmost importance for this assembly work! All parts must be washed in solvent before assembly. All machined mating surfaces must be clean and free from burrs. All grooves and seatings for "O"-rings and other static seals must be inspected for nicks or scratches. All threads must be clean especially those in holes for studs. **All "O"-rings MUST be replaced with new ones and they should be lubricated with light oil prior to assembly.**

ATTENTION:
Never use "O"-rings glued from "O"-ring stock. Our experience is that this glue joint will inevitably leak.

Place a new "O"-ring (527) on the bearing support (101). Carefully assemble back cover (507) to the bearing support and fasten with fastening set (534).

2.8.4 ASSEMBLY OF PUMP SIDE MECHANICAL SEAL

a) Stationary seat (all types)

Lubricate the rubber circumference of the static mechanical seal part and carefully press all the way into its seat in the back cover (507). The ring must fit tightly in place. Protect the seal face during this operation. Examine gap between shaft and inner diameter of seal face; when face is correctly installed, gap will be uniform all the way around.

ATTENTION:
The seal face is very brittle, and can easily snap unless pressure is uniform during installation. We suggest pushing in with special tool (Fig. 13).

Make sure that the shaft is free of burrs and has no sharp edges, so that the rubber part or the mechanical seal cannot be damaged. File groove edges if necessary.

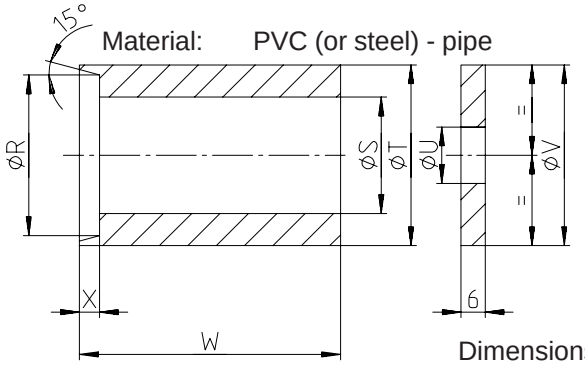

Fig. 13

Dimensions in mm

Seal size	ϕ R	ϕ S	ϕ T	ϕ U	ϕ V	W	X	Bolt size
1 1/8"	40 +/-1	29 +1/-0	45 +/-1	12	50	65	5	M10
1 1/2"	50 +/-1	39 +1/-0	55 +/-1	16	60	75	5	M12
2"	65 +/-1	51 +1/-0	70 +/-1	18	80	95	5	M16
3"	92 +/-1	77 +1/-0	100 +/-1	29	110	170	5	M27
100	110 +/-1	102 +1/-0	120 +/-1	38	130	350	5	M36

b) Exposed-spring seal - type "C"

Remove spring and spring retaining ring of mechanical seal. **Seal surfaces must be absolutely clean!** Place a few drops of light oil on the rotating (carbon) face of the mechanical seal, then lubricate inner bore of rubber part of the seal with oil and put a small amount of oil onto shaft. Install rotating face (with its rubber part) over shaft, and press gently down length of exposed shaft until carbon face touches stationary face. It may help to use a small wood "pusher" or a plastic pipe mandrel only slightly larger than shaft diameter, to push directly on the rubber part of the seal (Fig. 13). Be sure rubber part sits uniformly on shaft, and has *NOT* rolled out from under the metal part of the seal. Put on seal spring, and spring retaining ring.

Install snap ring (Seeger, 546) and turn shaft by hand to check for free running.

c) Rubber-bellows seal, internal spring - type "M"

Lubricate the rotating part of the mechanical seal, position the retaining ring "A" on the rubber bellows (Fig.14). Push the whole assembly by hand over the shaft as far as possible. Mount the special tool over the shaft tip (Fig. 15), and compress the mechanical seal until the lip of the rubber bellows is engaged in the shaft groove. Remove special tool. Turn the shaft by hand and watch that the retaining ring turns perfectly in line with the rubber bellows and that it is not cocked. Then try to pull the rubber bellows off shaft by hand to make sure that the lip has reliably engaged in the shaft groove.

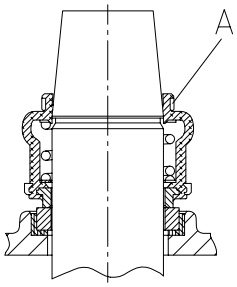

Fig. 14

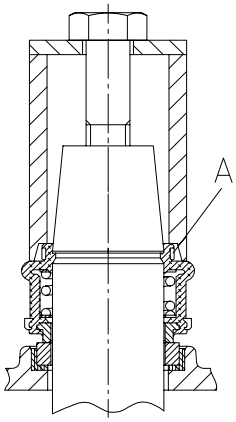

Fig. 15

d) Rubber-bellows seal, external spring - type "G" (Fig. 16)

Wet the rotating part of the mechanical seal with soapy water. Push the whole assembly by hand over the shaft as far as possible. Secure with snap ring (546).

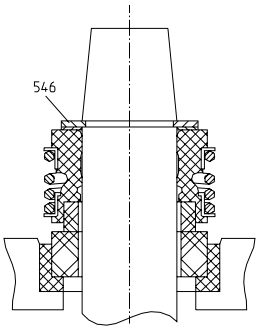

Fig. 16

e) Stainless-steel-shroud seal - type "X"

Lubricate inner rubber O-rings of seal and put a small amount of oil onto shaft. Install entire seal over shaft, and press gently down shaft until rotating face touches stationary face. Now install snapring over shaft, and push until it snaps into its groove. If necessary use the special tool (Fig. 13). Then re-install the three small setscrews into the seal rotating part, and tighten firmly.

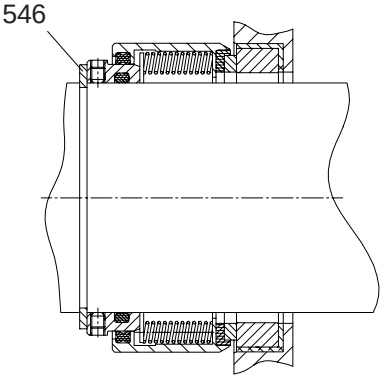

Fig. 17

Lubricants

General Statement

Hidrostal is often asked to comment on the appropriateness of using something other than our recommended lubricants. This is a legitimate request because customers often do not want to stock the specialized products that we recommend and warrant as suitable for normal operating conditions. The difficulty of providing a positive answer is that each lubricant is different, not only in the formulation and primary properties (Synthetic/non synthetic, base stock, ISO Grade, Viscosity, Viscosity Index, Pour Point, Flame Point, etc.) but even more in the additives that are present.

Therefore, when asked this question, our position is as follows:
Our lubricant recommendations are based on years of successful experience in the field. When considering an alternative, it is important that the formulation and primary properties should be similar. Normally if this is so, the bearing temperatures and lubrication film should be ok and the lubricant will prove to be acceptable.

However, there are two primary areas of uncertainty. The first and most critical uncertainty is the use of a different lubricant viscosity. The use of higher or lower viscosity lubricants should be avoided if possible. In the case of higher viscosity the bearing temperature will increase. In the case of lower viscosity, the oil film could be inadequate. Successful use of a different viscosity lubricant depends on the particular operating parameters and can only be known after operation for an extended period.
The second uncertainty is the fact that each lubricant will have different additives in its formulation that will affect its performance in the field. The effect of this can only be determined by a period of extended operation.

Therefore, our overall position is that if the formulation and primary properties are similar, the use of a different lubricant will, in the vast majority of cases, be acceptable. The use of a different viscosity lubricant is more problematical. But in all cases, the suitability or lack of suitability of a particular lubricant can only be determined by an extended period of successful operation in the field.

Hidrostal Lubricant Types

The table that follows summarizes the Hidrostal recommendations for 3 different types of lubricants:

- The first type is **grease** that is used in **bearing frames** and in **motor bearings**.
- The second type is **oil** that is used in certain **bearing frames** for bearing lubrication.
- The third type is **seal barrier fluid** and **motor cooling fluid**. This material is used in bearing frames that have an integral double seal; in submersible motors as a seal barrier fluid; and in immersible motors as both a seal barrier fluid and motor cooling fluid.

General Statement on Food Grade Lubricants

Of the three types of lubricants listed in the previous section, only the third type, when used as a seal barrier fluid, can possible come in contact with the product. Therefore when we are asked about food grade lubricants it is only this third type that is applicable.
The key factors here, as shown in the table, are the viscosity at 40°C, which must be under 18 mm^2/s, and the minimum flash point of 155°C.
Two food grade products that we have experience and can recommend are:

- BECHEM – Berusynth 15 H1
  (Food/NSF, Kosher, Halal)
- CLARION Food Grade White Mineral Oils, number 90
  (Food/NSF, Vegetarian, Nut Free, Kosher, Halal, Pharamceutical/FDI)

Disclaimer

The contents in this lubricant technical guideline are intended for informational purposes only. Data referring to fluid properties are based on published information from the manufacturer at the time of publication of this guideline.

Hidrostal Recommendations and Alternatives

Lubricant Type	Recommended Roller Bearing Grease Characteristics		Recommended Bearing Frame Oil Characteristics	Recommended Motor Coolant Fluid and Seal Barrier Fluid
Hidrostal Application	**General use**	**Bigger shaft diameters and high temperature industrial applications**	**All Oil lubricated Roller Bearings**	**All applications (Wastewater & Industry)**
Manufacturer	Kluber	Kluber	Kluber	ESS+Müller AG
Type	STABURAGS NBU 8 EP	ISOFLEX TOPAS NB 52	KLÜBERSYNTH GEM 4-100 N	Rinatol Hydraulic Fluid 856
Color	Light Brown	Beige	Gold yellow	Light yellow
Description	Mineral oil barium complex	Synthetic oil barium complex	Synthetic polyalphaolefin	Highly refined paraffin base mineral oil with improved pour point
Density at 20°C	0.99 g/cm^3	0.96 g/cm^3	0.85 g/cm^3	0.85 g/cm^3
Base Oil viscosity @ 40°C @ 100°C	97 mm^2/s 11.5 mm^2/s	30 mm^2/s 5.9 mm^2/s	100 mm^2/s 14 mm^2/s	14.2 mm^2/s 3.3 mm^2/s
Operating Temperature Range	-20°C to +140°C	-50°C to +150°C	-40°C to +140°C	-30°C to +100°C
ISO Viscosity Grade			100	15
Flash Point (ISO 2592)			≥ 200°C	190°C
Pour Point (ISO 3016)			≤ -40°C	-30°C
Viscosity Index (ISO 2909)			≥ 150	103
Shear Viscosity at 25°C, shear rate 300/s	5500-9500 mPa·s	4000-8000 mPa·s		
NGLI Consistency Class	2	2		
Penetration (ISO 2137) (0.1 mm)	265 to 295	265-295		
Dropping Point (ISO 2176)	> 220°C	> 240°C		
Speed Factor (n x d_m)	500'000	1'000'000		
Alternatives:				
Other products that have been used in Hidrostal pumps and motors	■ Chevron: Medium Industrial Grease, Polyurea base ■ Exxon: Mobil Mobilux EP No. 2, Lithium Base ■ Shell: Dolium BRB, Polyurea base			■ Shell: Tellus S2V 15 ■ BP: Bartran HV 15 ■ Total: Equivis ZS 15
Key selection factors	■ Base Oil Viscosity ■ Operating Temperature Range ■ Speed Factor		■ Base Oil Viscosity ■ Operating Temperature Range	■ Base Oil Viscosity @ 40°C maximum: 18mm^2/s ■ Flash Point minimum 155°C

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Standard Municipal Warranty

1. **WARRANTY -**For a period of fifteen (15) months from the date of shipment or twelve (12) months from start-up whichever occurs first, Hidrostal LLC gives a limited warranty that its Hidrostal equipment covered by this order shall be free of defects in material and workmanship under normal use and service, and when properly installed.
   1.1. Hidrostal agrees to repair or replace F.O.B. shipping point, such equipment, or any part thereof, previously furnished by Hidrostal, that as actually found to be defective, provided: (a) Startup of said equipment was conducted by an Authorized Representative of Hidrostal. Startup shall only occur after ninety percent (90%) of the invoice price of said equipment has been paid to Hidrostal. Startup of equipment by any unauthorized personnel shall nullify the warranty. (b) Said equipment has been properly stored & handled, installed, operated, and maintained by Buyer in accordance with Hidrostal recommendations and specifications. (c) Buyer notifies Hidrostal, in writing as soon as any such defect becomes apparent. Any claim by Buyer with reference to the equipment sold hereunder for any cause shall be deemed waived by Buyer unless submitted to Hidrostal in writing within (30) days from the date Buyer discovered, or should have discovered, any claimed breach within the limited warranty period. Unless agreed to the contrary by Hidrostal in writing, any work done, material furnished, repairs or designs made by others, shall void the warranty.
   1.2. Hidrostal does not warrant accessories or components not manufactured by Hidrostal. However, to the extent possible, Hidrostal agrees to assign to Buyer its rights under the original Manufacturer's warranty, without recourse to Hidrostal.
   1.3. Hidrostal makes no representation or inference within this warranty that it has reviewed the Buyer's and/or end user's system design to which the equipment supplied by Hidrostal will become a component of such a system. Overall system compatibility of all components within such a system shall be the responsibility of others.
   1.4. Hidrostal shall not be liable for any damage caused by abrasive materials, chemicals, scale deposits, corrosion, lightning, improper electrical supply, mishandling, or other similar conditions.
   1.5. Hidrostal shall not be liable for incidental or consequential losses, damages or expenses, directly or indirectly arising from the sale, handling or use of the equipment, or from any other cause relating thereto, and Hidrostal liability hereunder in any case is expressly limited to the replacement (in the original form shipped) of equipment or any part thereof, not complying with this order, or, at Hidrostal's election, to the repayment of or crediting Buyer with an amount equal to the purchase price of such equipment, whether such claims are for breach of warranty, negligence or any other reason.
   1.6. **OTHER WARRANTIES**-THIS WARRANTY IS EXPRESSLY MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESSED OR IMPLIED INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS.
   1.7. **LIMITATIONS OF LIABILITY**-NOTWITHSTANDING ANYTHING HEREIN OR OTHERWISE TO THE CONTRARY, COMPANY'S SOLE LIABILITY ON ANY CLAIM, WHETHER TORT, CONTRACT OR WARANTY, SHALL BE LIMITED TO REIMBURSEMENT OF THE ACTUAL COST OF ANY DEFECTIVE PRODUCT AND IN NO EVENT SHALL THE SELLER BE LIABLE FOR INDEMNIFICATION OF THE BUYER OR ANY THIRD PARTY ON ACCOUNT OF ANY CLAIM ASSERTED AGAINST THE BUYER OR ANY THIRD PARTY OR FOR ANY FURTHER DAMAGES WHATSOEVER, WHETHER DIRECT OR INDIRECT.
   1.8. **NO CONSEQUENTIAL DAMAGES**- NOTWITHSTANDING ANYTHING HEREIN OR OTHERWISE TO THE CONTRARY, IN NO EVENT SHALL THE SELLER BE LIABLE TO THE BUYER OR ANY OTHER PERSON FOR ANY INDIRECT, SPECIAL, INCEDENTAL OR CONSEQUENTIAL LOSS OR DAMAGES OF ANY KIND INCLUDING, BUT NOT LIMITED TO, ANY LOST PROFITS OR GOODWILL INDEMNITY, EVEN IF THE SELLER HAS BEEN ADVISED OF THE LIKELIHOOD OF SUCH LOSS OR DAMAGES AND REGARDLESS OF THE FORM OF ACTION.
   1.9. Conditions for Warranty: If Buyer is delinquent or not current in his account with Hidrostal, Buyers' rights under the Warranty shall be suspended with no further extension to the original warranty period.

Rev 01/01/2016

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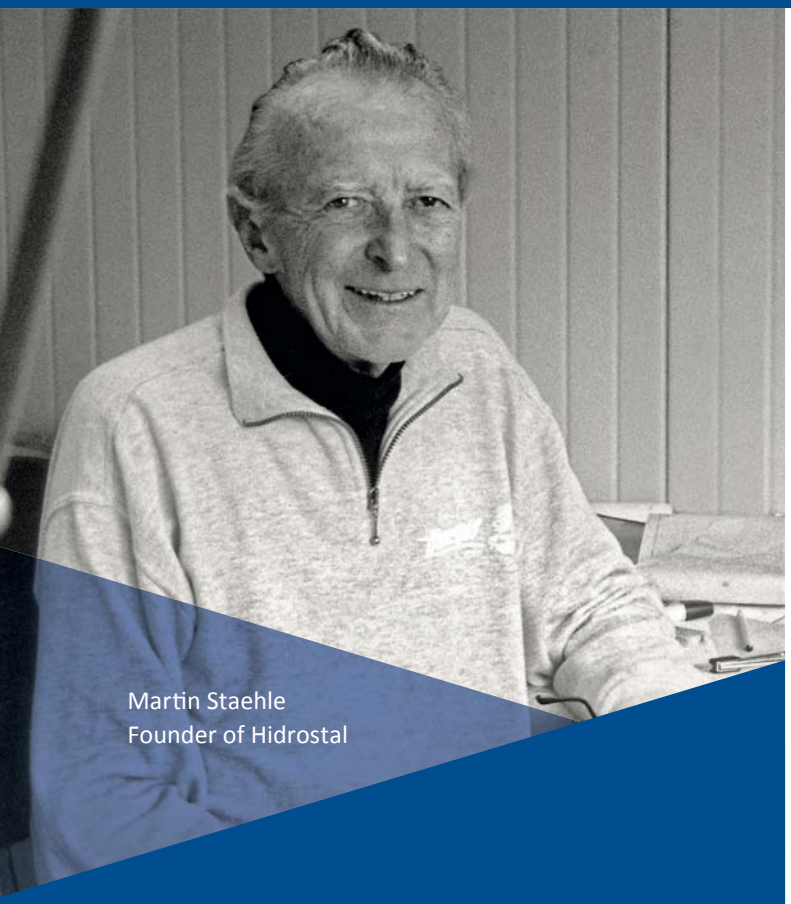
The ORIGINAL Screw Centrifugal Impeller Pump

High Quality pumping solutions for more than 60 years.
Now directly available from Hidrostal.



Martin Staehle
Founder of Hidrostal

Martin Staehle emigrated from Switzerland to Lima, Peru, in the early 1950s to seek economic opportunities that were not available in postwar Europe. In the mid-1960s a second facility, which is today the worldwide headquarters, was opened in Neunkirch, Switzerland.

Long-serving, experienced employees characterize Hidrostal.

Hidrostal - A success story for more than 60 years

The Hidrostal screw centrifugal pump was originally invented and then developed in Peru by Martin Staehle, the founder of Hidrostal.

As the company has grown Hidrostal has evolved to the point where today there are three distinct types of entities within and associated with the Hidrostal Group. These include; Hidrostal production companies, Hidrostal wholly owned sales and service companies, and Hidrostal sales partners.

Hidrostal production companies

The production companies produce our various product lines, including screw centrifugal pumps and submersible and immersible motors. Our production companies are located Switzerland, Peru, UK, Hungary and China. Hidrostal products have been and continue to be produced exclusively in these Hidrostal production facilities and nowhere else.

Hidrostal sales and service companies

Hidrostal wholly owned sales and service companies provide sales, technical support, and service for Hidrostal products. They also produce and assemble skids and pump packages and may manufacture other Hidrostal components as needed. They do not, however, manufacture the pumps and motors.

Sales partners

Our sales partners are not a part of the Hidrostal group. These are independent companies that provide sales, technical support, and service of Hidrostal products.

The Hidrostal sales strategy

In order to better serve our customers, Hidrostal is forming its own sales and service companies in key markets. Today there are 20 of these wholly owned Hidrostal sales and service companies throughout the world. In the past 3 years there have been 5 new companies formed, in South Africa, the Netherlands, USA, Australia and France. It is our plan to continue this process in other markets where we feel that it is appropriate.

Hidrostal in the North American market

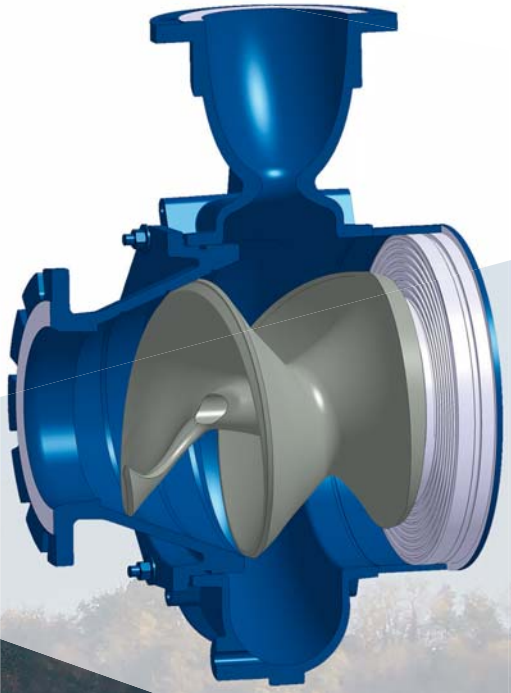
Get the «ORIGINAL»

Weir Salt Lake City (and their predecessor companies) previously represented Hidrostal in the USA and Canada as a sales partner, but have never manufactured Hidrostal pumps or motors. The pumps and motors sold by Weir under the brand name «WEMCO-Hidrostal» or similar were solely produced by Hidrostal.

Based on our sales strategy we decided to form Hidrostal USA in 2015. This decision was part of the ongoing process to better serve our customers and have a more direct relationship to the North American market. Hidrostal Pumps is located in Aurora, Illinois and cooperates with independent manufacturers representatives and distributors across the USA and Canada.

The screw centrifugal pumps and motors currently offered by Weir and branded as «WEMCO» are not designed, manufactured or supplied by Hidrostal, nor do they share the time tested performance of the ORIGINAL Hidrostal products. Please do not be fooled by sales information designed to confuse these facts. We do not assume any warranty or liability for those products nor stand with our good name behind them. Their design and manufacture lies only and exclusively in the responsibility of Weir and have no affiliation to Hidrostal.

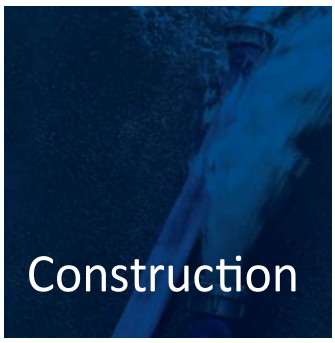
To be assured to get the «ORIGINAL» Screw Impeller Pump that has been designed, engineered, tested, manufactured and field proven for 60 years, specify only HIDROSTAL.

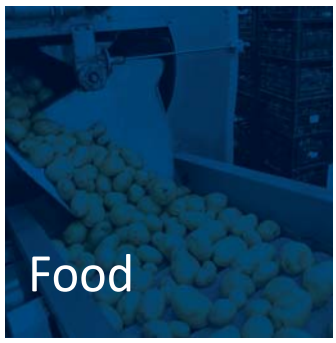


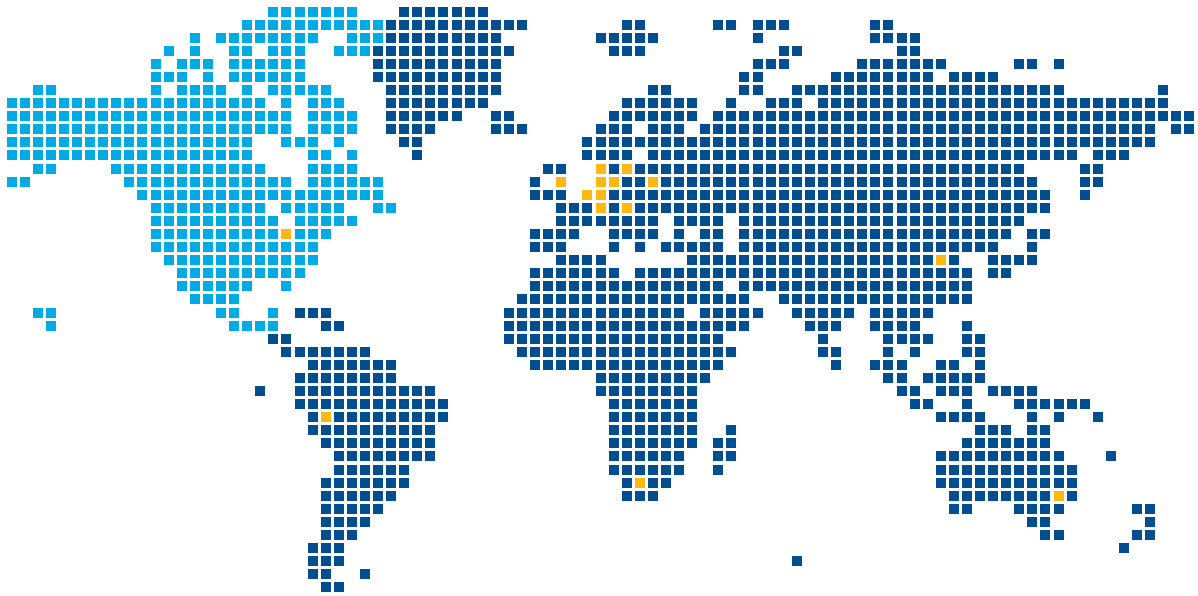
Hidrostal Pumps

Due to their outstanding characteristics, Hidrostal pumps are used in numerous municipal and industrial sectors all around the world. Our pumps are custom-made and are specially tailored to the needs of each location. Our specialists select the suitable material combinations and individually adapt every pump to the local conditions. We ensure with this process that Hidrostal pumps are successful in difficult applications and achieve the best results with respect to performance, energy efficiency and low life-cycle costs.

- → clog-free pumping
- → high suction capacity
- → gentle delivery due to low shear forces
- → high efficiency
- → stable, steep pump curve
- → long service life
- → low pulsation
- → continous flow proportional to the speed
- → high pressure stability across a wide speed range







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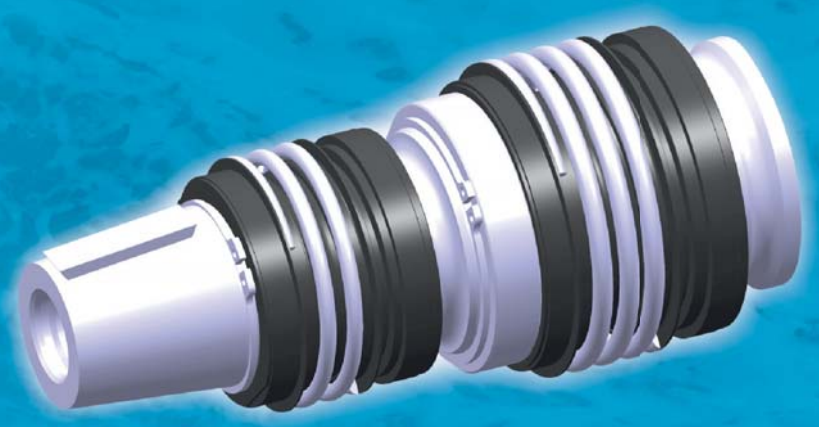
Tandem Mechanical Seal

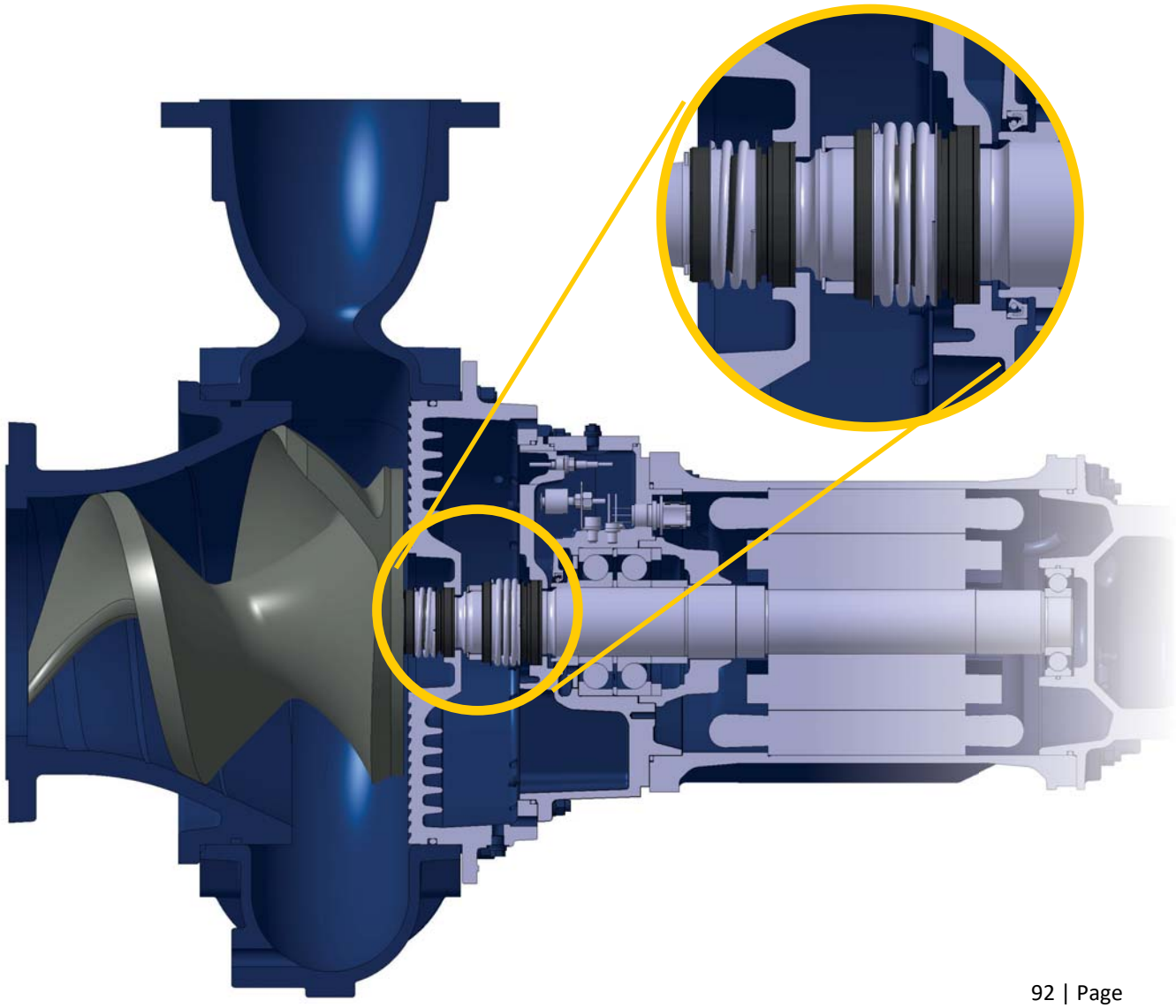
Hidrostal mechanical seals in tandem arrangement offer maximum reliability, smallest mechanical losses and long service lives with low maintenance requirements.



Performance and economic advantages

Sealed oil chamber maintains optimum mechanical seal environment

1. High Efficiency — reduces power costs. (Connected H.P. can now cost as much as $1,000 per H.P. per year.)
2. Clog-free Operation. No blockages mean minimum attention and minimum maintenance, except for periodic adjustments.
3. Gentle Action — prevents damage to delicate solids.
4. Steep Head-Capacity Curve — minimizes interruptions in capacity, prevents motor overloads, and provides additional pressure to blow out plugs.
   Flushless Tandem Mechanical Seal
5. Low NPSH requirements help to keep thick sludges and large solids moving as available suction head decreases. It also reduces installation costs.
6. Positive suction flow
   – enables pump to handle thick sludges.
7. Externally adjustable liner. Simple adjustment makes it easy to maintain as new efficiency.
8. Abrasion resistant construction — Hi-chrome iron impeller & externally adjustable suction liner provides maximum wear resistance.



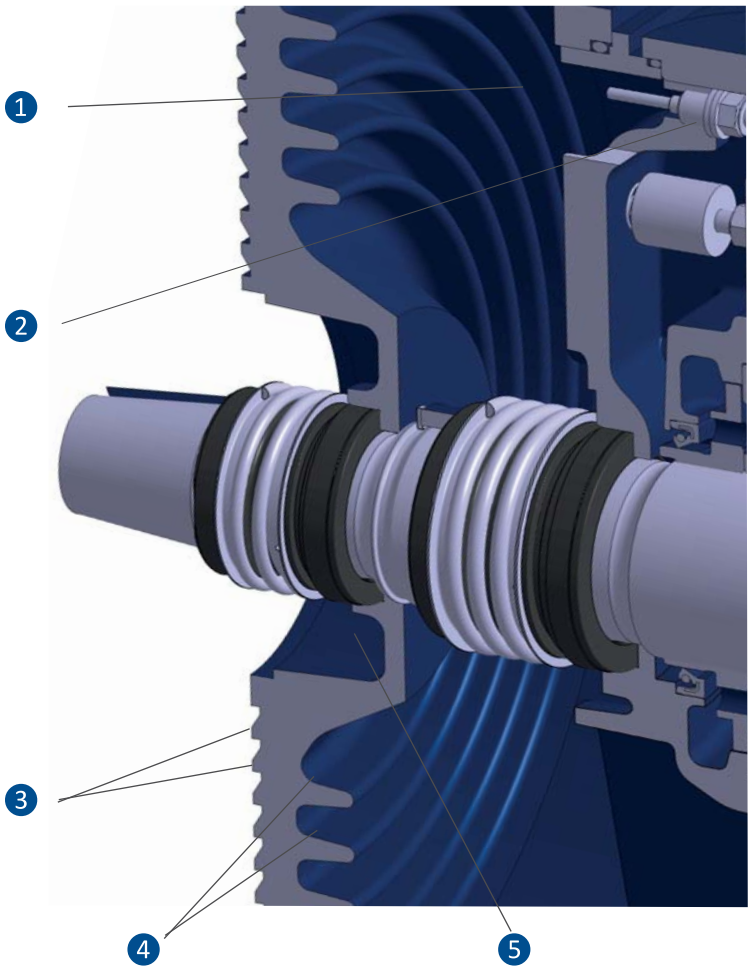
Sealed oil chamber maintains optimum mechanical seal environment

Outer Seal — protects the oil chamber from the pumpage with the toughest seal construction available. The rotating seal face is a solid tungsten/carbide running against a solid silicon/carbide stationary face.

- → Both seal faces are harder than any grit particles encountered so they grind the grit rather than being ground by the grit.
- → The combination of two different faces insures that no molecular welding can occur as can happen when two identical seal faces are used.
- → Springs are completely encased in a rubber boot or in a stainless steel bellows to avoid fouling by stringy materials.
- → Seal is dimensionally interchangeable with standard John Crane Type 21 seal.
- → For severe services, seal can be flushed through an optional flushing port.

Inner Seal — positively protects the pump bearings. The inner seal is a second line of defense that keeps the pump running even if the outer seal fails.

- → Seal is a readily available, standard John Crane Type 21 with carbon rotating and ceramic stationary faces.
- → Condition of oil in seal chamber easily checked.
- → Optional moisture probe for electronic monitoring.



1. Both seals run in a clean oil bath, lubricating springs and seal faces, permitting the pump to run dry without seal damage.

2. Optional moisture probe available for electronic monitoring.

3. A labyrinth between the pump backplate and impeller, plus pump-out grooves on the back of the impeller, keeps contaminants away from the outer seal.

4. Fins on the pump backplate allow the pump liquid to cool the oil.

5. **No Flush Benefits**

No flush required:

- → Saves hundreds of thousands of gallons of water per year per pump.
- → Eliminates seal water system maintenance and power.
- → Eliminates packing and shaft sleeve maintenance and replacement costs.
- → (For really tough sludges or other severe applications, the outer seal can be flushed through the optional flush port.)

Hidrostal Pumps

Make a quick and accurate pump selection:
www.hidrostal.com/pumpselector.php

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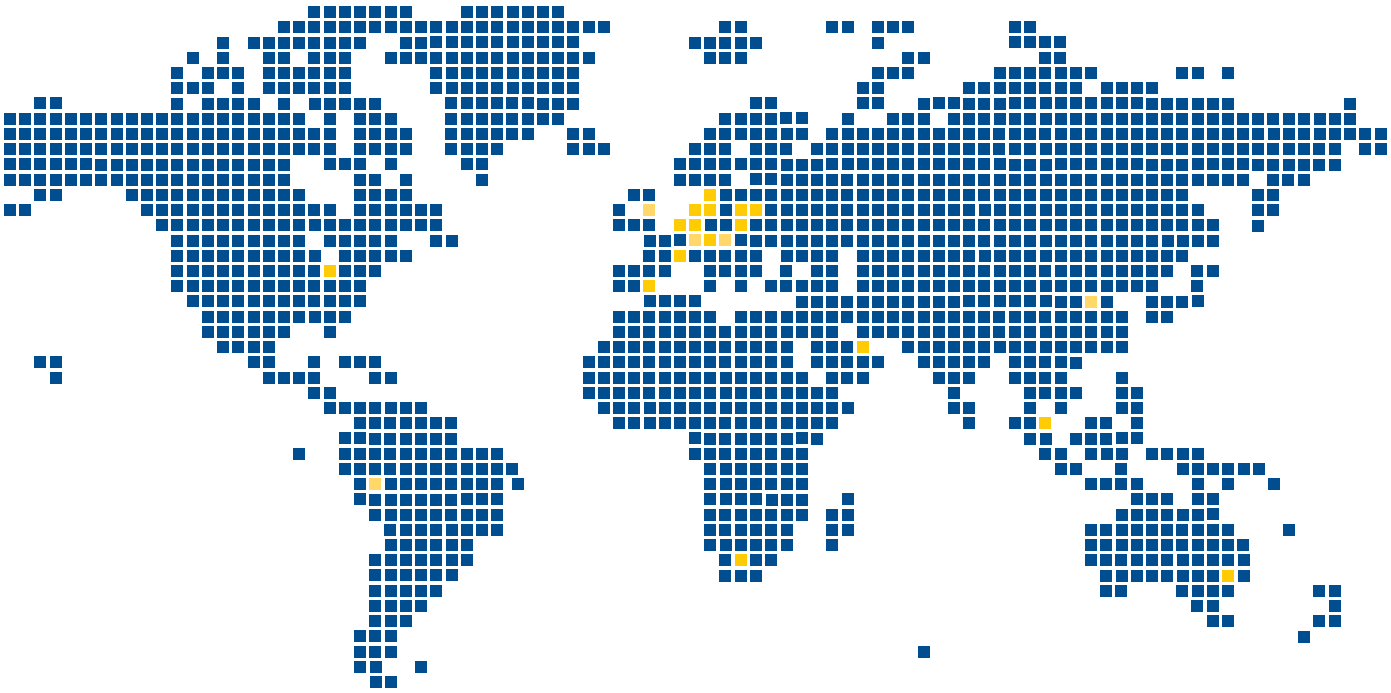

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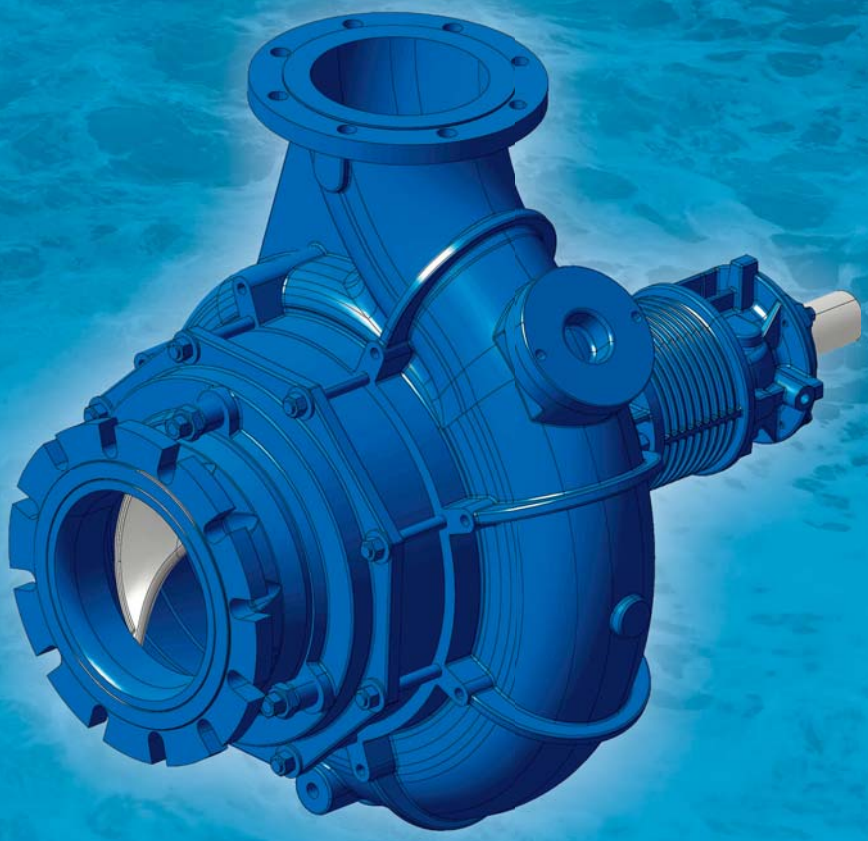
Horizontal and Vertical End Suction Pumps

A range of versatile, energy efficient bearing frame pumps, suitable for horizontal or vertical mounting and incorporating the Hidrostal Screw Centrifugal Impeller.



Bearing Frame Pumps: Horizontal and Vertical End Suction Pumps

Hidrostal offers two distinct end suction pump designs. Both designs are suitable for horizontal or vertical mounting.

Direct / Close Coupled End Suction Pump

The direct flange mounted motor is spigoted onto the bearing frame and eliminates the possibility of shaft misalignment. As additional security, a flexible coupling is also employed. The units are suitable for horizontal and vertical mounting and the back pull out design means the complete rotating unit, including the motor, can be simply withdrawn for inspection and maintenance of the hydraulic end. Available for pumps with dischange sizes of 50 to 700 mm
(2 to 28").

Long Coupled End Suction Pumps

The long coupled end suction pumps are of a traditional design, offering robust construction and long reliable service for both vertical and horizontal mounting. The standard construction has grease lubricated bearings, and oil lubrication can be provided on horizontal units to meet the requirements of process industries. The bearing housing is of modular construction, permitting various arrangements of mechanical seals or soft packing to be used. The shaft end bearings have been selected to be used with belt drives and yet maintain long bearing lives.

Product Highlights

Typical Applications

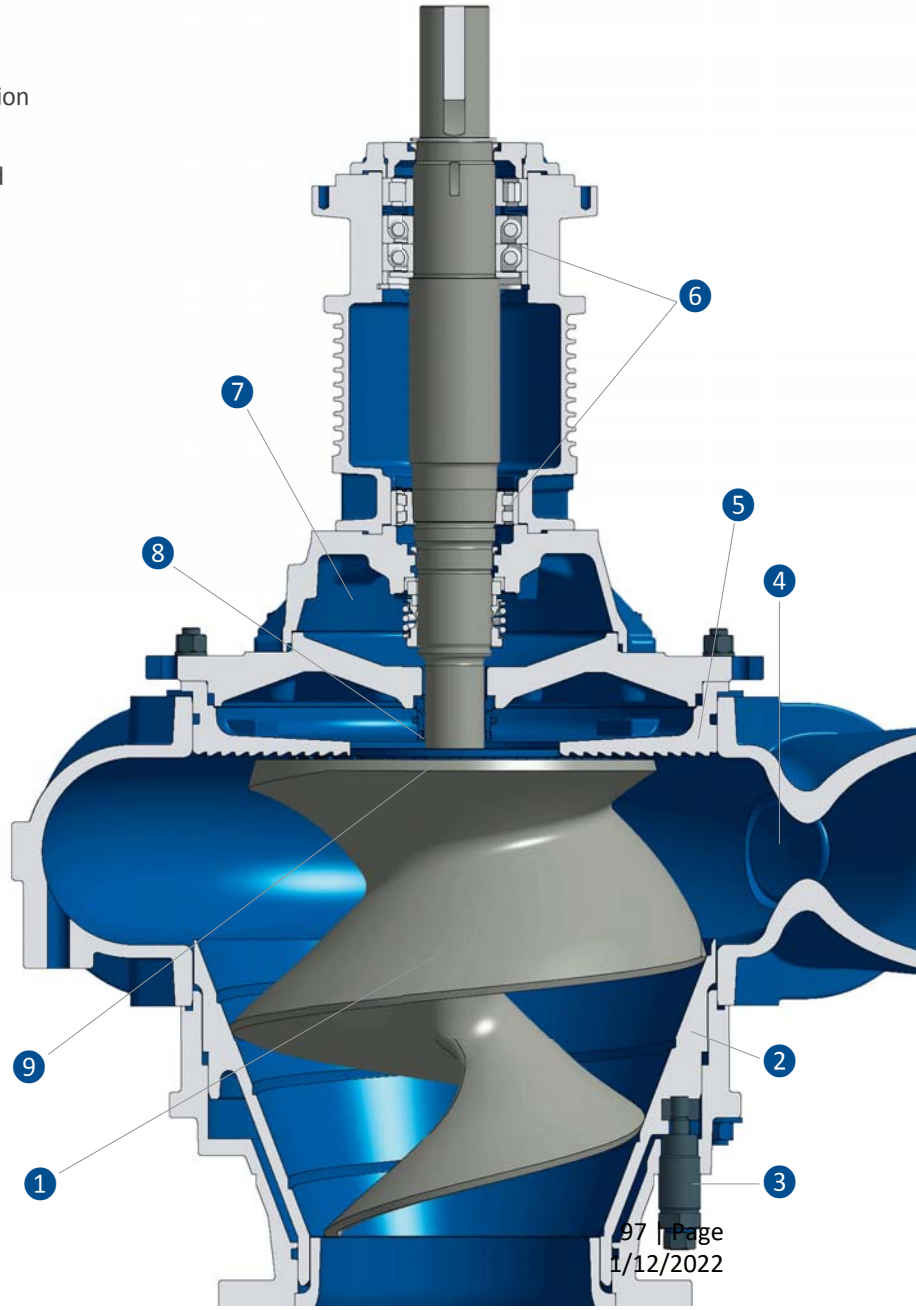
- Industrial effluent
- Raw unscreened sewage
- Viscous sludge
- Return activated sludge
- Drainage and storm water
- Process waste
- Sump cleanup
- Bacterial floc
- Live fish
- Fruits and vegetables

Specifications

- Discharge Sizes: 32 - 700 mm (1.5 - 28")
- Suction Sizes: 32 - 700 mm (1.5 - 28")
- Head: 0.5 - 90 m (2- 300 ft)
- Flow: 0.5 - 3000 l/s (7 - 47500 gpm)
- Power: 0.1 - 650 kW (0.1 - 870 HP)
- Frequencies: 50 Hz, 60 Hz, VFD
- Materials: Cast Iron, Ductile Iron, Hi-Chrome, Stainless Steel, Duplex

Advantages

- Direct access to the pump and to the instrumentation
- Maintenance in a clean environment
- Commercially-available drive elements can be used
- Robust construction for smooth operation
- Back pull-out design means the complete rotating unit can be simply withdrawn for inspection and maintenance of the hydraulic end
- Heavy duty bearings for superior L-10 bearing life in both direct or belt driven applications



1. Heavy duty impeller
2. Optional adjustable replaceable liner
3. External regulating nuts
4. Inspection port
5. Back pull-out design
6. Heavy duty bearings
7. Oversized integrated seal oil chamber
8. Multiple sealing options
9. Tapered shaft

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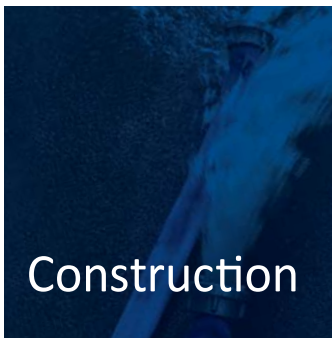

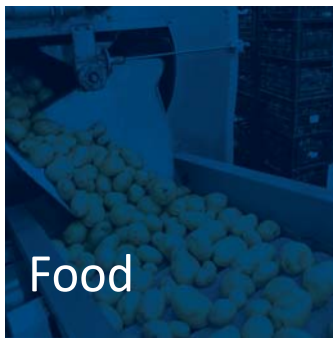

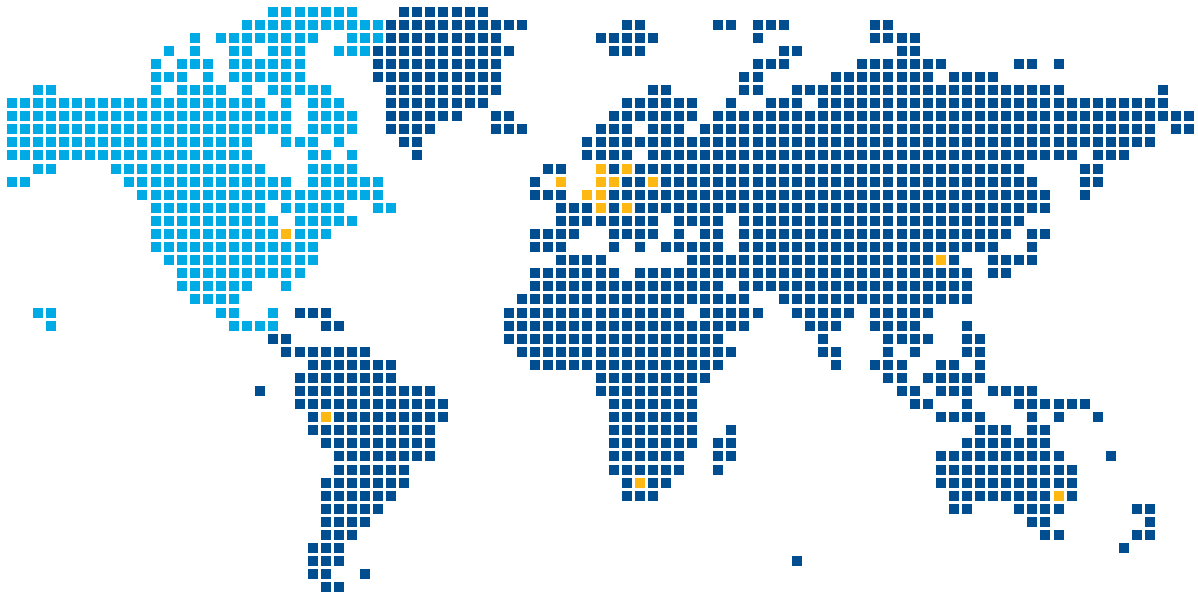

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