EXPERT IN ENGINEERED

VACUUM SYSTEMS SINCE 1993

Performance. Reliability. Efficiency.

333 Rt 46 W

Building A,

Fairfield, NJ 07004

1-800-297-3550

www.nescompany.com

Operation & Maintenance Manual for NCC Series Vacuum Pumps & Compressors

NES COMPANY

WARNING

Do not operate PUMP before primed and connected to the constant supply of clean compressant liquid. **IF RUN DRY, PUMP WILL BE DAMAGED**; always use a strainer to prevent sand and scale from entering the pump with liquid sealant.

Specific operating conditions combined with water hardness may result in excessive lime deposits inside the pump, causing it to bind. Should this condition be evident, flush the pump with a solvent at regular intervals.

This pump has been drained and flushed with water-soluble preservative oil before shipment. After the pump has been in service, do not store without draining as specified in this manual. The freezing of the preservative oil can damage the pump.

USE CAUTION when removing inlet screens. Any foreign material on the screen may fall into the pump and cause extensive damage at start-up.

The base must be mounted to a leveled foundation, and final coupling alignment is done during installation. (Refer to manual No.XXX, Installation Instructions, N.E.S. Company Vacuum Pumps and Compressors.)

NOTICE

SERVICE AND PARTS

SERVICE AND PARTS FOR NES VACUUM PUMPS ARE ASSURED THROUGH A WORLDWIDE NETWORK OF SALES AND SERVICE OFFICES LISTED ON THE BACK COVER OF THIS MANUAL. ANY REQUEST FOR INFORMATION, SERVICE, AND PARTS SHOULD BE DIRECTED TO THE NEAREST NES SITE / FIELD OFFICE.

WHEN ORDERING REPLACEMENT AND SPARE PARTS, SERIAL NUMBERS AND PUMP SIZES MUST BE PROVIDED.

Serial number and pump size are located on nameplates riveted/fastened to the pump's casing/body. Parts must be identified by index number and name. Refer to pump exploded view and legend found in this manual.

If the location of the nearest office is unknown, information may be secured directly from N.E.S. Company Inc. New Jersey Head Quarters: 333 RT 46 W, BLDG: A, FAIRFIELD NJ 07004. Telephone number is 1-800-297-3550, Fax No. 973-933-6322

WARRANTY

NES Company warrants that (1) the goods will be of the kind described on its acceptance of Buyer's order as modified by any subsequent mutual agreement of the parties, (2) it will convey to Buyer good title to such goods, (3) such goods will be delivered free of any lawful security interest or lien or encumbrances unknown to Buyer, and (4) such goods will be of merchantable quality and free from defects in material or workmanship defects under normal use and prescribed maintenance for a period of two (2) years from the date of shipment. The warranties specified shall also extend to goods manufactured by others and supplied by N.E.S., unless such goods have been separately stated and quoted by N.E.S., in which case only the warranties in clauses (1), (2) and (3) shall apply. NES MAKES NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE MERCHANTABILITY OF GOODS MANUFACTURED BY ITS SUPPLIERS AND SEPARATELY STATED AND QUOTED HEREIN. N.E.S.'s warranty in clause (4) above shall not apply to goods of standard construction when handling corrosive gases of using corrosive liquid compressant nor will clause (4) apply to goods which have been damaged, altered, or negligently maintained after delivery. Buyer's exclusive remedy for N.E.S.'s breach of the warranties outlined in clauses (1), (2) and (3) above shall be the replacement by N.E.S. of non-conforming goods with conforming goods, without extra cost to Buyer, F.O.B. point of manufacture, with transportation prepaid to U.S. destination or domestic port, and Buyer's exclusive remedy for N.E.S.'s breach of the warranty contained in clause (4) above shall be the repair by N.E.S. without charge, or the furnishing by N.E.S. F.O.B. point of manufacture, with transportation prepaid to U.S. destination or domestic port of a part or item of equipment to replace any part or item of equipment which is proved to have been defective; provided that (1) Buyer shall have notified N.E.S. of any such breach not later than ten days after the expiration of two (2) years from the date of shipment of the goods, and that (2) N.E.S. shall have the option of requiring the return of any defective material transportation prepaid to establish a claim. N.E.S. shall in no event be liable for Buyer's manufacturing costs, lost profits, goodwill, expenses, or any other consequential or incidental damages resulting from a breach by N.E.S. of any warranty. THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, WHICH EXTENDED BEYOND THE WARRANTIES SET FORTH HEREIN

Manual Index

List of Sections

1. Safety Precautions

In these operating manual, essential information, warnings, and notes are conveyed using the following key words and symbols:

1.1 Warning Symbols

The warning symbol ⚠ is displayed within the safety instructions, located in the associated title frame on the left side, along with key phrases like DANGER, WARNING, or CAUTION. Safety instructions, accompanied by warning symbols, are designed to highlight the potential risk of personal injury. It's crucial to adhere to these safety guidelines to ensure your safety and prevent any harm or fatality. On the other hand, safety instructions not accompanied by warning symbols indicate a potential risk of material damage.

Safety Alerts and Symbols

Danger of Personal Injury:

This symbol signifies an imminent danger that could result in death or severe injury if proper precautions are ignored.

WARNING!

Danger of personal injury: This symbol highlights an imminent danger that could lead to death or severe injury if necessary precautions are not taken.

CAUTION!

This symbol indicates a possible disadvantage or undesirable outcome that might occur if the appropriate precautions are not observed.

Danger of personal injury: This symbol indicates a potential danger that might result in moderate or minor injury if the required precautions are disregarded.

Danger of material damage: This symbol warns of a potential risk that could lead to material damage if the necessary precautions are not followed.

NOTE

This symbol points out a potential advantage or benefit that can be gained by following the recommended precautions; consider it as a helpful tip.

1.2 General Safety Instructions

WARNING!

Failure to handle the unit properly could lead to severe, and possibly fatal, injuries!

This operating manual must be:

Read and comprehended before any work involving the unit begins.

Adhered to meticulously during all operations.

Readily accessible at the location of the unit.

WARNING!

Improper handling of the unit can result in serious or even fatal injuries!

When operating the unit utilize it exclusively for the purposes specified

Abide by the values provided in "Technical Data"

WARNING!

Improper handling of the unit can result in serious or even fatal injuries! Only adequately trained and responsible specialist personnel are authorized to perform tasks related to the unit, such as:

Transportation
Installation
Startup
Shutdown
Maintenance
Disposal

WARNING!

Working on the unit involves the risk of injury, such as cutting, shearing, crushing, and burning!

Prioritize personal protective gear (helmet, gloves, safety shoes).

Only proceed with work on the system after wearing proper protection.

WARNING!

Hair and clothing can get caught in moving parts or drawn into the unit!
Avoid wearing loose or oversized clothing.
If you have long hair, wear a hair net to prevent entanglement.

DANGER!

Electrical hazard!
Before commencing work on the unit or system, adhere to these precautions:
De-energize the system.
Prevent accidental re-energization.
Confirm the system is de-energized.
Ground and bypass the system.
Safeguard live adjacent parts.

DANGER!

Electrical hazard!
Work on electrical components must be carried out by specialized electricians!

DANGER!

Electrical hazard!
Verify de-energization first.
Then access the motor terminal box.

WARNING!

Risks associated with overpressure, negative pressure, and leaking media!
Before beginning work on the unit or system:
Disable the operating-liquid supply.
Release pressure from the piping and unit.

WARNING!

Risk from rotating external fan!
Operate the unit solely with the fan guard in place!

WARNING!

Risk from rotating impeller!
Operate the unit only with the cover in place!
Removing the cover is prohibited!

WARNING!

Risks associated with overpressure, negative pressure, leaking media, and rotating impeller!
Operate the unit only when piping/hoses are connected to suction, discharge, and operating-liquid connections.

WARNING!

Risk of limbs being caught by the impeller!
Do not insert objects through openings.
Avoid reaching inside the unit via open connections.

WARNING!

Risks associated with overpressure, negative pressure, and leaking media!
Conduct pressure tests on installed piping and vessels.

WARNING!

Risks associated with overpressure, negative pressure, and leaking media!
Inspect piping/hose connections for any signs of leakage.

WARNING!

Risk of burns from hot surfaces and media!
Avoid touching during operation.
Allow the system to cool after shutdown.

CAUTION!

Risk of tipping and crushing!
Secure the unit to its foundation before starting.

1.3 Additional Hazards

WARNING!

Long, loose hair can potentially be pulled into the external fan through the grille in the fan guard!
Wear a hair net to prevent entanglement.

WARNING!

Long, loose hair is at risk of being caught and entangled in the rotation of the shaft between the motor end-shield and the pump casing.
Wear a hair net for safety.

WARNING!

Friction-related injuries (abrasion, burns, etc.) can result from contact with the rotating shaft between the motor end-shield and the pump casing.
Avoid reaching into the openings between the motor end-shield and the pump casing.
Refrain from inserting objects into these openings.

WARNING!

Burning or scalding can occur from contact with hot surfaces!
Do not touch these surfaces.
Wear protective gloves as needed.

2. About the Manual

The following document provides set-up instructions, Operation and maintenance information for your NES NCC series of vacuum pumps. Please read the complete document carefully before operating your pump. If you need further assistance in understanding the details in this document or the pumps, please call NES Company Inc. at 1-800-297-3550 or email at info@nescompany.com
When contacting NES Company Inc., please be ready with the following information:

1. A reference number to locate your pump in NES Company Inc.'s system.
2. The nature of the process in which the pump is used.
3. The steps taken so far in the installation and set-up of the vacuum pump.
4. Please ensure that the manual has been completely read by all the people involved in operating the pump.

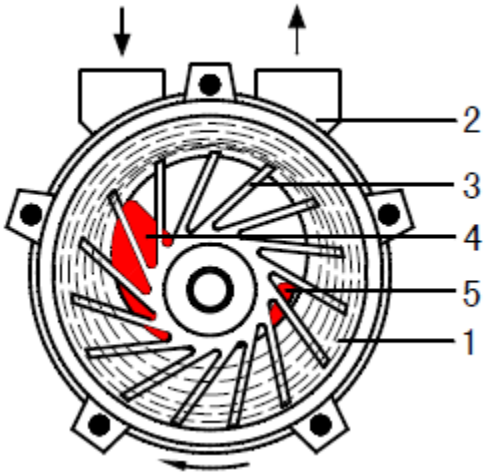
3. NCC pump description

The NCC pumps are single-stage liquid-ring units designed for continuous operation, serving the purpose of generating either vacuum or excess pressure. These pump units are proficient at extracting and pumping dry and moist gases, with a primary focus on air and air/vapor mixtures. It is important to note that the gases being pumped must not be flammable, explosive, or corrosive. For applications involving flammable, explosive, toxic, or corrosive substances, customized units are provided in accordance with customer requirements. In such cases, the user must adhere to relevant safety precautions. Water is commonly employed as the sealing liquid. In scenarios requiring enhanced corrosion resistance and hygiene standards, stainless steel variants are available. These pump units are engineered for operation within the rough vacuum range. The maximum attainable vacuum is contingent on the vapor pressure of the selected sealing liquid. These pumps are sanctioned for use in spaces where explosive gases may occasionally be present. However, it's imperative to avoid pumping explosive gases themselves. Follow the rating plate for the specified temperature classes.

3.1 Operating principle

The NES NCC pump units operate based on the liquid-ring principle. NCC pumps, when coupled with the motor, create a compact and space-efficient unit. Within a cylindrical pump casing, an impeller is positioned slightly off-center from the rotor axis. When the pump starts, this

impeller imparts driving power to a liquid ring, which takes shape concentrically within the casing. As the liquid moves outward, it draws in gas through the inlet port on the port plate. This gas is subsequently compressed and expelled through the discharge port in the same plate. Fig. 1 shows a sectional representation of the compression chamber, viewed from the perspective of the pump cover. An even surface is only required for its installation; there's no need for additional baseplates.



1 Liquid ring
2 Pump cover
3 Impeller
4 Inlet port
5 Outlet port

Fig. 1 Sectional view through the compression chamber

3.2 Operational parameters

3.2.1 Surface sound-pressure level

Please refer to Table. 1 for details of the measuring surface sound-pressure level.

Type	Sound pressure level measured at 3.28 ft distance, L[dB(A)] 60 Hz
NCC-20	70
NCC-35	70
NCC-55	71
NCC-75	76
NCC-115	70
NCC-160	74
NCC-200	75
NCC-300	77
NCC-350	75

Table 1. Surface sound pressure level measured at distance of 3.28 ft.

3.2.2 Minimum inlet pressure

The minimum gas suction pressure varies depending on the temperature and the type of sealing liquid use. Please ensure the following precautions are met:

1. The gas suction pressure should not drop below 2.36”Hg absolute when operating the pump without cavitation protection. This threshold applies when using water at 60°F as the sealing liquid and extracting dry air at 70°F. This is vital to prevent cavitation-induced damage. At higher temperatures, this limit escalates based on the vapor pressure of the chosen sealing liquid.
2. The vacuum pump is operable until it reaches its maximum vacuum, implying full throttling when operating with cavitation protection.

It's important to note that consistent operation of the pump below the minimum permissible suction pressure can lead to substantial damage to the pump unit.

3.2.3 Maximum Discharge Pressure for Vacuum Operation

For all NCC vacuum pumps, the maximum discharge pressure allowed during vacuum operation is 19 PSIG, provided the indicated nominal sealing liquid flowrate (refer to Table. 2) is maintained.

Design operating-liquid flow [ft^3/h]				
Type	Flow rate vacuum operation in the pressure range [PSI]			Flow rate, compressor operation
	0.479 – 2.90	2.90 – 7.25	>7.25	
NCC-20	7.06	7.06	7.06	7.06
NCC-35	8.12	8.12	8.12	8.83
NCC-55	12.0	6.0	6.0	17.66
NCC-75	15.89	9.89	9.89	24.72
NCC-115	28.25	12.36	10.59	31.78
NCC-160	42.38	14.13	12.36	42.38
NCC-200	52.97	14.13	12.36	52.97
NCC-300	63.57	15.89	14.13	63.57
NCC-350	84.76	24.72	17.66	84.76

Table. 2 Flow rate at vacuum operation

3.2.4 Maximum Differential Pressure for Compressor Operation

For NCC compressors with serial motors and an inlet pressure of 29.9'' Hg, the following parameters apply, as seen in Table 2 & 3.

Max. discharge pressure, $p_{2\ max}$ for compressor operation (at suction pressure, p_1=1 bar abs. [14.5 PSIA])	
Type	[PSIA] **60 Hz**
NCC-20	31.9
NCC-35	27.6
NCC-55	42.1
NCC-75	37.7
NCC-115	23.2
NCC-160	21.8
NCC-200	20.3
NCC-300	20.3
NCC-350	21.8

Table. 3 Maximum differential pressure for compressor operation

Maximum allowable pressure within the pump unit: P int max = 116 PSIG

3.2.5 Suction Gas or Vapor

The gas or gas/vapor mixture to be extracted should be devoid of solid particles. Small quantities of light suspended matter or liquid entrainment are acceptable. (Refer to Table. 4 for the maximum permissible entrained water quantity via the suction flange.) If extracting hot gases and vapors of 176°F or above, we recommend increasing the sealing-liquid flowrate to up to 2.5 times the nominal sealing-liquid flowrate (see 3.2.6 and Table. 5) or utilizing an upstream condenser.

Max. permissible quantity of water entrained via suction flange		
Type	[GPM]	
NCC-20	2.2	
NCC-35	2.5	
NCC-55	3.08	
NCC-75	4.93	
NCC-115	8.8	11
NCC-160	13.2	15
NCC-200	15.4	19.8
NCC-300	22	22
NCC-350	19.8	26.4

Table 4. maximum permissible quantity of water entrained

3.2.6 Sealing Liquid

Continual supply of seal water liquid (refer Table. 5) that is free from solids like sand is essential during pump unit operation. If necessary, incorporate a filter on the intake side. In cases of very hard water usage, either soften the water or periodically flush the pump with a solvent. To ensure an adequate working-liquid flow, adjust the pressure in the feed pipe to approximately 0.1 PSI above the required suction pressure. The discharged seal liquid exits through the pump unit's delivery branch alongside the extracted gas. As an accessory, a separator is available to segregate gas and liquid. It facilitates partial recirculation of the sealing liquid.

P/N	GPM
NCC-20	0.6
NCC-35	0.6
NCC-55	0.7
NCC-75	1.1
NCC-115	1.8
NCC-160	2.5
NCC-200	2.75
NCC-300	4
NCC-350	5.5

Table. 5 Seal Liquid flowrate

4.Installation

CAUTION!

Risk of crushing if the equipment tilts during installation that hasn't been completed yet! Wear protective gloves and safety footwear. Handle the equipment with care.

CAUTION!

Risk of tripping and falling over the equipment! Avoid areas where tripping hazards might be present.

WARNING!

Electrical hazard! Ensure that the system's installation prevents external factors from damaging the electrical components. Safely arrange connecting cables, such as using cable ducts or burying them underground.

CAUTION!

Risk of injury from fragments of a broken external fan flying off! Position the equipment so that in case fragments from a broken external fan pass through the grille, no personnel are at risk of being struck.

CAUTION!

Risk of equipment damage due to overheating caused by obstructed heat dissipation and airflow! Ensure that exhaust air from other equipment is not drawn into the system.

4.1 Pump Installation

The NCC pump unit should be installed horizontally on a level surface and can be securely fastened using its feet. A specialized foundation or baseplate is not required for the installation. However, if an alternative mounting configuration is desired, such as placing the shaft

in a vertical position, it is advisable to consult the NES company for guidance. When employing a crane for transport, it's crucial to properly secure the pump unit using sling straps.

During transport, the following considerations should be taken into account:

1. The load suspension devices and hoisting equipment must possess sufficient load-carrying capacity to accommodate the weight of the pump unit, as indicated in Table. 6.
2. The sling straps used should be of adequate length to ensure spread angles remain below 90 degrees.
3. Appropriate attachment points for slinging must be selected.
4. The sling straps should be secured in a manner that prevents the pump unit from toppling off during transport.
5. Special care must be taken to prevent any damage to the integrated fittings.

Type	Material conveying parts	weight* approx. [lbs.]
NCC-20	Cast iron	55.5
NCC-35	Cast iron	57.5
NCC-55	Cast iron	77.5
	Stainless steel	93.0
NCC-75	Cast iron	135
	Stainless steel	148
NCC-115	Cast iron	201
	Stainless steel	216
NCC-160	Cast iron	201
	Stainless steel	216
NCC-200	Cast iron	375
	Stainless steel	401
NCC-300	Cast iron	399
	Stainless steel	432
NCC-350	Cast iron	556
	Stainless steel	582
*Specified is the weight for the largest motor size.		

Table 6. Pump Weights

4.2 Electrical Connection Requirements

Adhere to the guidelines below when connecting the pump, taking into account national standards and the regulations stipulated by the utility company relevant to the installation site:

Ensure compliance with the motor circuit-breakers for safeguarding the motors against overload. Set these breakers to the rated current specified on the rating plate.

WARNING!

Prior to any work, ensure that the machine is completely deactivated.

DANGER!

Electrical hazard! Incorrect actions can result in severe harm to individuals and material damage.

DANGER!

Electrical hazard! Electrical connections should only be performed by specialized electricians.

DANGER!

Electrical hazard! Before commencing work on the unit or system, the following precautions must be taken:

De-energize the unit.

Ensure it cannot be switched on again.

Confirm it is de-energized.

Ground and bypass it.

Cover or block any adjacent live parts.

CAUTION: Incorrect motor connection can lead to significant damage to the unit.

WARNING: Electrical hazard!

The air gaps between non-insulated, energized components in relation to each other and to the earth must measure at least 5.5 mm [0.217"] (at a design voltage of UN ≤ 690V). Exposed wires are not permitted. The electrical connections should be securely fastened.

WARNING: Electrical hazard!

Terminal boxes must be devoid of:

Foreign objects

Dirt

Moisture

Ensure the terminal box cover is closed and sealed, and also seal the cable entry openings to prevent the ingress of dust and water. Perform regular checks to ensure tight sealing.

Before initiating any work, disable the main circuit-breaker and secure it to prevent unintended closure.

Verify that the system voltage and frequency match those indicated on the rating plate. Deviations of ±5% in voltage and ±2% in frequency are allowable without necessitating power reduction.

Align and connect the terminal links according to the circuit diagram within the terminal box.

Link the protective earth conductor to this designated terminal.

When terminal clips are employed for machine connection, guarantee uniform terminal plate elevation on each side of the connection. Consequently, conductor ends might need to be bent into a U-shape or connected using cable lugs. This practice applies to both the protective conductor and external earth conductor. In cases involving external earth brackets, all conductor ends must be bent into a U-shape (see Table. 7 & 8). Please refer to Table. 8 for appropriate tightening torques for screw-based electrical connections on terminal boards.

4.3 Pipe Connection Requirements

CAUTION!

If the unit is connected to a vacuum tunnel, there is a risk that the operating liquid can be drawn out of the unit into the system, potentially causing damage. To mitigate this risk, install a check valve in the suction line.

CAUTION!

Do not exceed a tightening torque of 100 Nm [73.8 ft lbs] for piping connections to the suction and discharge connections.

CAUTION!

When attaching pipelines or hoses, ensure that they are free from any mechanical stresses.

CAUTION!

For gases or vapors containing impurities, consider installing a filter, strainer, or separator in the suction line if necessary.

CAUTION!

To prevent residues from installation work (such as welding beads) from entering the unit, it is advisable to install an intake strainer in the suction line for the first 100 operating hours."

To prevent foreign particles from entering the pump, all connection openings come covered for delivery. Do not remove these covers until piping has been properly connected. It's essential that piping connections are made without any undue stress, and the weight of the piping should be adequately supported. Refer to fig. 2-4 for pipe connection diagram of various NCC pumps.

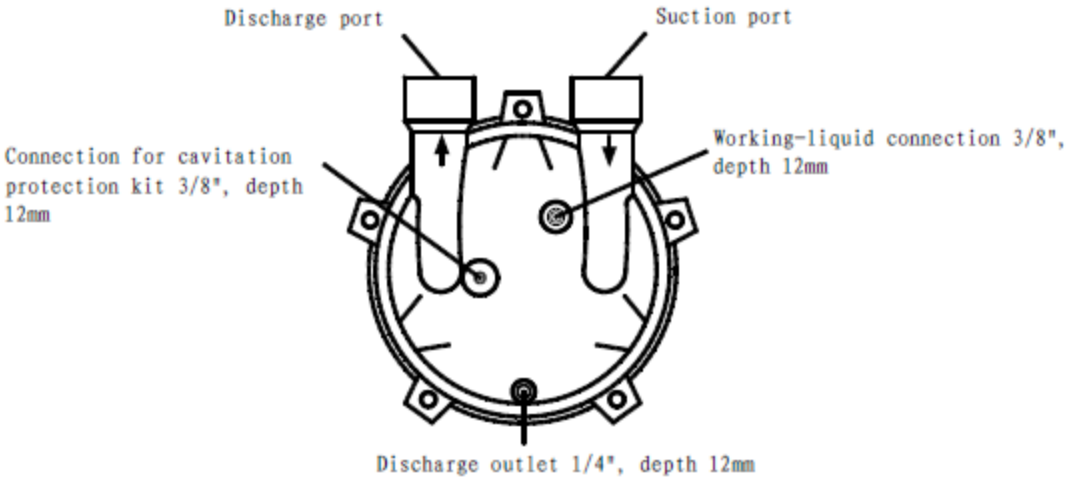


Fig. 2 Pipe Connection NCC- 20-75

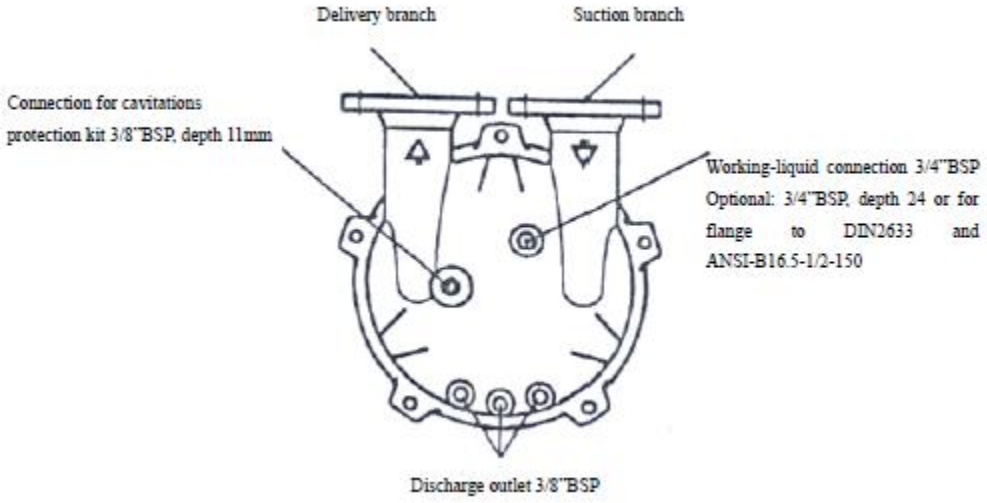


Fig. 3 Pipe Connection of NCC 115-350 cast iron version

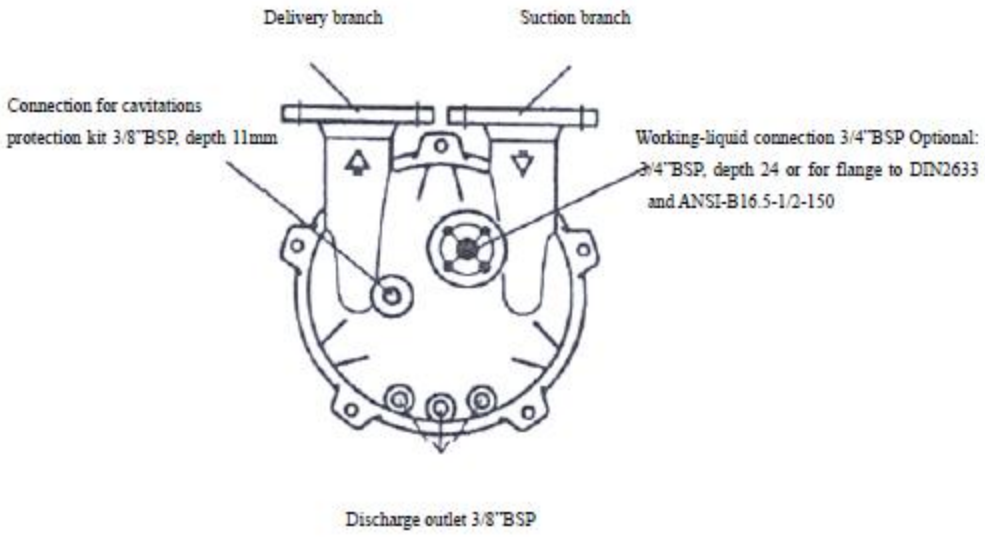


Fig. 4 Pipe Connection of NCC 115-350 stainless steel version

a) Delivery Branch Connection

NCC 20-35: 1”

NCC 55-75: 1 ½”

NCC 115-160: 2”

NCC 200-300: 2 ½”

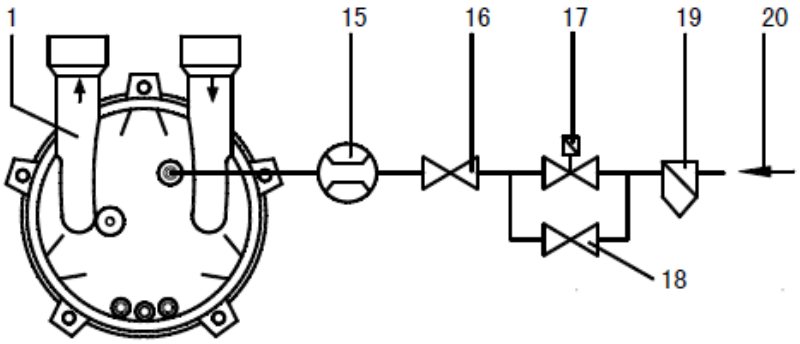
NCC 350: 3”

If the discharged gas is being routed, ensure that the maximum discharge pressure specified in section 3.2.3 is not exceeded.

b) Suction Flange Connection

The suction flange is same connection as the delivery branch side. To prevent any installation residues like welding beads from entering the pump unit, it's advisable to use a start-up filter in the suction pipe for the initial 100 operating hours.

c) Kindly refer to Fig. 5 below for sealing-Liquid Connection.



1. NCC vacuum pump 15. Flow meter (optional)
16. Control valve 17. Solenoid valve, coupled with, motor (Motor on-valve open Motor off- valve closed)
18. Bypass with shutoff 19. Filter (optional)
20. Working liquid pipe

Fig. 5 Sealing liquid connection

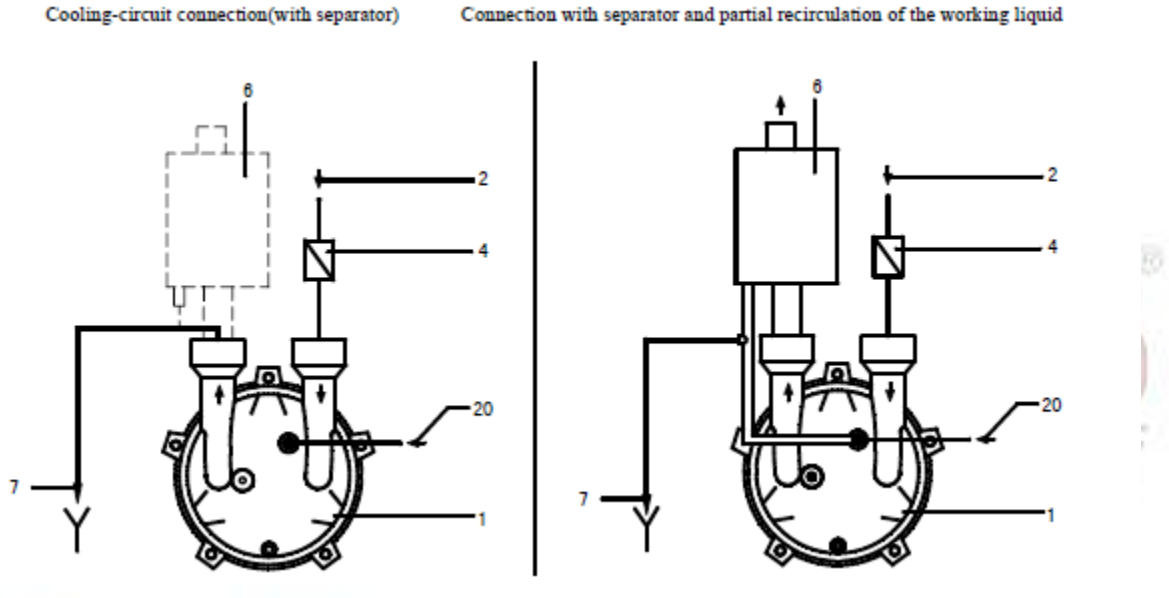
4.3 Types of Sealing Liquid Supply

4.3.1 Cooling-Circuit Connection

This is the preferred method where an abundant supply of sealing liquid is available, and a low suction pressure is needed. The Sealing liquid discharged from the pump is completely drained and replaced with new liquid. After the initial priming, the pump unit can be operated in a self-priming mode. Make sure the water level is aligned with the clean-liquid connection when the pump unit is activated.

4.3.2 Connection with Separator and Partial Recirculation of Sealing Liquid

This connection approach is chosen when sealing liquid needs to be used sparingly. Part of the Sealing liquid collected from the discharge in the separator is recirculated back to the pump unit without cooling, while the remaining portion is replaced with fresh liquid. The required pipes are provided along with the separator.

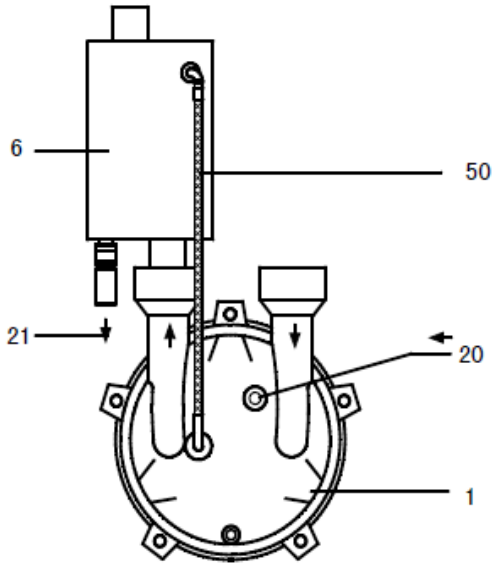


1. NCC pump 2. Suction pipe 4. Non-return valve 6. Liquid separator 7. Overflow 20. Sealing liquid feed pipe

Fig. 6 Different ways of supplying sealing liquid

4.3.4 Sealing-Liquid Separator

The sealing-liquid separator can be acquired as an accessory with its corresponding connection pipe. Refer to Fig. 7 for details. It separates the sealing liquid from the handled gas and facilitates partial recirculation of the sealing liquid. This substantially reduces the necessary sealing liquid quantity (as seen in Fig. 2). For operation with cavitation protection (refer to section 3.2.2), ensure the enclosed hose connection (50) is placed between the separator and pump cover.



1. NCC pump 6. Liquid separator 20. Sealing liquid feed pipe 21. Working liquid discharge
50. Connection tube for cavitation protection

Fig. 7 NCC pump with sealing liquid separator and cavitation protector

Fitting Hoses

Hoses should be connected in a manner that prevents twisting and offers protection against external mechanical damage.

Fitting Cutting-Ring Screwed Connections

For stainless steel cutting-ring screwed connections, ii is essential to lubricate the inside taper, external thread, and inside of the union nut beforehand. Gently thread the union nut onto the threaded coupling, ensuring even coating of the entire thread.

4.3.5 Non-Return Valve

To prevent gas and sealing liquid recirculation when the pump is not in operation, a non-return valve with minimal resistance must be installed in the suction pipe.

4.3.6 Suction Pressure Between 1.2'' Hg and 0.3'' Hg with Pump Unit and Gas Ejector

For gas extraction within the 1.2'' Hg and 0.3'' Hg pressure range, connect a gas ejector to the line side of the NCC vacuum pump. The gas ejector compresses the extracted gas to the suction pressure of the NCC vacuum pump. A suction pressure as low as 0.3'' Hg is achievable with a gas ejector. The power requirements of the NCC vacuum pump remain within acceptable limits with a line-side gas ejector. No separate energy source is required to operate the gas ejectors. Gas ejector positioning has no operational impact, and concentric sealing is crucial to avoid flow area reduction. Short, adequately sized connecting leads are recommended. If the gas ejector's mixing connection is smaller than the NCC vacuum pump's suction connection, a cone-shaped adapter is advised. It's essential that the motive gas (ambient air at 70°F, 29.9" Hg) does not contain any liquid droplets. During tank evacuation, the gas ejector functions as a throttle within the range of 29.53'' Hg to approximately 2.95" Hg. The gas ejector can be bypassed for shorter evacuation times, with the bypass needing closure for the gas ejector to engage. The optimal switchover point for the gas ejector to engage is around 1.2'' Hg (See Fig. 8 below).

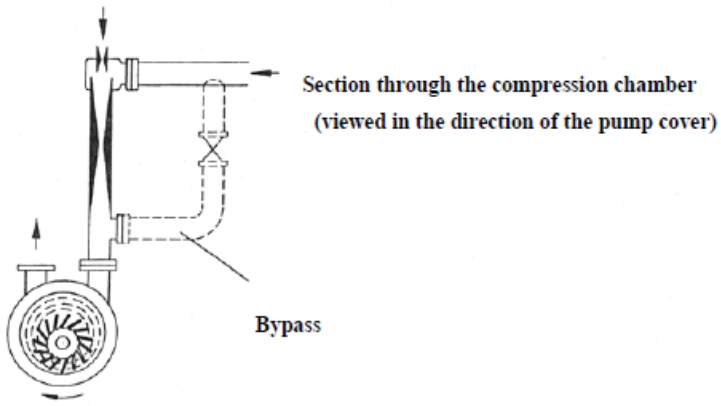


Fig. 8 Operation with gas ejector

5. Operation

WARNING!
Failure to handle the equipment properly can lead to severe or even fatal injuries!

WARNING!
Risk of overpressure and negative pressure! Risk presented by media leaks! Risk presented by moving parts! The unit must be started only under the following conditions.
The fan guard and cover are in place.
The piping is connected to the suction and discharge ports, along with the operating-liquid inlet.
Both piping and connections have undergone pressure and leak testing.

CAUTION!
Running the unit without proper lubrication will lead to the destruction of the rotary seals in a matter of seconds. DO NOT activate the system until it has been adequately filled with operating liquid!

5.1 Preparation for Initial Start-up

CAUTION!
When gases or vapors are being expelled on the discharge side for further transfer, it is essential to ensure that the maximum outlet pressure is not surpassed.

If a shut-off valve is present in the discharge pipe, ensure that the pump unit is neither started nor stopped with the valve closed. Avoid running the pump unit dry. Before start-up, prime the pump unit through the suction or delivery branch with sealing liquid, or open the shut-off valve in the bypass (refer to Fig. 5) for about 20 seconds to enable sealing liquid flow into the pump. Confirm the tightness of supply and discharge pipe connections. To verify rotation direction, briefly start the pump unit. Rotation direction indicators are marked with arrows on the pump unit for gas flow and shaft rotation. Compare the motor fan's rotation direction with the arrow on the pump casing's back (see Fig. 9 & 10). If necessary, alter rotation direction by switching two connection cables when the pump is electrically isolated.

5.2 Start-up

WARNING!

Risk of overpressure, negative pressure, leaking media, and moving parts! The unit can only be started under the following conditions:

The fan guard and cover are properly installed.

Piping is connected to the suction and discharge connections.

Piping and connections have undergone pressure and leak testing.

CAUTION!

Operating the unit without proper liquid will result in the destruction of rotary seals within seconds. DO NOT switch on until the system has been filled with operating liquid.

WARNING!

There is a risk of burns or scalding from hot surfaces on the unit and from hot media. Do not touch while in operation, and allow the system to cool down after shutdown.

If the pump is powered by converters, note that high-frequency currents and voltage harmonics can lead to electromagnetic interference in the motor supply leads. Screened supply leads are recommended. Exceeding the operating speed (as indicated on the rating plate) can raise noise levels and vibrations, reducing grease lifespan and bearing replacement intervals. Consult the manufacturer to determine the speed limit and prevent excessive speeds that could lead to damage. Begin by switching on the pump unit. Check the sealing-liquid flow rate (Table. 5) and adjust if needed using the control valve (16, refer to Fig. 5). The flow meter (15) regulates the nominal sealing-liquid flow rate. Liquid flow can also be measured in liters on the discharge side at the overflow (7, refer to Fig. 6).

5.3 Operating Checks

5.3.1 Starting and Shutting Down

In cases where the pump is controlled automatically (as shown in Fig. 5), the supply of clean sealing liquid is regulated by a solenoid valve (17), synchronized with the motor's operation.

NCC pump on = valve open.

NCC pump off = valve closed.

For situations where automatic control is not in place, follow these steps:

Starting: Initiate the pump and immediately open the shut-off valve (18) (refer to Fig. 5).

Shutting down: Close the shut-off valve (18) and promptly turn off the pump (refer to Fig. 5).

5.3.2 Draining

CAUTION!

Pump units using potentially hazardous sealing liquids require rinsing while the machine is operational before any opening is attempted.

WARNING!

Risk associated with combustible, caustic, or poisonous substances! To safeguard individuals and the environment:

Units that have been exposed to hazardous substances should be flushed while operational before being opened up.

To drain, unscrew the plug on the pump cover to allow the liquid to drain out. While draining, manually rotate the motor occasionally in the opposite direction to dislodge any remaining sealing liquid.

Tilting the pump unit at a 45-degree angle towards the pump cover enables almost complete draining, preventing damage during extended periods of inactivity or in the presence of frost.

5.4 Preparation for Long-term Standstill

If the pump unit will be inactive for over four weeks or during frosty conditions, pre-drain the unit following the procedure in 5.3.2. Then,

apply preservation (for cast-iron versions) by pouring half a liter of anti-corrosive oil into the suction or discharge branch and briefly activating the pump. If the impeller becomes jammed due to hard water usage during prolonged inactivity, introduce a 10% oxalic acid solution into the compression chamber, allowing it to act for approximately 30 minutes.

CAUTION!

Oxalic acid can be harmful if ingested or comes into contact with the skin.

6 Preventative Maintenance

6.1 General

To prevent impeller and pump casing wear or impeller jamming, eliminate fine dirt particles entering the compression chamber through the flushing outlet located at the pump's bottom. In case of impeller jamming, first remove the fan, then manually rotate the shaft with an appropriate tool. The shaft can subsequently be released (prior removal of the fan cowl).

Note: Cover the fan cowl before turning on the machine. If very hard water is used as the sealing liquid, it should be either softened or the compression chamber flushed with a solvent at suitable intervals.

Note: For motor designs incorporating sealed condensate drain holes (e.g., protection class IP55 or IP56, as indicated on the rating plate), these openings should be occasionally opened to allow accumulated condensate to drain.

WARNING!

Incorrect handling of the unit can lead to severe or even fatal injuries. All maintenance and service tasks concerning the system must be executed by the service department. Operators are only allowed to conduct maintenance procedures on the unit if they possess the relevant maintenance instructions. For guidance, please consult our service department.

WARNING!

Risk associated with the impeller's rotation! It is strictly prohibited to remove the cover.

WARNING!

Risk of injury due to components tipping over or falling off! In case fixings become loose, certain components may only be held in place by centring or seating or may not be held at all, leading to potential falls. Take appropriate precautions when dismantling and reassembling components.

WARNING!

Risk associated with combustible, caustic, or poisonous substances! Units that have encountered hazardous substances must be flushed while operational prior to their disassembly.

6.2 Lubrication

6.2.1 Bearing and Space Lubrication

After approximately 20,000 operating hours or at a minimum of every 3 years, it's essential to clean out spent grease and accumulated dirt deposits from the rolling-contact bearings and adjacent spaces. Replace them with fresh grease. Fill about 50% of the rolling-contact bearing's free space and approximately 65% of the volume of adjacent spaces in the bearing cover with grease. Locked bearings must remain free of grease. The relubrication intervals should be adjusted if the pump operates under unfavorable conditions, such as varying frequencies or high-speed converter operation. When using new rolling-contact bearings, we recommend replacing any worn sealing elements (e.g., V ring).

7. Troubleshooting

Fault	Possible Causes	Solutions
Motor doesn't start; no sound	• Interruption of at least two power supply leads	➢ Inspect the fuses, terminals and supply leads
Motor doesn't start; humming sound	• Any one of supply leads is interrupted • Motor may be jammed • Faulty Impeller • Faulty motor bearing	➢ Drain and clean the pump ➢ Recheck and correct the impeller settings if needed ➢ Change the bearing
Motor circuit-breaker trips when the motor is switched on	• Winding short-circuit • Motor is overloaded • Too high counterpressure in discharge • Too much seal liquid • entrained	➢ Check the motor winding ➢ Decrease the sealing liquid flow ➢ Lower the counterpressure ➢ Reduce the quantity of seal liquid
Pump doesn't produce vacuum	• No sealing liquid • Several leaks m ay be present in the system • Wrong direction of rotation	➢ Verify the supply of seal liquid is correct ➢ Fix any leaks in the system ➢ Inverse the direction of rotation by changing over two of the leads
Pump produces very less vacuum	• Pump size is too small • Sealing liquid flow too low • Sealing liquid too warm >60F • Erosion • Minor leak in the system • Sliding mechanical seal may be present	➢ A bigger pump may be used ➢ Increase sealing liquid flow to maximum value (2 times nominal value) ➢ Cool the sealing liquid or increase its flow ➢ Change the relevant parts ➢ Fix the leak ➢ Change the mechanical seal
Abnormal screeching noises from the pump	• Pump cavitation • Sealing liquid flow too high	➢ Connect a cavitation protection line ➢ Check the flow of sealing liquid and reduce it
Pump is leaking	• Gaskets seal may be faulty	➢ Recheck all the gaskets and seals
Power consumption is too high	• Lime or other deposits may be present	➢ Clean the pump and remove deposits if necessary.

8. Technical data

8.1 Torque Specifications for Screwed Connections

Unless stated otherwise, the tightening torque values mentioned in Table. 7 & 8 should be followed when tightening nuts and bolts.

Thread -ϕ	M4	M5	M6	M8	M10	M12	M16
Strength classes	5.6	5.6	8.8	8.8	8.8	8.8	5.6
Tightening torques ±10%	1.4	3	8	20	40	70	100

Table. 7 tightening torques for screwed connections (not for electrical connections)

Thread - ϕ	M4	M5	M6	M8	M10
Tightening torques	1.0	2.2	3	7	11

Table. 8 tightening torques for screwed connections-terminal board connections

8.2 Spare Parts

When ordering spare parts, provide the part designation, part number, and complete pump unit type. The pump unit's type number is displayed on the nameplate. Ensure that the part designation matches the designation in the spare parts list (refer to Table. 9 & 10). Standard parts can usually be obtained from local suppliers, but it's crucial that these parts have identical construction types, dimensions, strength classes, etc.

001A	Motor casing, complete	047A	Impeller
002A	Pump casing	048B	Port plate
005A	Motor rotor	050A	Valve plate
006A	Key	051A	Intercepting plate
007A	Deep-groove ball bearing	057A	Seal for cover
008A	Deep-groove ball bearing	061A	Pump cover
011A	Centering pin	063A	Bolt
018A	Bearing contact set	065A	Screw plug
025A	Bolt	066A	Cap
026A	Bearing shield	068A	Screw plug
027A	Bearing cup internal	068B	Sealing ring
028A	Bolt	071A	Pipe for cavitations protection
030A	Pin for mechanical seal	072A	Washer for cavitations protection
031A	Spacer sleeve for deep-groove ball bearing	078B	Screw plug
032A	Sealing ring	080A	Sealing ring
033A	Shaft seal	127A	Supporting disc
035A	Mechanical seal	153A	Washer
036A	Washer	400 A	Bearing shield
037A	Set screw	401A	Bolt
038A	Washer	455A	Spring strip
038B	Bolt	500A	Fan cowl
040A	Rating Plate	501A	External fan
041A	Bolt	503A	Screw
042A	Terminal box, complete	507A	Washer

Table. 9 Spare parts List of NCC-20-75

001A	Motor casing, complete	084A	Contact bracket
002A	Pump casing	084C	Adhesive tape
005A	Motor rotor	085A	Earthing screw
007A	Deep-groove ball bearing	085C	Cover
008A	Deep-groove ball bearing	088C	Sealing ring
011A	Centering pin	102A	Washer for cavitations protection
018A	Spring washer	164A	V ring
022A	Bearing shield, D end	165A	Stud bolt
026A	Bearing cap	300A	Washer for cavitations protection
027A	Pin for mechanical seal	450A	Bearing shield, ND-end
030A	V ring	455A	Spring strip
033A	Mechanical seal	500A	Fan cowl
035A	Washer	501A	External fan
036A	Centering pin	503A	Screw
037A	Rating plate	504A	Support sleeve
040A	Bolt	505A	Feather key for external fan
041A	Terminal box, complete	511A	Terminal board
042A	Impeller	512A	Rubber plug
047A	Tolerance ring for impeller	513A	Connecting bar
048A	Port plate	514A	Terminal clip
050A	Valve plate	515A	Bracket
051A	Intercepting plate	520A	Washer
058A	Sealing ring	544A	Terminal box, upper section
051A	Pump cover	571A	Clamping plate
064A	Plate for cover	582A	O-ring
065A	Protective plug	584A	Terminal box, cover
066A	Cap	640A	Terminal board
068A	Screw plug	648A	Adapter plate
068B	Sealing ring	654A	Seal
071A	Pipe for cavitations protection	656A	Upper section
072A	Washer for cavitations protection	660A	Sealing plug
078B	Screw plug	662A	Earthing
080A	Sealing ring	663A	Seal
080C	Clamping plate	665A	Cover
081A	Earthing screw	674A	Lead
083A	Earthing bracket	888E	Adapter plate
083C	Foot		

Table. 10 Spare parts List of NCC-115-350

8.3 Exploded View

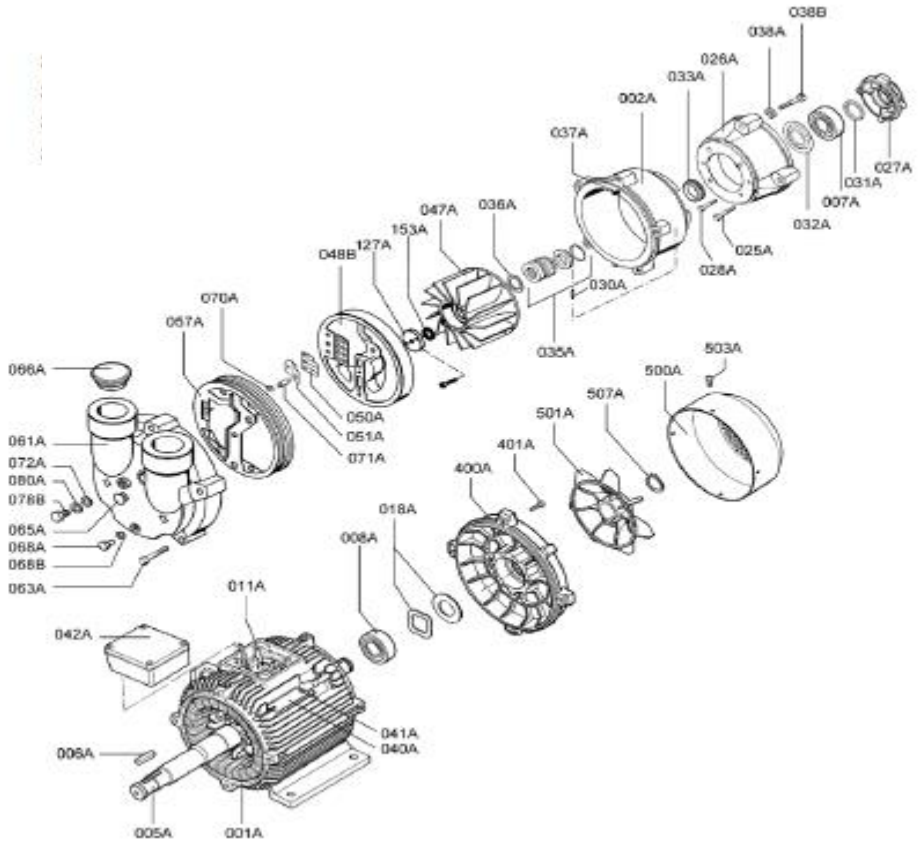


Fig. 9 Explode view of NCC-20-75 vacuum pump/compressor

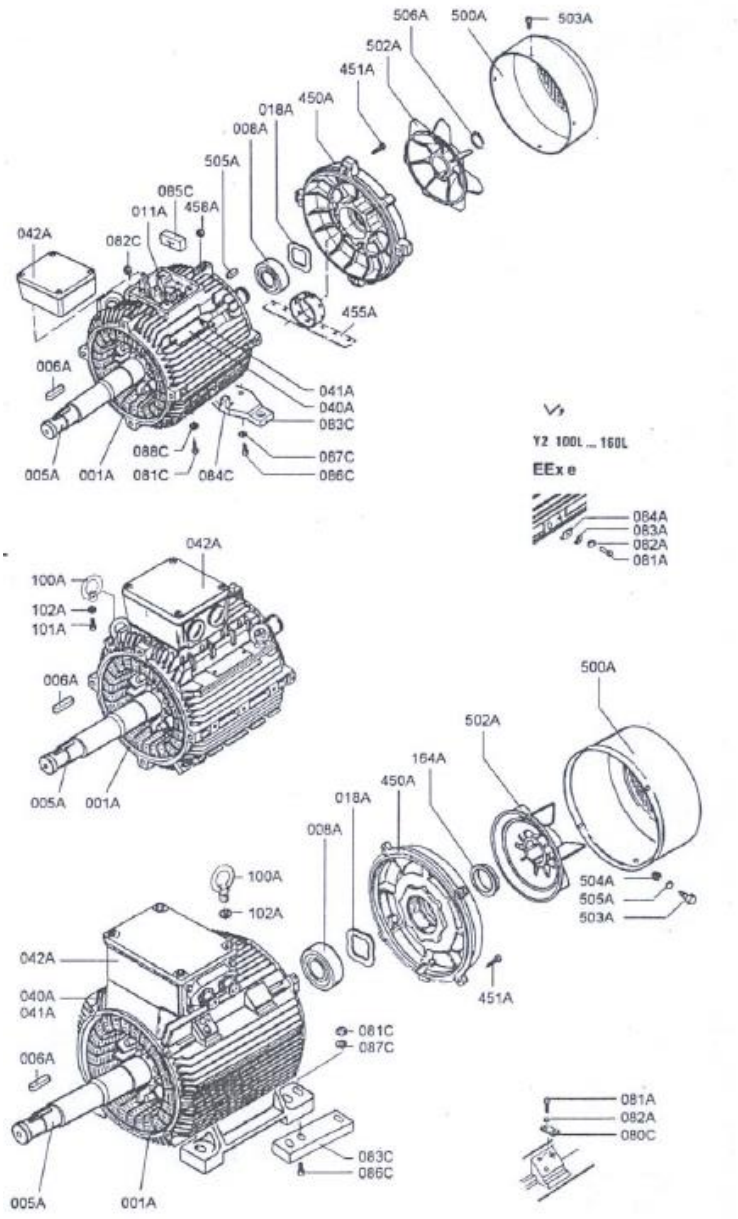


Fig. 10 Exploded view of NCC-115-350 vacuum pump/compressor