NIKKISO

NIKKISO NON-SEAL® PUMP

NIKKISO CO.,LTD.

NIKKISO NON-SEAL® PUMP

Nikkiso Company Limited is the pioneer to start the production of "Canned Motor Pumps" in Japan beginning in 1957 and now has become one of the largest manufacturers of the Canned Motor Pumps in the world.

Non–Seal Pump is a registered trade mark of Nikkiso and now used commonly as another term for "Canned Motor Pump".
The "Canned Motor Pump" was first created to meet the zero leakage and maximum reliability requirements of the nuclear power industry, since then, Nikkiso Non–Seal Pumps have been continually refined for these 50 years to economically meet the needs of the safety, reliability and maintainability in the chemical industry and now are widely used in general industries even for handling water.

More than 600 units of Nikkiso Non–Seal Pumps are manufactured per month at the Fluid Equipment Division of the Higashimurayama Factory in Tokyo, Japan.
To respond to the wide ranges of products and the large volumes of such required by industry, and in order to keep pace with progress in production technology, the productivity of the Fluid Equipment Division is increased yearly by utilizing the fully computorized production control systems.
While pursuing this maximum productivity, each part and component of Nikkiso Non–Seal Pumps are completely examined and inspected at each step of production to maintain high quality and reliability.

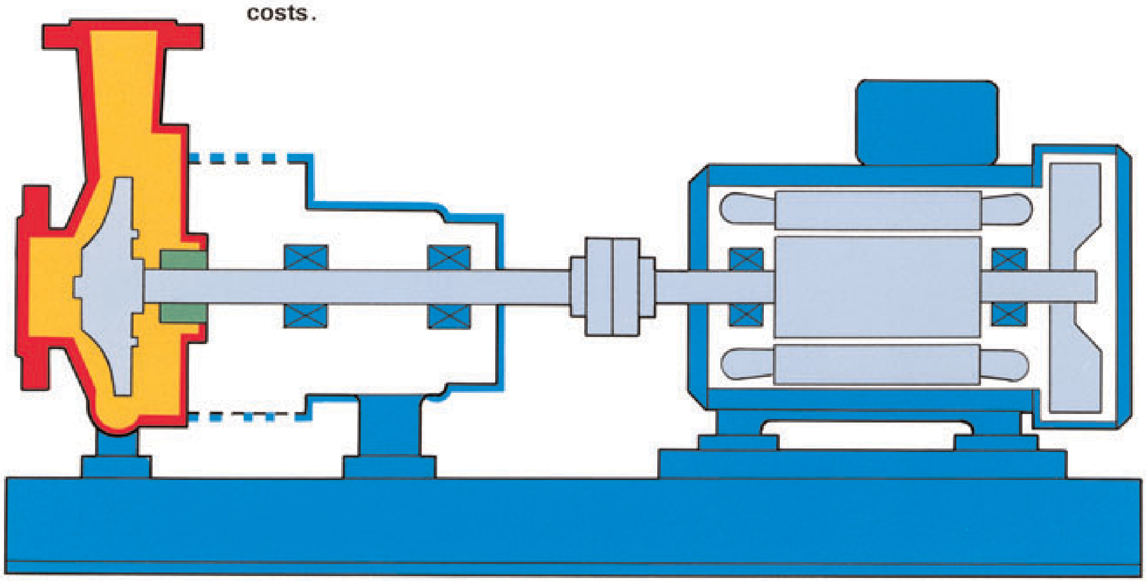
Handling Hazardous Fluids-You've got 3 choices...

1. Conventional Centrifugal Pumps with Double Mechanical Seals.

Not the Best Choice

Many factors lead to seal failure and unpredictable, massive increase in leakage. Frequent replacements of expensive mechanical seals increase maintenance costs.

— 4 pump/motor bearings
— 2 seals—leak path
— coupling
— alignment critical



- Bearing failure
- Loss of buffer fluid
- Shaft deflections from operating upsets
- Solids or dirt in process fluid (icing, coking, precipitating, etc.)
- Coupling misalignment
- Improper seal clearance setting
- Loss of cooling
- Chemical attack of seal elastomers
- Loss of seal pressure balance on volatile fluids

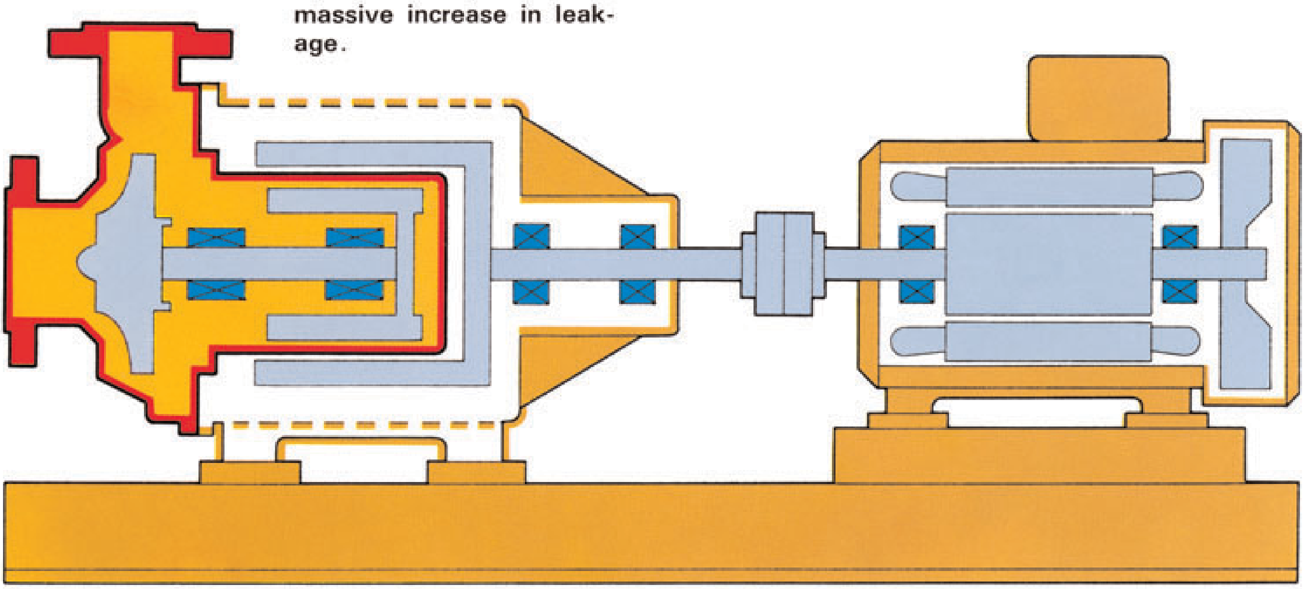
2. Magnet Drive Pumps.

Not the Best Choice

Magnet drive pumps have a single leak containment shell but many factors lead to containment shell rupture and unpredictable, massive increase in leakage.

— 6 pump/frame/motor bearings
— coupling
— alignment critical

— vulnerable single leak containment shell
— no bearing monitor



· Single containment shell vulnerable to rubbing and gall-through by both internal and external magnets.
· No secondary leak containment.
· When containment shell ruptures, outer magnet acts as a slinger.

· Locked rotor, improper venting, or dry running causes high heat generation, thermal expansion results in rubbing and containment shell rupture.
· Failure of input or impeller shaft bearings causes containment shell rubbing.

· No effective way to control bearing fluid environment—sensitive to solids and vaporization.
· No way to monitor wear of impeller shaft bearings.
· Coupling misalignment leads to input bearing failure and rubbing of containment shell.

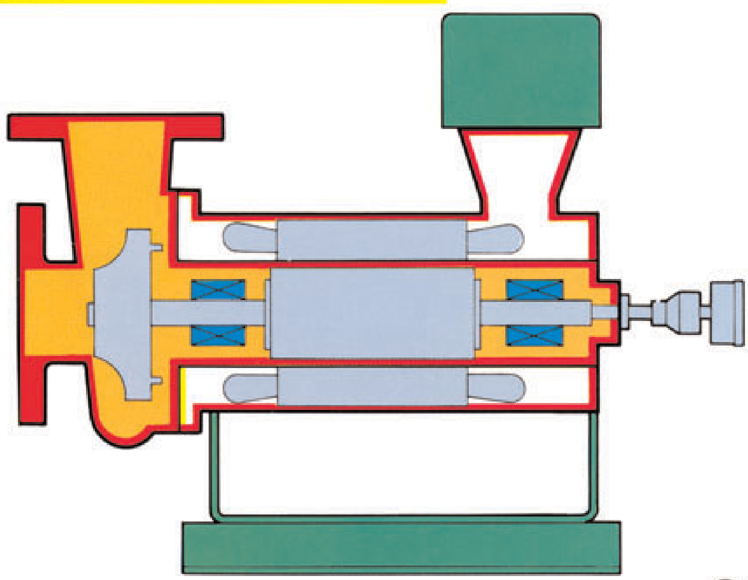
3. NIKKISO Non-Seal® Pumps.

NIKKISO Non-Seal® Pumps...The Best Choice

— 2 pump/motor bearings
— no seals
— no coupling
— no alignment required
— primary and secondary leak containment
— proven bearing monitor

Ultimate reliability comes from use of a minimum number of high reliability components and from use of a redundant secondary leak containment shell.

· No shaft seals—no leak paths
· No buffer pots to maintain
· No coupling or alignment problems
· Primary leak containment shell
· Proven bearing monitor detects bearing wear before primary leak containment shell is contacted by the rotor
· Dry stator design and sealed junction box terminal plate
· Controlled bearing environment, conservative bearing design and hydraulic thrust balancing yield average over one year bearing life



Design Benefits

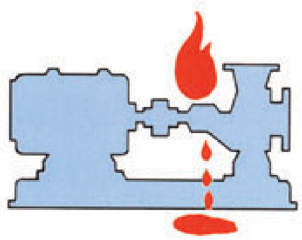
Keep your working environment safe, neat & silent, and save your maintenance cost.

Now, Nikkiso Non-Seal Pumps are not only for special services.

Design benefits lead Non-Seal Pumps to general conventional services not only for hazardous fluids but for water.

Safe—No Shaft Protrusion to Seal—No Seals to Leak

Eliminates most frequent source of sudden, sometimes massive, uncontained leakage—mechanical seals.
Minimizes risk of fire and explosions, burns, immediate, and long term health problems and prevents escape of unpleasant odors.

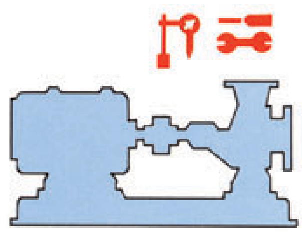


Vacuum Tight & High Pressure Resistance

Hermetically sealed design prevents air contamination of process liquids under vacuum conditions and easily increases static strength of whole pump motor unit even up to 800kgf/cm^{2}G (11,378psig).
Also ideal to handle fluids of High Temperature, High Melting Points or Extremely Low Temperature.

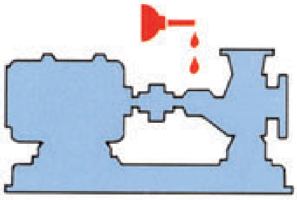
Stays on Line—Not in the Shop

Average bearing life of over 1 year means lower maintenance cost and less exposure to risks associated with repair of equipment used for hazardous fluids. Proven bearing monitor detects wear before motor is damaged.



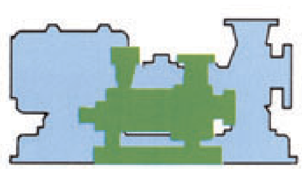
Field Repairable

No shimming or clearance setting required.
Bearing replacement time usually is less than 1-1/2 hours.
Over 70% of conventional pump repairs are for seals, pump bearings and couplings with average repair frequency of only 1 year.



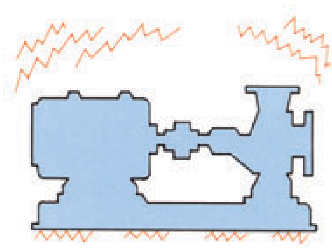
Low Routine Maintenance

No motor bearings to lubricate or replace, no coupling alignment or lubrication, no pump bearings to lubricate, no buffer pots to fill.



Small, Compact and Self Contained

The integral pump and motor makes efficient use of space (about half the space required for a conventional centrifugal pump). Installation costs are reduced with minimal foundation requirements.



Low Noise & Vibration

Totally enclosed with neither motor fans nor exposed bearings. Typical noise levels and vibration amplitudes are 60-65 dB(A) and 15-20μ peak to peak respectively

Bearings

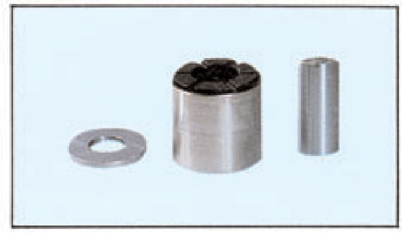
Average bearing life of over 1 year has been demonstrated on over 70,000 units in operation.
This means that average mean time between planned maintenance is over 1 year since the few other parts required for this single pump/motor combination are not subject to wear in typical operation.

Requirements for long bearing life are simple. Design based on years of field experience combined with selection of the right type pump assures bearing environment necessary for long life.

Thrust is hydraulically balanced so that thrust bearings are normally loaded only during start up and upset conditions.

Clean liquid to lubricate and remove heat. A slurry type which utilizes a clean external flush for the motor has been developed for process streams which contain solid particles.
Normally clean process liquids are satisfactory for lubrication and cooling using Basic and other types.

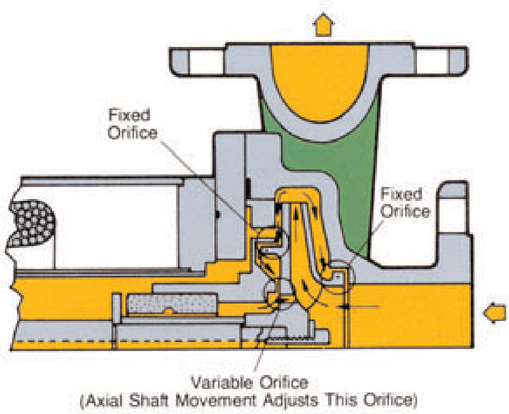
Liquid not vapor. Reverse circulation type has been developed to maintain pressure in bearing area substantially above suction pressure to avoid flashing of liquids having steep vapor pressure vs. temperature curves.



Shatter proof materials. Use of shatter proof materials which do not cause secondary damage when momentarily run dry is adopted.

All new wear surfaces are installed by replacement of shaft sleeves and thrust washers to establish like new surface finish and clearances.

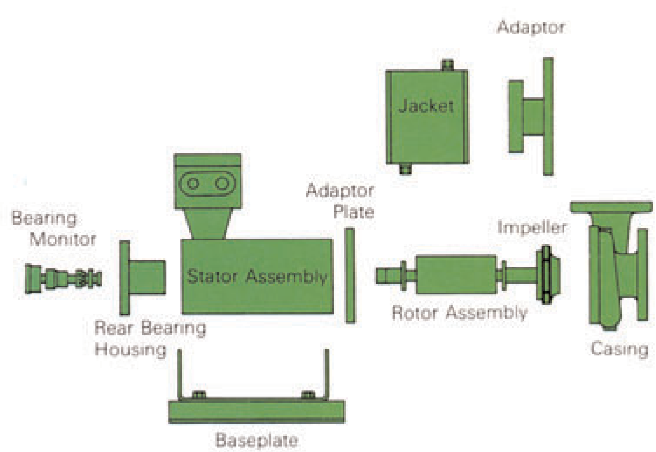
Automatic Thrust Balance



The hydrodynamic action of a set of fixed and variable orifices provides automatic thrust balancing to center the shaft between thrust bearings. This eliminates thrust bearing wear during normal operation. Contact between the replaceable thrust washers and the thrust face of the carbon bearings occurs only during start up and upset conditions such as loss of suction. By controlling thrust loads at the impeller, motor cooling flow is not affected by shaft position.

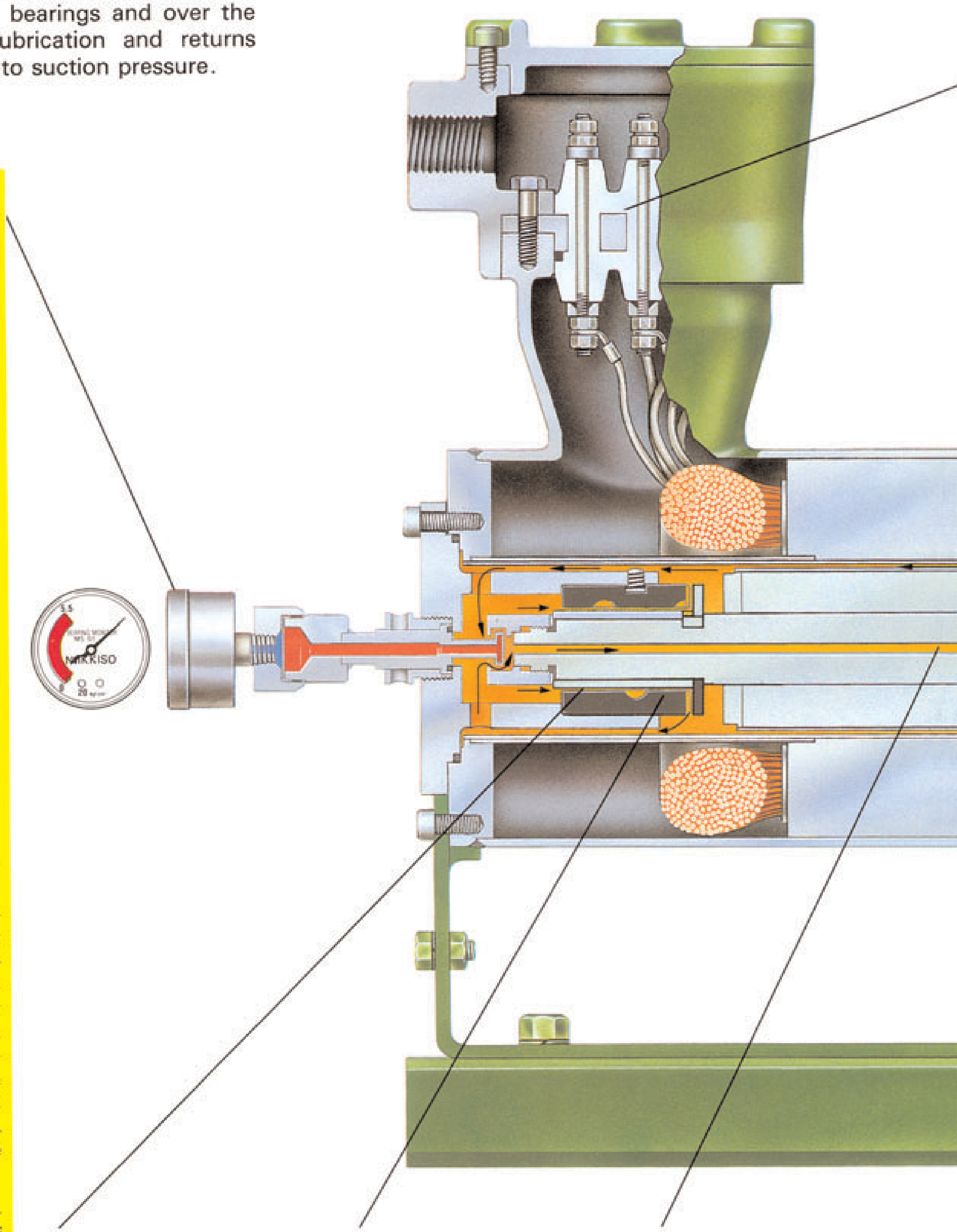
Building Block System

Nikkiso Non-Seal Pumps are only one in the world applying the building block system to the canned motor pump. Wide interchangeabilities of pump modules and motor modules are available and these modules can be freely combined, so it is possible to minimize numbers of spare pumps, motors and numbers of parts in stocks. This also makes on site repair possible.



Type HN Basic

Suitable for a broad range of clean , nonvolatile liquids with moderate temperatures.
Fluid at approximately 60% of discharge pressure is circulated through the bearings and over the rotor for cooling and lubrication and returns through the hollow shaft to suction pressure.



Bearing Monitor (Patented)

The standard bearing monitor solves the most basic problem common to all sealless pumps —detecting normal bearing wear so that routine maintenance can be accomplished before serious motor damage occurs. It responds to bearing wear in both the axial and radial directions and is over 98% effective on 70,000 operational units.
The design is uniquely simple. The interior of the monitor contains either pressurized inert gas or is kept at atmospheric pressures depending on operating conditions. The end of the monitor has a contact tip which is fitted within a cavity in the end nut on the rotor shaft. Clearances between the contact tip and the end nut correspond to the maximum allowable bearing wear.
As normal bearing wear (either radial or axial) occurs, the clearances between the stationary tip and rotating end nut converge. At maximum allowable bearing wear the tip is contacted and ruptured, prior to physical contact between the rotor and stator. The resulting change in pressure within the interior is displayed on the face of the monitor. A pressure switch for remote alarm/shutdown is optional.

In addition, the monitor is useful in detecting corrosion of the stator liner and rotor sleeve since the contact tip is supplied in the same metallurgy but about one-half the thickness of those components.

Shaft Sleeves

Available in a variety of surface treatments to suit the specific fluid applications. Replaced when bearings are changed for like new wear surfaces and clearances.

Bearings

Available in a variety of materials to suit the specific fluid application.

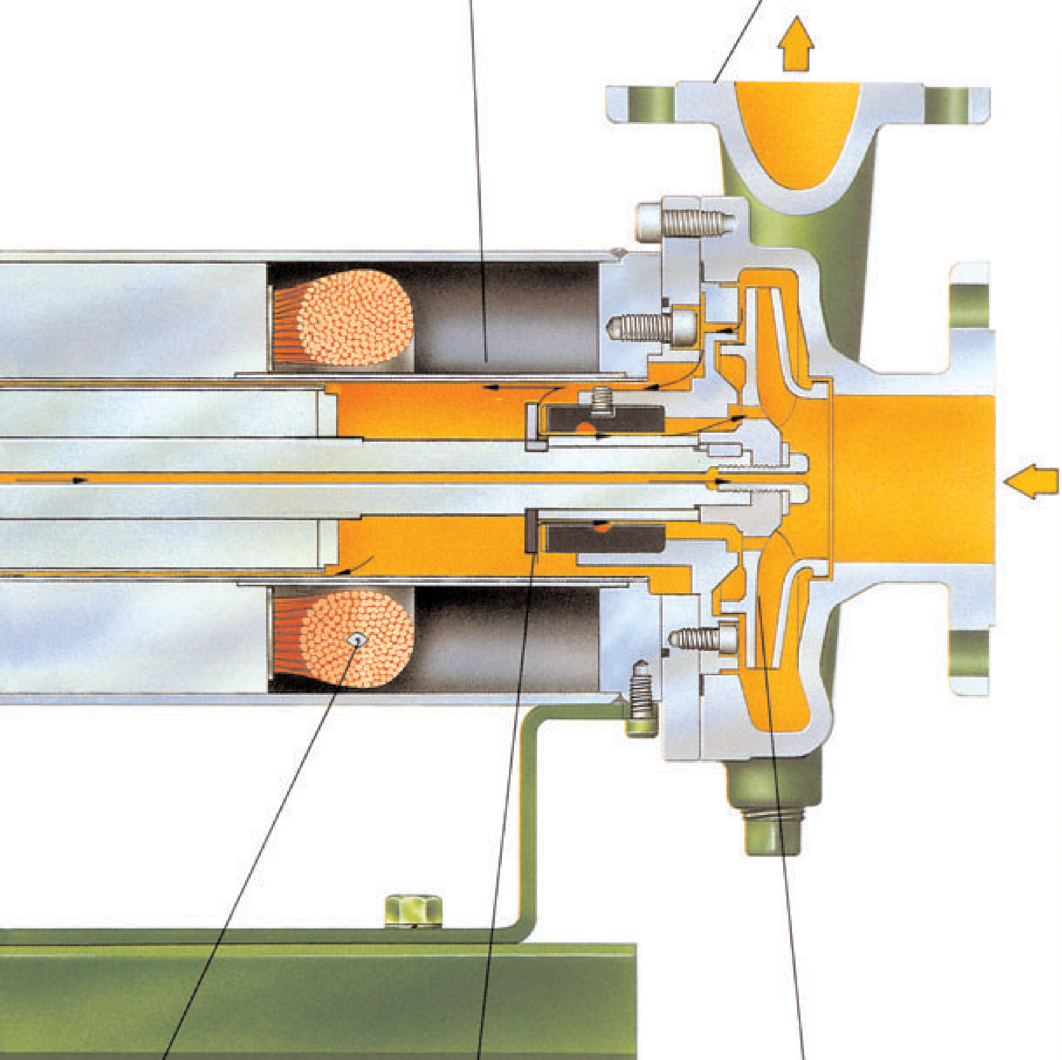
Hollow Shaft (Basic Type Only)

Assures motor cooling and prevents vapor collection at the bearings.

Terminal Plate
O-ring sealing for positive secondary fluid containment.

Dry Stator
Eliminates oil pressure relief valve required for oil filled stators. Integrity of secondary leak containment shell is maintained.

Flanges
Self venting centerline discharge.



Motors

In the NIKKISO Non-Seal® Pump design, the entire outside of the motor is enclosed in a secondary leakage containment shell or can. Primary leakage protection is provided by corrosion resistant liners which are seal welded and 100% leak checked to assure that pumped fluid does not contact the stator windings or rotor core. There is no shaft protrusion to seal and thus no seals to leak.

Pumped fluid is circulated in the area between the rotor and stator liner to cool the motor, and lubricate the bearings.

Motor windings and insulation system are specially designed, developed and applied as an integral part of the pump so that design life is at least as great as for conventional air cooled motors.

Winding temperature is primarily influenced by pumped fluid temperature and secondarily by use of cooling jacket. Fluid temperature is considered in pump application to assure full winding life. Thermostats are embedded in the hot spots of windings for shutdown in case of overheating.

Thermostats
Embedded in the hot spot of the windings for protection against overheating.

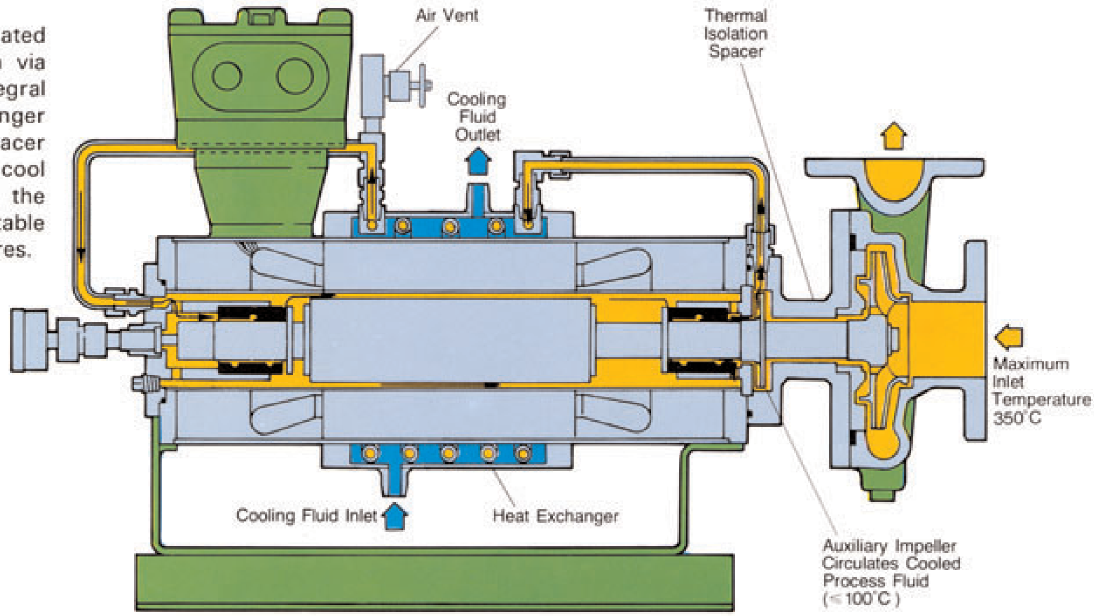
Thrust Washers
Absorb thrust loads during upset conditions and provide back-up to hydraulic thrust balancing.

Impeller
High efficiency design, open and closed configurations.

(Optional flow inducers available for minimum NPSH requirements.)

Type HT High Temperature with Cooling

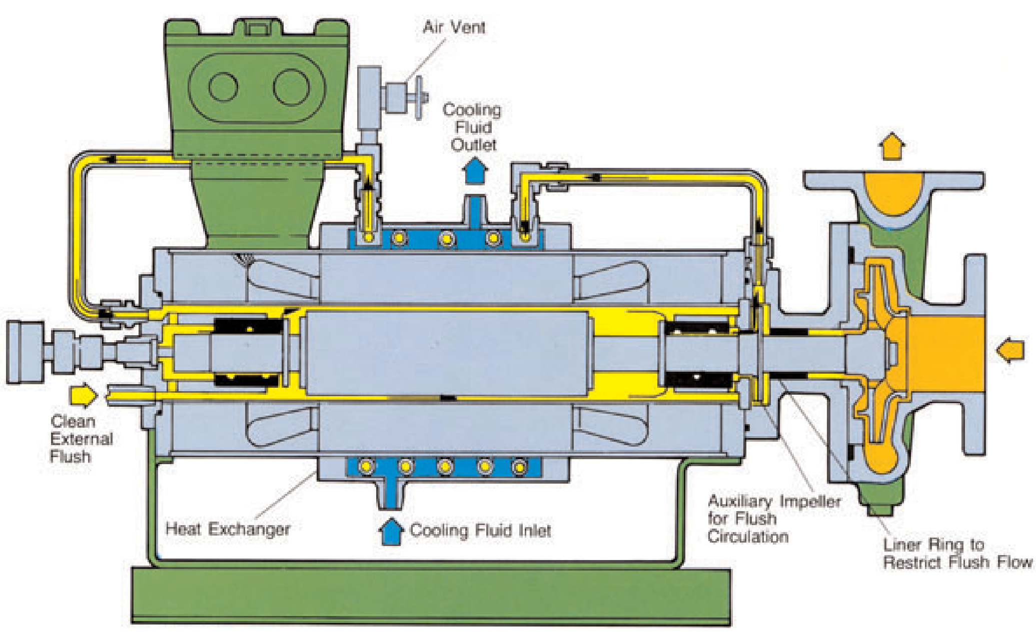
Designed for hot fluid applications. Maximum suction temperature 350°C(662F).
Process fluid is recirculated within the motor section via an auxiliary impeller. An integral shell and coiled heat exchanger and thermal isolation spacer are provided to maintain cool fluid temperatures within the motor, and maintain acceptable motor winding temperatures.



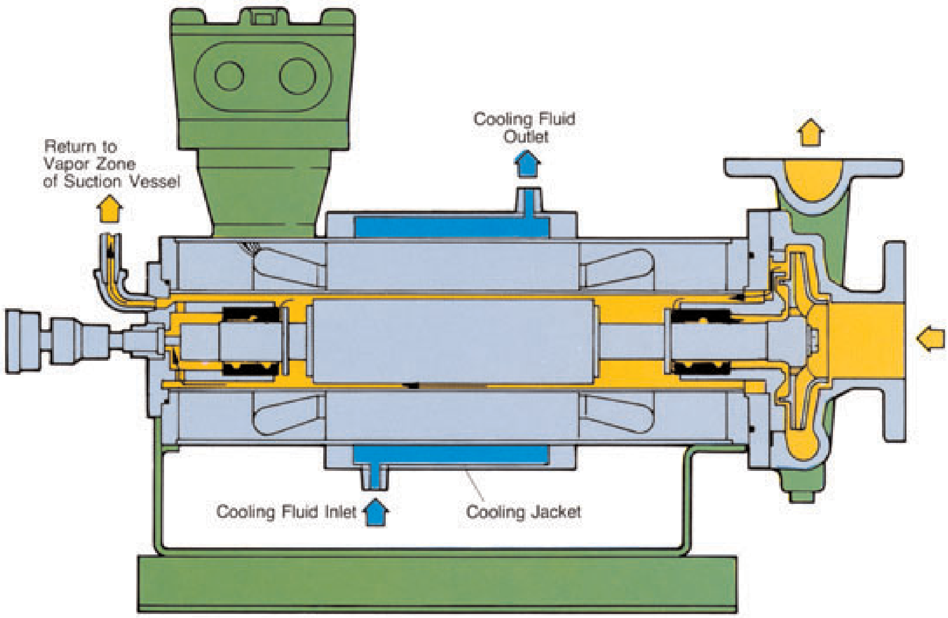
Type HS Slurry

Designed for fluids with suspended solids.

A clean, compatible buffer fluid supply is required and is constantly recirculated within the motor section to provide cooling and bearing lubrication and to prevent solids migration into the motor.
Recirculation is accomplished by use of an auxiliary impeller. An integral heat exchanger is provided to remove heat from friction and electrical inefficiency. Buffer fluid loss to process is minimized by a close clearance bushing (Liner Ring) between the motor and pump end. Although a buffer fluid is required (similar to conventional pumps with double seals) there is no shaft protrusion to seal and no seals to leak.

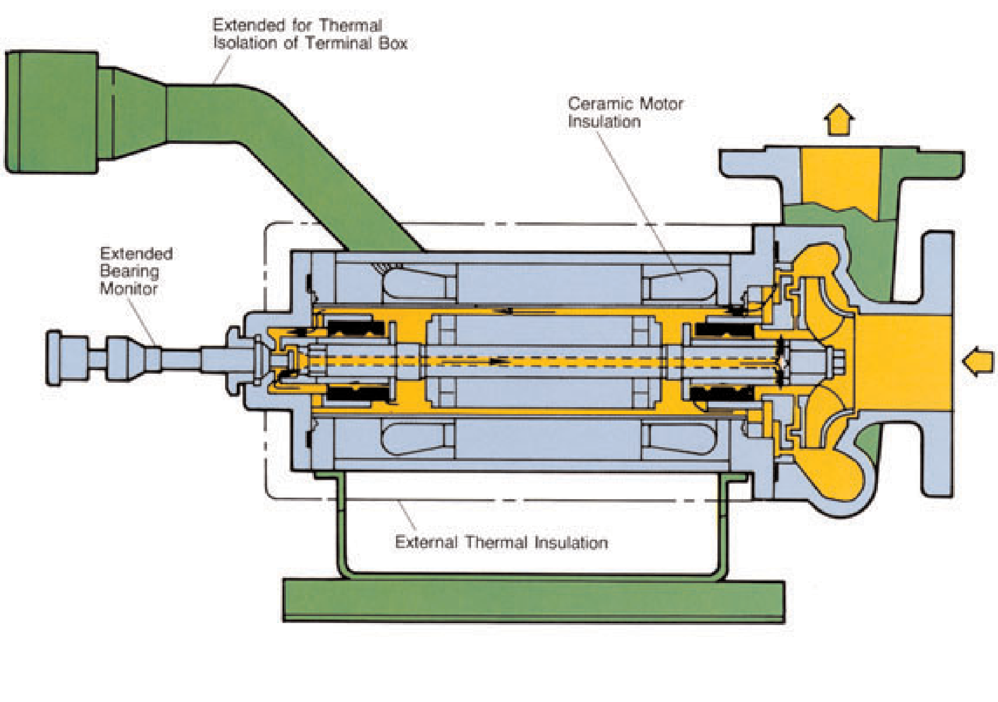


Type HQ Reverse Circulation



Designed for fluids with steep vapor pressure curves which would tend to flash to vapor if retuned to impeller eye after picking up motor heat.
The type HQ utilizes a reverse circulation flow through the motor to the vapor zone of the suction vessel. The return line is throttled to maintain high pressure liquid within the motor and also serves as a vent line normally installed for this type fluid.

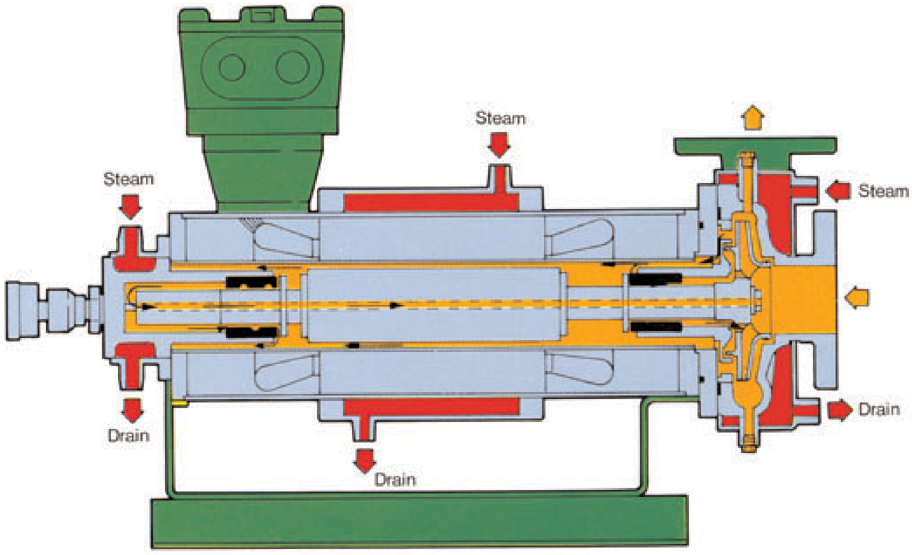
Type HX High Temperature No Cooling Required



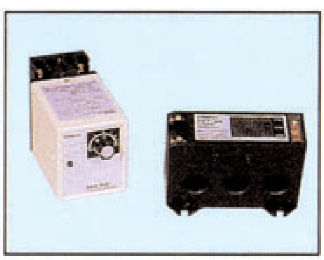
Designed for hot fluids (maximum 400°C(752F)) without cooling. The type HX utilizes an exclusive all ceramic motor insulation system and can be externally insulated for maximum system thermal efficiency making it ideal for heat transfer oil services. Optional jacketing in conjunction with the ceramic motor insulation system makes the HX well suited for handling high melting point liquids (above 140°C (284F)) which would exceed the temperature limits of normal organic motor insulation materials.

Type HB Jacketed for High Melting Point Liquids

The Type HB features complete jacketing of the pump case, motor stator and rear bearing housing for precise temperature control when handling fluids with melting points in the range of ambient to 140°C (284F).



Options



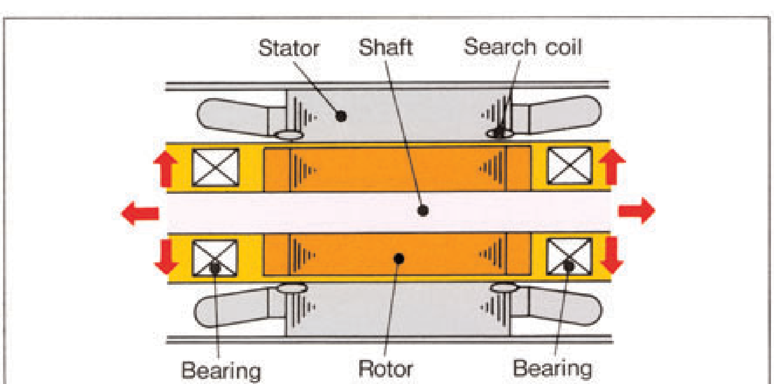
Dry Operation Protection

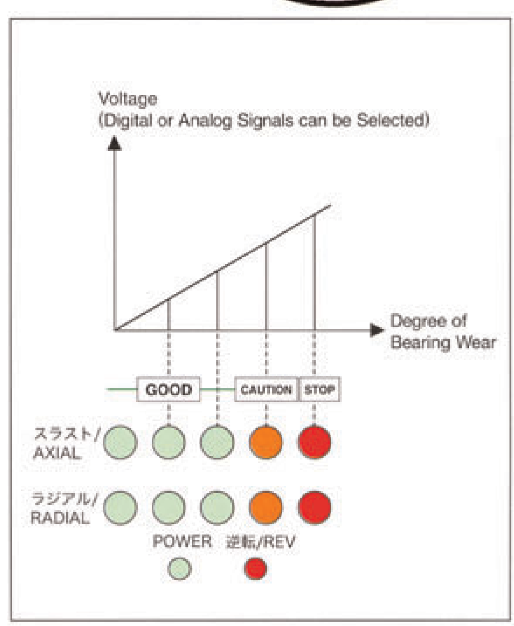
A load current sensing relay protects the pump from dry operation on services such as truck/tank car unloading. It detects low load resulting from dry operation and provides for shutdown of the motor.

Indicator
(Design Registration Pending)

E Monitor (Patent Pending)

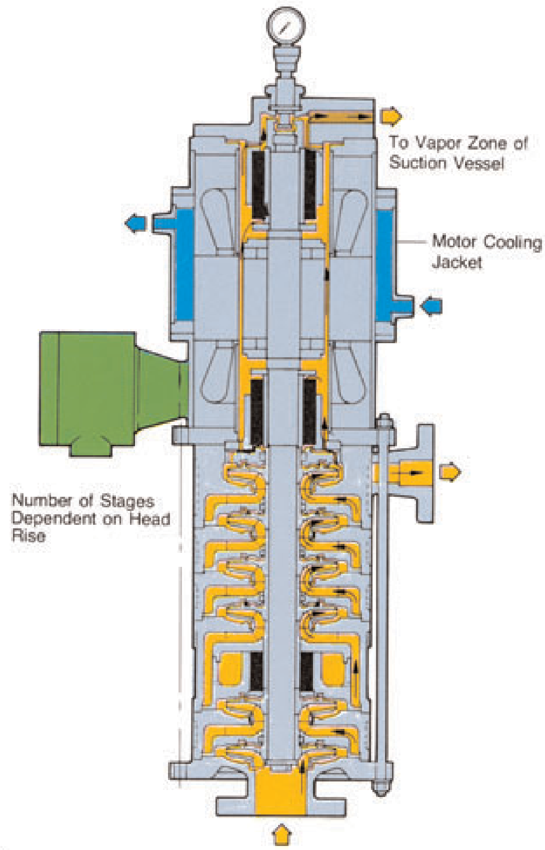
〔Reliable bearing monitoring system for detecting Bearing Wear〕
When bearing wear occurs, the rotor assembly shifts along the radial and/or axial position. These minute shifts are detected by eight search coils embedded in the stator, enabling precise readings of bearing wear in both directions. Real-time bearing status is conveniently displayed on an easy-to-read LED display.





Additional Configurations

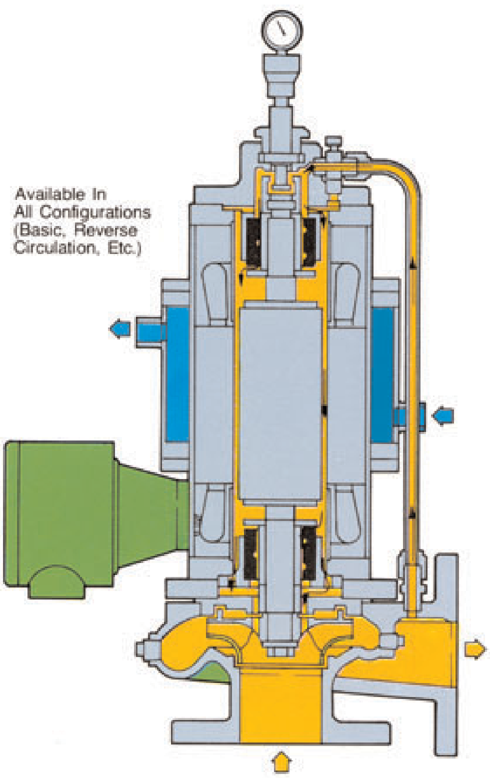
NIKKISO Non-Seal Pumps are available in a wide range of additional configurations to assure reliable operation for more specialized requirements.



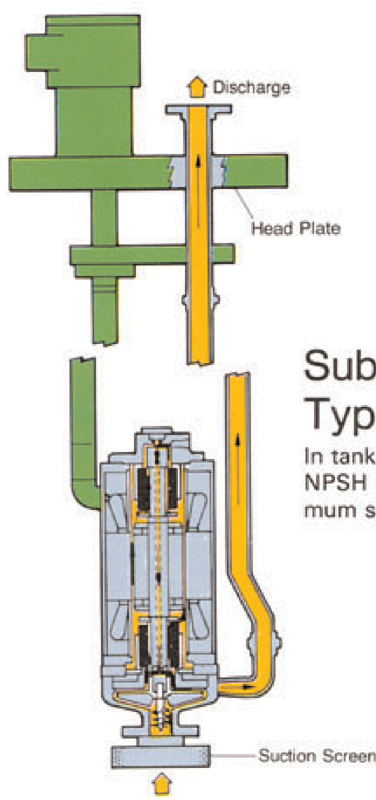
Multistage Type

Efficient operations in high head applications (Reverse circulation configuration shown)

Vertical Configuration
(Motor Over Pump)

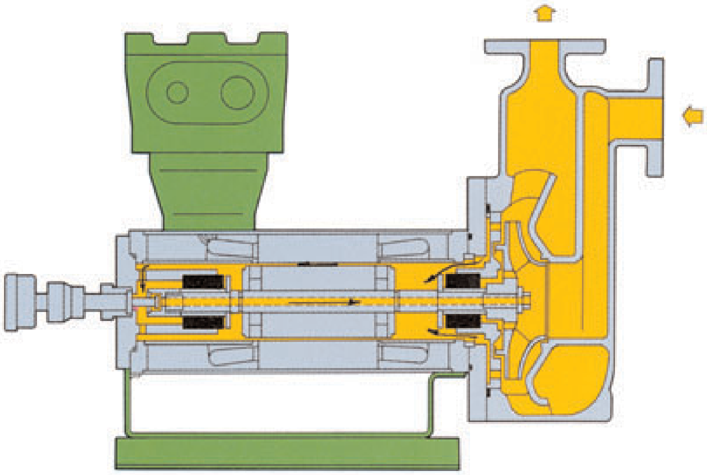


Minimizes radial load on bearings by transferring load to axial direction and then floating the entire rotor via hydraulic thrust balancing. Easier to disassemble large, heavy units. Assures positive venting on volatile fluids.



Submersible Type

In tank mounting for minimum NPSH requirements and maximum safety

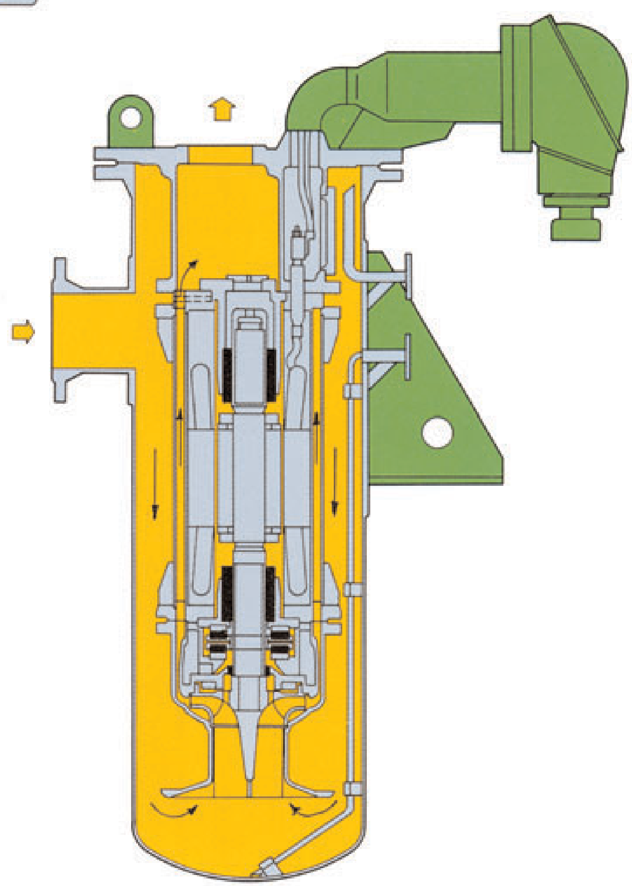


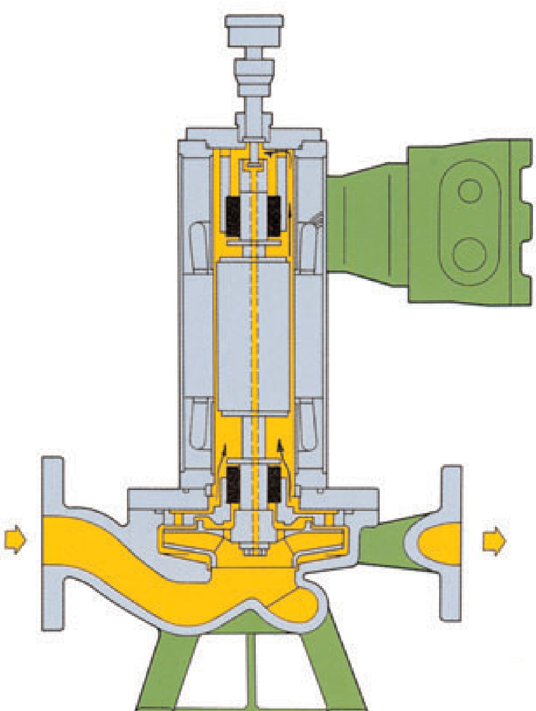
Self-Priming Type

Self-priming volute casing without flap valve minimizes clogging troubles
Suction lift of max. 7m (Nearly 23ft.) from underground tank is possible.

Submersible Pit Barrel Type

Suitable for liquefied gases.
In pot mounting for minimum NPSH requirements and for large capacities and high heads.

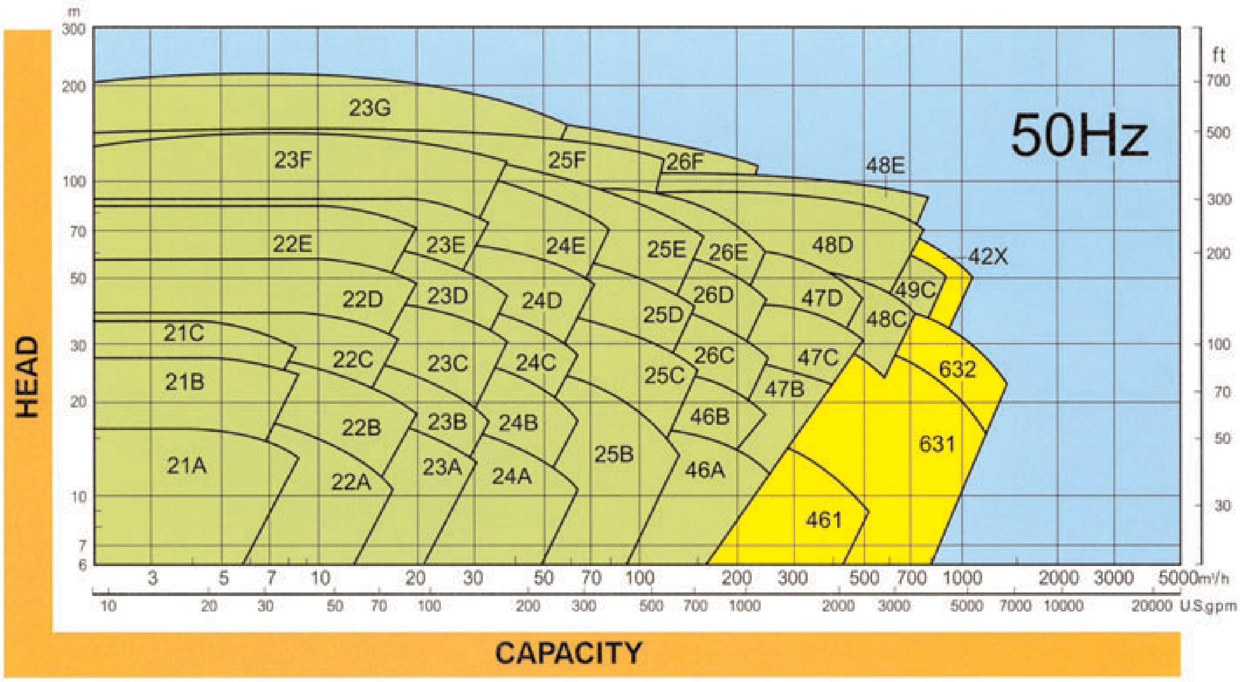


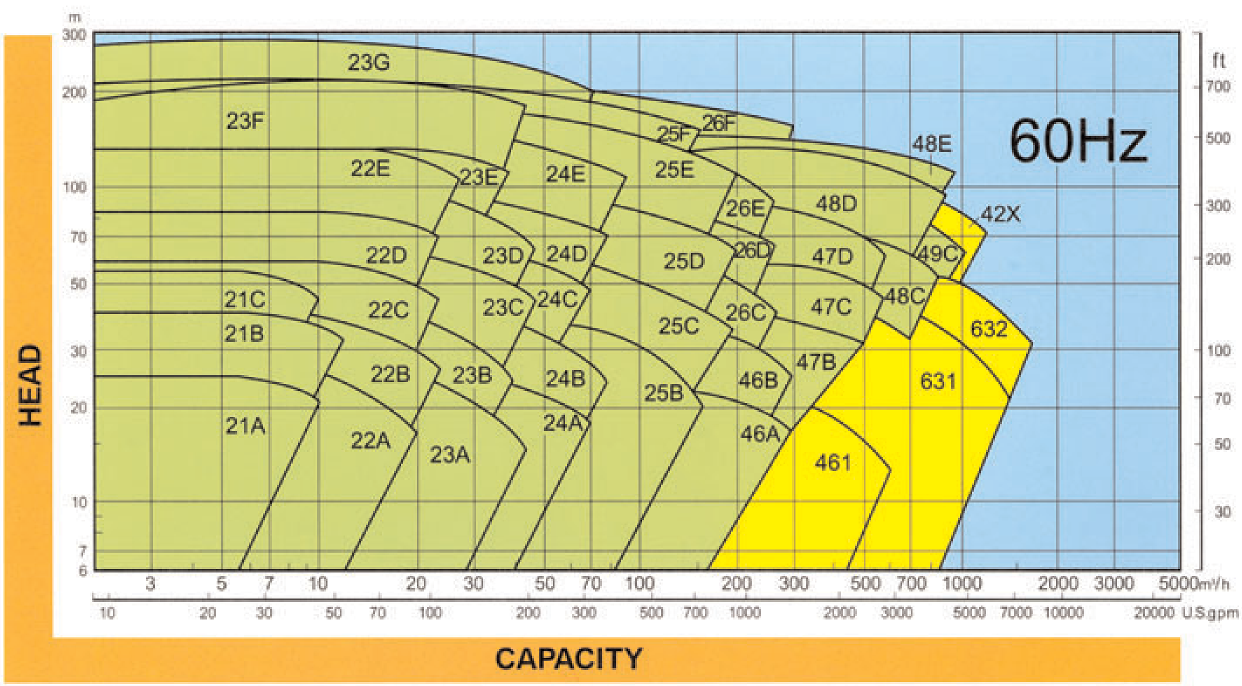


Vertical In-Line Type

In-Line position of suction and discharge nozzles makes piping works easy and minimizes installation space.

Head-Capacity Envelope



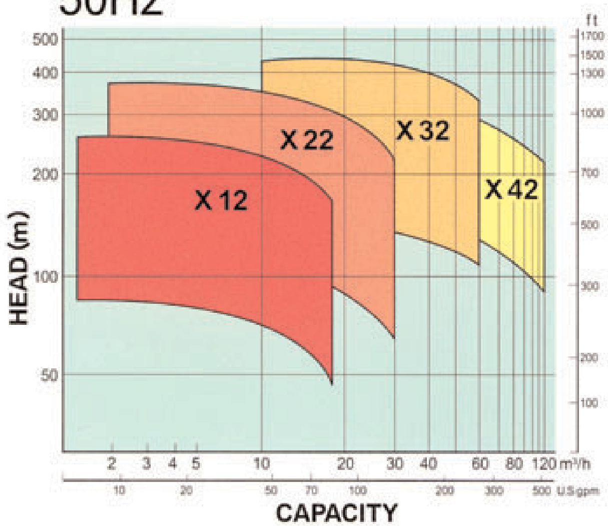


Specifications

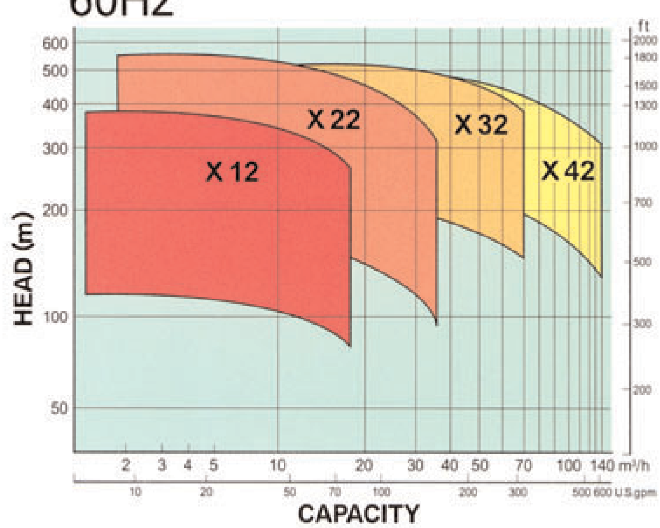
	Standard	Semi-Standard
Head-Capacity	Max. 210m − Max. 800m³/h (Max. 690ft − Max. 3,520U.S.gpm)	Max. 500m − Max. 2,400m³/h (Max. 1,640ft − Max. 10,600U.S.gpm)
Temp	−50°C ~ +350°C (−58F ~ +662F)	−200°C ~ +450°C (−328F ~ +842F)
Sp. Gr.	0.3 ~ 2.0	Max. 13.6
Viscosity	Max. 200mPa·s (Max. 200cp)	Max. 500mPa·s (Max. 500cp)
Design Pressure	1/2/4MPa (150/300/600psig)	Max. 80MPa (Max. 1,200psig)
Liquid End Materials	Ductile Iron, Stainless Steel	Nickel Alloys (Ca-20, Hastelloy, etc.) Titanium, Zirconium, etc.
Motor kW	0.4 ~ 132kW (0.54 ~ 177Hp)	140 ~ 270kW (187 ~ 362Hp)
Explosion-Proof	Flame Proof d2G1, G2, G3, G4, to JIS	(Ex) sd3nG1, G2, G3, G4, G5, to VDE (+/S) (Ex) dB3T3, dC3T4, dD3T5 to SEV (UL) Class I, Div. 1, Gr. C & D. T4A, T3C E-78432 (N)

Head-Capacity Envelope for Multi-Stage

50Hz



60Hz



Inquiry Data

1. Liquid Pumped

* Name (________________) Conc. (______%) * Spec. Grav. (Max.______ Nor.______)
* Temperature (Max.____°C/F Nor.____°C/F Min.____°C/F) Melt.point (____°C/F) * Viscosity (Max.______ Nor.______)

Vapour Pressure (Max.______ Nor.______) Specific Heat(______)

* Suspended mt'ls (Yes) (No) Name(______) Conc.(_____) wt.% Grain Size (Max.______ Nor.______)

Spec. Gravity(______) Viscosity (Mother Liquid______ Apparent ______)

Remarkable Characteristics (________________)

(Adhesiveness, Sedimentation, Hardness, Shape, Solubility, Degeneration Grain-Size Distribution)

Others (________________)

(Corrosion/Erosion, Compressibility, Boiling Point, Crystallization, Thermal Conductivity, Polymerization, Degeneration, etc.)

2. Pump Specifications (Required Characteristics)

Pump Type (Normal, Self Priming Type, Submerged)

Impeller Type (Open, Closed) only when requested

* Capacity (Max.______ Nor.______ Min.______) * Total Head (____m/ft.) Differential Pressure (______)
* Suction Pressure (Max.______ Nor.______ Min.______) Dis. Pressure (Max.______ Nor.______ Min.______)

Pump Operation (Independently, In Series, In Parallel)

Back Flushing (Yes) (No) Liquid (______) Temperature (______°C/F) Pressure (______)

Starter (Direct・Transformer・Reactor)

Operating Condition (Continuous, Intermittent ______hr/day)

Connection Box Cable Entry (Steel Conduit Type, Bell Mouth Type, Packing Type)

Liquid End Materials (______) Flange St'd (Suc.______ Disc.______)

Jacket (Yes) (No) Heating/Cooling Medium (______) Temp. (______°C/F) Press.(____)

Others.

(Material Selection, Restriction to Dome Curve, Suction Height, Submerged Depth, Back Flushing Volume Limit Flange Direction, Designated Motor Revolution Speed, Possibility of Operation with Water, Impeller Diameter Limit etc.)

3. Installation Condition

Ambient Temp. (Max.______°C/F Nor.______°C/F Min.______°C/F) Elevation (______)

* Location (Indoor, Outdoor) Mounting (Horizontal, Vertical, In-Line)
* Electric Source (3φ____Hz ______V) * Explosion Proof Class (______)

Applicable Regulations(________________)

Utility (________________)

(Cooling Water, Stem, Electric Source for Instrument, Gas etc.)

Others (________________)

(Installation Space, Designated Motor Insulation Class, Noise, Vibration Limit, Piping Load etc.)

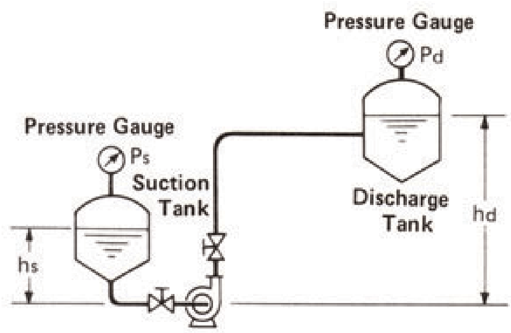
4. Piping Condition

* NPSHA (______m/ft.)

(Suction Side) Ps(______) hs(______) Dp1(______)
Lp1(______) Le1(______) Pv(______)

(Discharge Side) Pd(______) hd(______) Dp2(______)
Lp2(______) Le2(______)

Dp_1, Dp_2 (Pipe Inner Dia.)
Lp_1, Lp_2 (Pipe Actual Length)
Le_1, Le_2 (Pipe Equivalent Length)



Pv (Vapour Pressure at Pump Inlet)

5. Others

Spare Parts ________________

Accessories ________________

Remarks ________________

[Note] Items marked with * are minimum information required for selection of pump.

Job Site Installations

Solvent Transfer
in Paints Manufacturing Plant
(Self Priming Type)

Lithium Bromide Circulation
in Gas-absorption Refrigerator
(Gas-absorption Refrigerator Type)

LPG Transfer
in LPG Filling station
(Vertical In-Line Type, Reverse Circulation)

High Temperature & High Line-Pressure Service
in Nuclear Power Station

Liquefied Gas Service
LPG Transfer in Oil Refinery
(Submersible Pit Barrel Type)

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Catalog No. 2062R10

Printed in Japan 2005. 10. 1000（T）

NIKKISO Non-Seal® Pumps

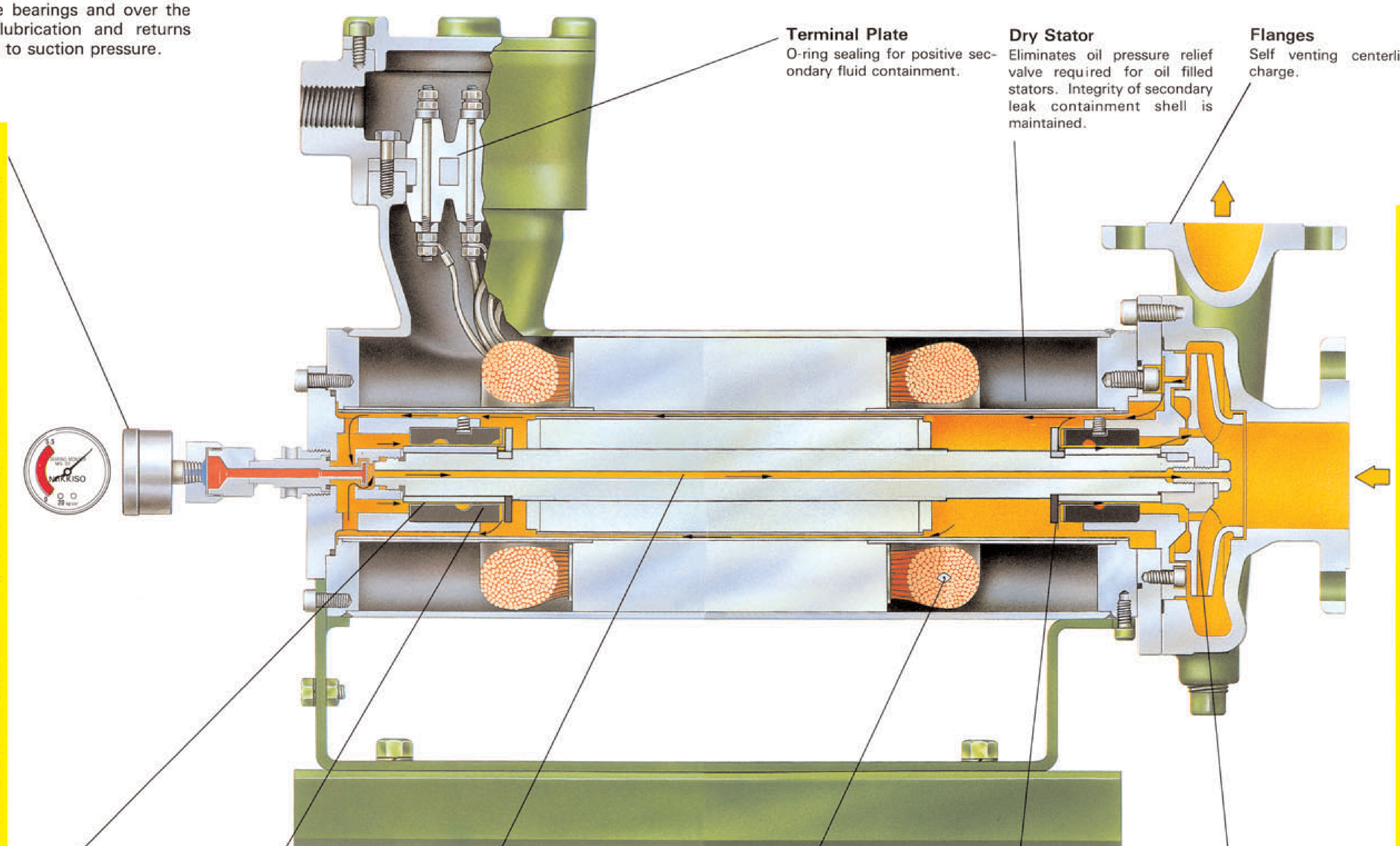
Type HN Basic

Suitable for a broad range of clean , nonvolatile liquids with moderate temperatures.
Fluid at approximately 60% of discharge pressure is circulated through the bearings and over the rotor for cooling and lubrication and returns through the hollow shaft to suction pressure.

Bearing Monitor (Patented)

The standard bearing monitor solves the most basic problem common to all sealless pumps —detecting normal bearing wear so that routine maintenance can be accomplished before serious motor damage occurs. It responds to bearing wear in both the axial and radial directions and is over 98% effective on 70,000 operational units.
The design is uniquely simple. The interior of the monitor contains either pressurized inert gas or is kept at atmospheric pressures depending on operating conditions. The end of the monitor has a contact tip which is fitted within a cavity in the end nut on the rotor shaft. Clearances between the contact tip and the end nut correspond to the maximum allowable bearing wear.
As normal bearing wear (either radial or axial) occurs, the clearances between the stationary tip and rotating end nut converge. At maximum allowable bearing wear the tip is contacted and ruptured, prior to physical contact between the rotor and stator. The resulting change in pressure within the interior is displayed on the face of the monitor. A pressure switch for remote alarm/shutdown is optional.

In addition, the monitor is useful in detecting corrosion of the stator liner and rotor sleeve since the contact tip is supplied in the same metallurgy but about one-half the thickness of those components.



Terminal Plate

O-ring sealing for positive secondary fluid containment.

Dry Stator

Eliminates oil pressure relief valve required for oil filled stators. Integrity of secondary leak containment shell is maintained.

Flanges

Self venting centerline discharge.

Motors

In the NIKKISO Non-Seal® Pump design, the entire outside of the motor is enclosed in a secondary leakage containment shell or can. Primary leakage protection is provided by corrosion resistant liners which are seal welded and 100% leak checked to assure that pumped fluid does not contact the stator windings or rotor core. There is no shaft protrusion to seal and thus no seals to leak.
Pumped fluid is circulated in the area between the rotor and stator liner to cool the motor, and lubricate the bearings.
Motor windings and insulation system are specially designed, developed and applied as an integral part of the pump so that design life is at least as great as for conventional air cooled motors.
Winding temperature is primarily influenced by pumped fluid temperature and secondarily by use of cooling jacket. Fluid temperature is considered in pump application to assure full winding life. Thermostats are embedded in the hot spots of windings for shutdown in case of overheating.

Shaft Sleeves

Available in a variety of surface treatments to suit the specific fluid applications. Replaced when bearings are changed for like new wear surfaces and clearances.

Bearings

Available in a variety of materials to suit the specific fluid application.

Hollow Shaft (Basic Type Only)

Assures motor cooling and prevents vapor collection at the bearings.

Thermostats

Embedded in the hot spot of the windings for protection against overheating.

Thrust Washers

Absorb thrust loads during upset conditions and provide back-up to hydraulic thrust balancing.

Impeller

High efficiency design, open and closed configurations.

(Optional flow inducers available for minimum NPSH requirements.)