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NCC LIQUID RING VACUUM PUMP



INSTALLATION, OPERATION, & MAINTENANCE MANUAL

PLEASE LEAVE THIS MANUAL FOR OWNER'S USE

SAFETY INSTRUCTIONS

Read this manual carefully to learn how to safely install and operate your system. Throughout this manual there are a number of SAFETY HAZARDS that must be read and adhered to in order to prevent possible personal injury and/or damage to the equipment. Three keywords, "DANGER", "WARNING", and "CAUTION", are used to indicate the potential severity of the hazard, and are preceded by a SAFETY ALERT SYMBOL. Failure to follow the safety-related instructions may result in a safety hazard.

OPERATION OVERVIEW

Because pump installations are seldom identical, this manual cannot possibly provide detailed instructions and precautions for each specific application. Therefore, it is the responsibility and the duty of all personnel involved in the installation, operation and maintenance of the equipment to ensure that applications not addressed in this manual are performed only after establishing that neither operator safety nor pump integrity are compromised by the installation.

This instruction manual covers the NCC Series liquid ring vacuum pumps. These single stage, close-coupled vacuum pumps are designed for general industrial vacuum applications with moderate ultimate vacuum requirements. The NCC series pumps are suitable for the continuous vacuum operation for the evacuation of humid gas, nonflammable, non-corrosive atmosphere and atmospheric/steam mixture. Upon request, NCC series pumps may be supplied with explosion proof motors and/or stainless steel construction as suitable for flammable or corrosive applications. The seal fluid is typically water, but may be other fluids or oils. Please consult factory before ordering a pump which will employ a seal fluid other than water. Ultimate vacuum level depends on the saturated vapor pressure, temperature, and operating fluid.

This manual includes basic installation, operation, and service information. Therefore, before installing and the starting your pump we recommend carefully reading the entire manual and place the manual in a location where it can be easily accessed by operation personnel.

WARNING: Do not run the pump dry or without verifying that it has a proper supply of seal water with a corresponding flow control valve. Running the pump with too little or too much water will result in excessive damage.

WARNING: When running the pump with no cavitation protection, the suction pressure should do not be lower than 2.36”Hg absolute when the water temperature is 60F and dry gas temperature is 70F. The higher the temperature is, the higher the lowest allowable suction pressure. Cavitation will cause excessive damage and load operation. To prevent cavitation install a vacuum breaker in the the suction line to limit the ultimate vacuum level.

Maximum Discharge Pressure: Maximum discharge pressure is 19 PSIA. Please ensure that back pressure caused by lifting water or other obstructions on the discharge side of the pump are removed.

Vapor/Fluid Ingestion: The NCC liquid ring vacuum pumps are designed for industrial applications where they may be required to ingest saturated vapors and/or fluid slugs. If the pump is becoming overloaded you may be required to add a knock-out tank in front of the pump to reduce the liquid carry-over or if your application cannot tolerate mixing of the seal fluid with carry-over fluid. When pumping hot gas or steam over 175F we suggest doubling the required seal water to help keep the pump cool and prevent cavitation.

Liquid Seal Fluid: The following table contains the recommended seal fluid flow rates. Seal water should be provided at a constant rate controlled by a flow control orifice, and if necessary filtered through a strainer. The NCC series is sold with an optional discharge separator which may be used to recover up to 50% of the seal fluid. See following sections for installation and configuration of the discharge separators. Seal fluid must be supplied at a pressure at least 0.1 PSI higher than the suction pressure. As will all liquid ring vacuum pumps the seal fluid will be discharged along with the suction gas through the discharge port. The discharge separator can be used to capture and if necessary re-circulate the seal fluid.

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	4.0
NCC-350	5.5

PRE-INSTALLATION CHECK

Open all cartons and inspect for shipping damage. Report any damage to your shipping carrier or NES Company sales representative immediately. Always verify that the pump nameplate Voltage, Phase, and Horsepower ratings as well as Amps rating on motor match your control panel and power supply. Warranty does not cover damage caused by connecting pumps and controls to an incorrect power source (i.e., voltage and phase).

Site Inspection: The pump should be of the proper size and capacity for the proposed installation. Refer to nameplate for rated capacities. Check motor voltage against available power supply.

INSTALLATION

Electrical Requirements: Electrical connections are to be made by a qualified electrician in accordance with the National Electrical Code (NEC) or the Canadian Electrical Code, as well all national, state and local codes. Code questions should be directed to your local electrical inspector. Failure to follow electrical codes and OSHA safety standards may result in personal injury or equipment damage. Failure to follow manufacturer’s installation instructions may result in electrical shock, fire hazard, personal injury or death, damaged equipment, provide unsatisfactory performance, and may void the manufacturer’s warranty.

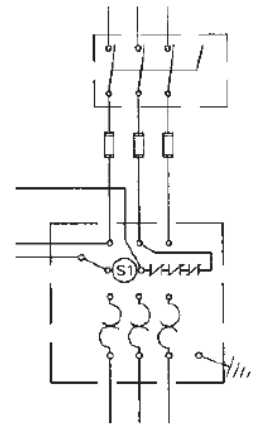
Motor must have a properly sized starter with a properly sized heater to provide overload and under voltage protection unless motor meets following two conditions: single phase and motor horsepower is 1 HP or less. Motors that satisfy these two conditions have built-in thermal overload protection. Operating personnel should be trained in the operation of the pump and any associated system.

Electrical Wiring: Units are furnished with single-phase or three-phase motors. Single phase motors are usually furnished as dual 115/230/1/60. Three-phase motors are usually furnished as tri-voltage 208/230/460/3/60. Motors should be connected according to manufacturer's instructions for correct voltage.

If control a panel is furnished, confirm that the nameplate data on the control panel[s] matches the supply current. If the nameplate data does not match the power source, consult factory. Verify controls, starter coils, etc., match the control voltages before installing. The secondary side of transformer is the control circuit. Wire in accordance with the National Electrical Code, state and local codes where applicable. See typical wiring diagrams (Figure 1)

Short Circuit Protection: According to the National Electrical Code, branch circuit over-current protection must be provided for each contactor or starter. The following table is provided as a guide. **DO NOT EXCEED MAXIMUM PROTECTIVE DEVICE RATINGS.**

Maximum HP Maximum Volts					NEMA Size	Maximum Voltage	Class K5 or R Fuse (Ampere)	Class K1 or J Fuse (Ampere)	Inverse--Time Circuit Breaker (Ampere)
Single Phase		Three Phase							
115v	230v	208v	250v	600v					
1/3	1	1 1/2	1 1/2	2	00	600 250	10 12	15 15	15 15
1	2	3	3	5	0	600 250	20 25	30 30	20 35
2	3	7 1/2	7 1/2	10	1	600 250	30 40	60 60	40 60
-	-	10	15	25	2	600 250	60 60	100 100	80 90
-	-	25	30	50	3	600 250	100 125	200 200	125 150

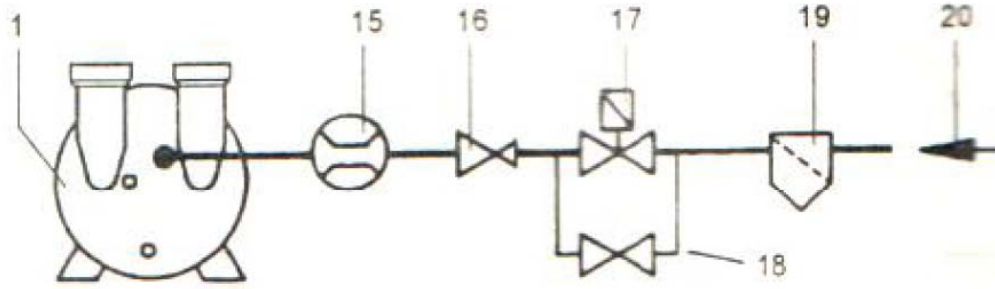


Pump Mounting: Install the vacuum pump on a level plane and fix with bolts through bolt holes onto the foundation. When transporting the pump we suggest lifting it with the lifting eye bolt on the motor near the pump and bolt hole in the inlet flange. (See Fig 2) Pay attention to the capacity of hoisting equipment.

Pipe Connections: In order to prevent foreign matter from entering and potentially damaging your vacuum pump all piping connections have been plugged prior to shipment. It is important to leave all temporary plugs in place until you are ready to make the pipe connections to avoid allowing dirt or other matter from falling into the pump housing. All pipe connections should be made in a manner to avoid imparting stress to the vacuum pump. Connecting pipes which have the potential to push, pull, rotate, or vibrate the pump can severely damage the pump during operation. It is always best to install vibration, and or dresser couplings to reduce the potential for damage.

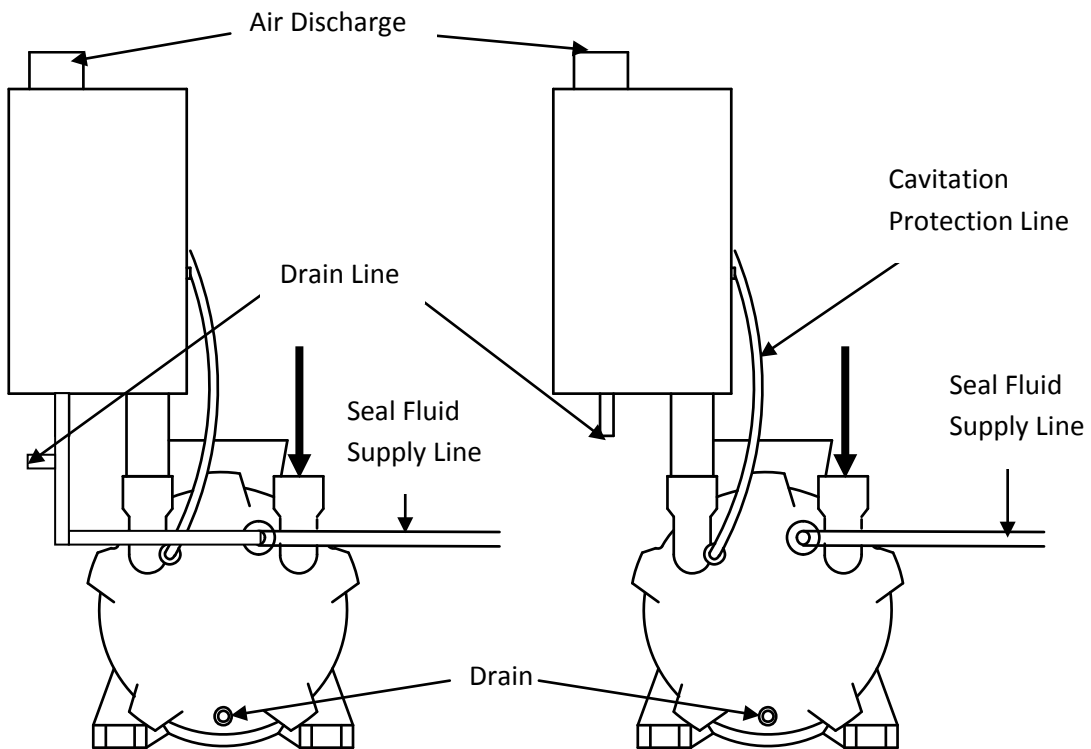
Air Inlet & discharge connections: The inlet connection piping should be fitted with a vacuum check and manual shut off valves in order to maintain a vacuum and prevent seal fluid backflow when the pump is not in service. When running the pump without a separator it is important to install a vacuum breaker set to break at >28"Hg on the inlet piping (see following figures). Exhaust pressure should not exceed 19 PSIG. In order to prevent weld slag and other installation debris from entering the pump it is suggested to install an inlet filter for the first 100 hours of operation.

Seal fluid connection: The seal water connection should include the following items according to the following figure: 15) Flow meter, 16) Flow Control Valve, 17) Solenoid valve, 18) manual by-pass, 19) Y-strainer, 20) Seal water supply line



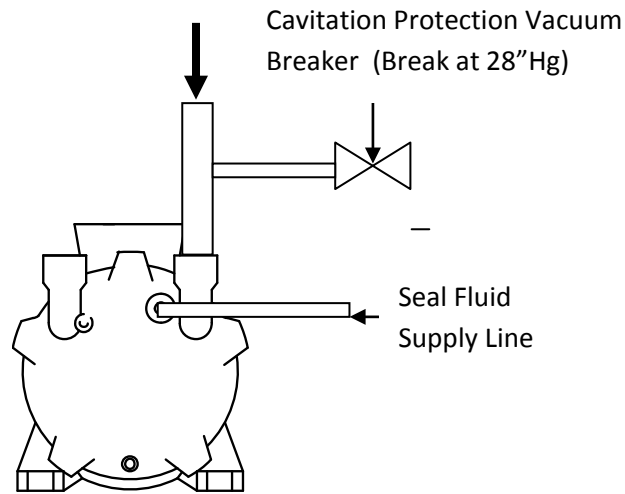
Before starting the pump, it must be primed with seal water allowing the pump to fill approximately half way. Once the pump has been primed seal water should be automatically turned off and on using a solenoid valve. When connecting the pump it is good practice to flush the pump out through the drain hole to remove any debris, oil, or loose particles that may have entered the pump during assembly and shipment.

Seal fluid Operating Modes: When you purchase the optional discharge separator it is possible to recover up to 40% of the seal fluid by connecting the overflow drain pipe to the seal fluid port on the pump. It is important to connect the cavitation protection hose, or when not using a separator to connect a vacuum breaker on the inlet side of the pump (see figures below):



Partial Seal Recovery Configuration

Once-Thru Configuration (w/separator)



Once-Thru Configuration (w/o separator)

START UP

When starting up the pump follow the startup procedure:

1. Check all pipe connections to ensure the pump is plumbed correctly
2. Check that the all manual shut off valves are open
3. Check that the seal fluid is on and ready to fill the pump
4. **DO NOT START THE PUMP UNLESS THE SEAL FLUID IS ON AND IT HAS BEEN PRIMED.**
5. Open by-pass valve or manually actuate the seal fluid solenoid valve for minimum 20 seconds to ensure that the vacuum pump case is flooded so that the pump is properly lubricated, and can produce a vacuum when started.
6. Manually rotate pump by hand using the motor fan to ensure that the pump rotates freely. If necessary remove the fan cover and use a wrench. If the pump has been in storage for an extended period of time it may be necessary to jog it free prior to initial start up.
7. Kick Start the pump using the manual start button to ensure that the pump is wired correctly and rotates according to the red arrow on the pump casing. If necessary reverse to polarity of the wiring to ensure proper rotation.
8. Start to vacuum pump and monitor the seal fluid flow rate. If necessary you may throttle back the seal fluid to obtain optimal flow rate (see table above).

TROUBLESHOOTING

Pump Will Not Start

1. The power supply has been interrupted, disconnect switch is open or a selector switch is not in proper position.
2. Wiring to the control panel is incorrect or connection requires tightening.
3. Voltage supplied to unit is wrong. Check voltage and wiring with motor and panel specs.
4. Starter coil wrong for power supplied.
5. Overload relays in the starter have tripped and require resetting. Ambient temperature may be too high.

Pump Does Not Operate Adequately.

1. Pump may be running backwards. Rotation of 3 phase motors can be corrected by interchanging any two of the three wires. Pump should run clockwise.
2. A valve in the discharge/inlet line is closed or throttled too tightly. A check valve may be installed incorrectly.
3. The total back pressure at the pump discharge is greater than the rated discharge pressure of the pump. Check the total pressure including lift, pipe friction loss, and any system pressure.
4. The seal fluid strainer is dirty. Clean the strainer.

Pump is noisy.

1. Seal fluid is not flowing or not connected.
2. Vacuum level is over 28" Hg and the pump is cavitating. Install a vacuum breaker valve to limit maximum vacuum level.
3. Pump is not balance or rotor is damaged.
4. Starters chatter. Trouble is caused by low line voltage, poor connection, defective starter coil, or burned contacts.
5. Hum or bearing noise in motor. Consult motor manufacturer's authorized service station nearest pump location & replace the mechanical seal.
6. Pump is running backwards.

Pump Not Handling Air.

1. Air discharge blocked or improperly connected. Check air discharge and make sure it is open to atmosphere.
2. Suction check valve fails. Make sure the vacuum inlet check valve is properly installed and functioning.
3. Vacuum seal water is in adequately supplied. Verify that the vacuum pumps are receiving the proper amount of water through the seal water line and that the seal water orifice is not blocked.

SHUT DOWN

Warning: If the operating liquid is toxic or environmentally unsafe, before opening the thread plug to drain you must flush the pump.

Draining & Prolonged Shutdown: When draining, open the top thread plug on the pump cover and turn the motor fan by hand to turn the pump until all liquid flow out. Alternatively you may tilt the pump cover to an incline of 45 degrees to drain off all the liquid. For prolonged period of shutdown of greater than 4 weeks or during the cold season it is advisable to drain the pump and fill it with 2 quarts of diluted machining oil and rotated the pump until the the internal components have been coated in oil.

MAINTENANCE

General: To prolong pump life and reduce impeller and body wear and blockage dust and debris from normal operations should be regularly flushed out through the flushing mouth on pump cover base. If the liquid seal fluid is hard water, it should be softened or flushed regularly with solvent. If the impeller, air inlet port, or air vent are blocked by scale from hard water, fill the pump with a 10% oxalic acid solution for 30 minutes and flush.

Lubrication: After normal pump operation for 20,000 hours or not more than 3 years every pump should be lubricated by cleaning the old bearing grease and supply new grease. The new grease will should occupy 50% space of bearing, and 65% space of bearing cover. If the pump application is severe, the lubrication replacement schedule should be shortened.

Disassembly & Mechanical Seal Replacement: When disassembling first remover the cover and carefully inspect and inventory each component as you remove it. As you disassemble the pump look for excessive signs of wear and/or scale build-up. Clean the pump thoroughly and replace all worn components as necessary (reference appendix A for part numbers and description). After dissembling the pump you should replace the mechanical seal and gaskets provided with the standard repair kit.

Assembly & Clearance Settings: After the mechanical seal has been replaced, place the impeller on the pump shaft and tighten the impeller shaft screw all the way to ensure that the impeller is fully seated. After the impeller is seated, measure the clearance between the impeller and port plate. The minimum clearance should comply with the following chart. Make sure you place the appropriate number of ship gaskets under the impeller bolt in order to maintain the appropriate clearance. After the clearance has been set complete the assembly of the pump and rotate it by hand to ensure it turns freely.

P/N	Minimum Clearance b/w Port Plate & Impeller [in]
NCC-20	.003 - .004"
NCC-35	.003 - .004"
NCC-55	.003 - .004"
NCC-75	.004 - .006"
NCC-115	.006 - .008"
NCC-160	.006 - .008"
NCC-200	.008 - .010"
NCC-300	.008 - .010"
NCC-350	.010 - .012"

WARRANTY

Subject to the terms and conditions hereinafter set forth and set forth in General Terms of Sale, NES Company Inc. (the seller) warrants products and parts of its manufacture, when shipped, and its work (including installation and start-up) when performed, will be of good quality and will be free from defects in material and workmanship. This warranty applies only to Seller's equipment, under use and service in accordance with seller's written instructions, recommendations and ratings for installation, operating, maintenance and service of products, for a period as stated in the table below. Because of varying conditions of installation and operation, all guarantees of performance are subject to plus or minus 5% variation. (Non-standard materials are subject to a plus or minus 10% variation). THIS WARRANTY EXTENDS ONLY TO BUYER AND/OR ORIGINAL END USER, AND IN NO EVENT SHALL THE SELLER BE LIABLE FOR PROPERTY DAMAGE SUSTAINED BY A PERSON DESIGNATED BY THE LAW OF ANY JURISDICTION AS A THIRD PARTY BENEFICIARY OF THIS WARRANTY OR ANY OTHER WARRANTY HELD TO SURVIVE SELLER'S DISCLAIMER.

Product Type Warranty Duration

New 15 months after date of shipment or 12 months after initial startup date, whichever occurs first. Repair 6 months after date of shipment or remaining warranty period, whichever is greater. Remanufactured 9 months after date of shipment or 6 months after initial startup date, whichever occurs first. All accessories furnished by Seller but manufactured by others bear only that manufacturer's standard warranty. All claims for defective products, parts, or work under this warranty must be made in writing immediately upon discovery and, in any event within one (1) year from date of shipment of the applicable item and all claims for defective work must be made in writing immediately upon discovery and in any event within one (1) year from date of completion thereof by Seller. Unless done with prior written consent of Seller, any repairs, alterations or disassembly of Seller's equipment shall void warranty. Installation and transportation costs are not included and defective items must be held for Seller's inspection and returned to Seller's Ex-works point upon request. THERE ARE NO WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OF PURPOSE. After Buyer's submission of a claim as provided above and its approval, Seller shall at its option either repair or replace its product, part, or work at the original Ex-works point of shipment, or refund an equitable portion of the purchase price. The products and parts sold hereunder are not warranted for operation with erosive or corrosive material or those which may lead to build up of material within the product supplied, nor those which are incompatible with the materials of construction. The Buyer shall have no claim whatsoever and no product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action nor for problems resulting from build-up of material within the unit nor for problems due to incompatibility with the materials of construction. Any improper use, operation beyond capacity, substitution of parts not approved by Seller, or any alteration or repair by others in such manner as in Seller's judgment affects the product materially and adversely shall void this warranty. No employee or representative of Seller other than an Officer of the Company is authorized to change this warranty in any way or grant any other warranty. Any such change by an Officer of the Company must be in writing. The foregoing is Seller's only obligation and Buyer's only remedy for breach of warranty, and except for gross negligence, willful misconduct and remedies permitted under the General Terms of Sale in the sections on CONTRACT PERFORMANCE, INSPECTION

AND ACCEPTANCE and the PATENTS Clause hereof, the foregoing is BUYER'S ONLY REMEDY HEREUNDER BY WAY OF BREACH OF CONTRACT, TORT OR OTHERWISE, WITHOUT REGARD TO WHETHER ANY DEFECT WAS DISCOVERED OR LATENT AT THE TIME OF DELIVERY OF THE PRODUCT OR WORK. In no event shall Buyer be entitled to incidental or consequential damages. Any action for breach of this agreement must commence within one (1) year after the cause of action has occurred.

Appendix A

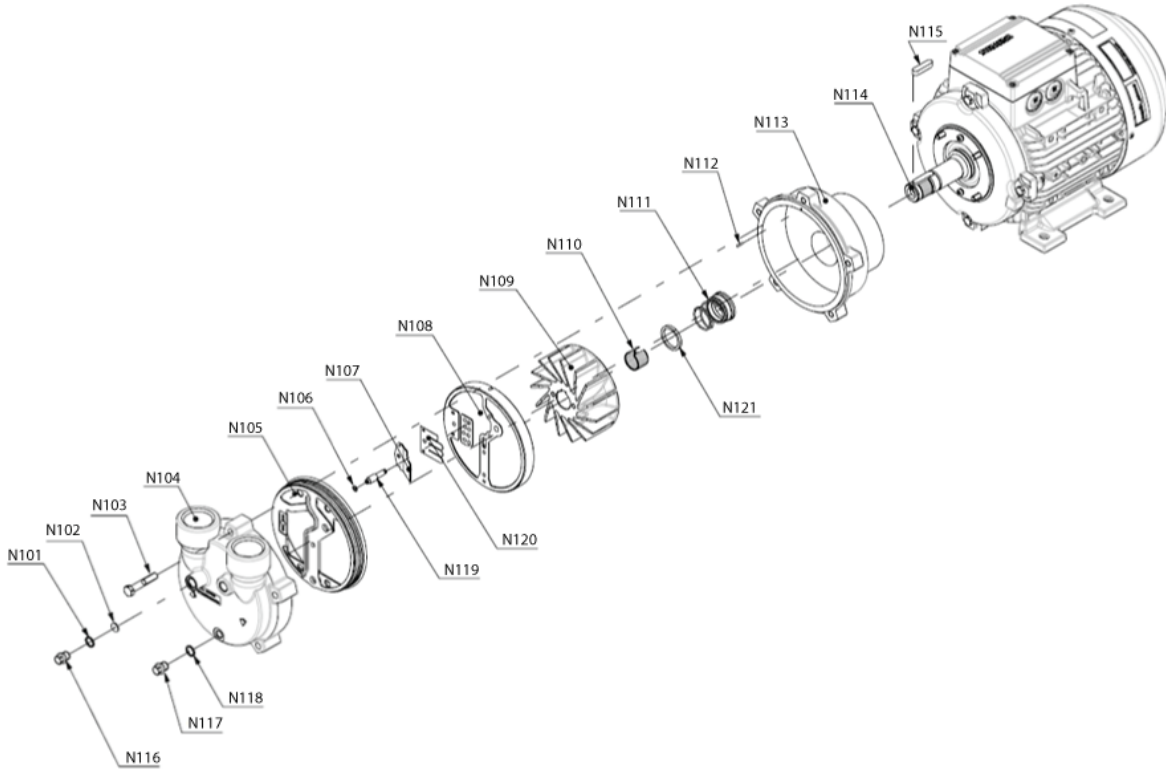


Figure A1: NCC-20 Thru NCC-75 Exploded View

P/N	Description	Material
N101	Sealing Ring	Teflon
N102	Washer for Cavitation Protection	Chrome Nickel Steel
N103	Screw	Steel
N104	Cover	Grey Cast Iron
N105	Cover Gasket	Nitrile-butadiene-caotchouc
N106	O-Ring	FPM (Flouro Rubber)
N107	Intercepting Plate	Chrome Nickle-Molybdenum Steel
N108	Port Plate	Ceramic
N109	Impeller	Cast Aluminum Bronze
N110	Tolerancing Ring for Impeller	Chrome Nickel Steel
N111	Mechanical Seal	Carbon/Ceramic/ NBR
N112	Set Screw	Chrome Nickel Steel
N113	Casing	Grey Cast Iron
N114	Pump Shaft	Chrome Steel
N115	Feather Key	Chrome Steel
N116	Plug Screw	Machining Steel
N117	Plug Screw	Machining Steel
N118	Sealing Ring	Teflon
N119	Cavitation Protection Pipe	Chrome Nickel Steel
N120	Valve Plate	Teflon
N121	Washer	Chrome Nickel Steel

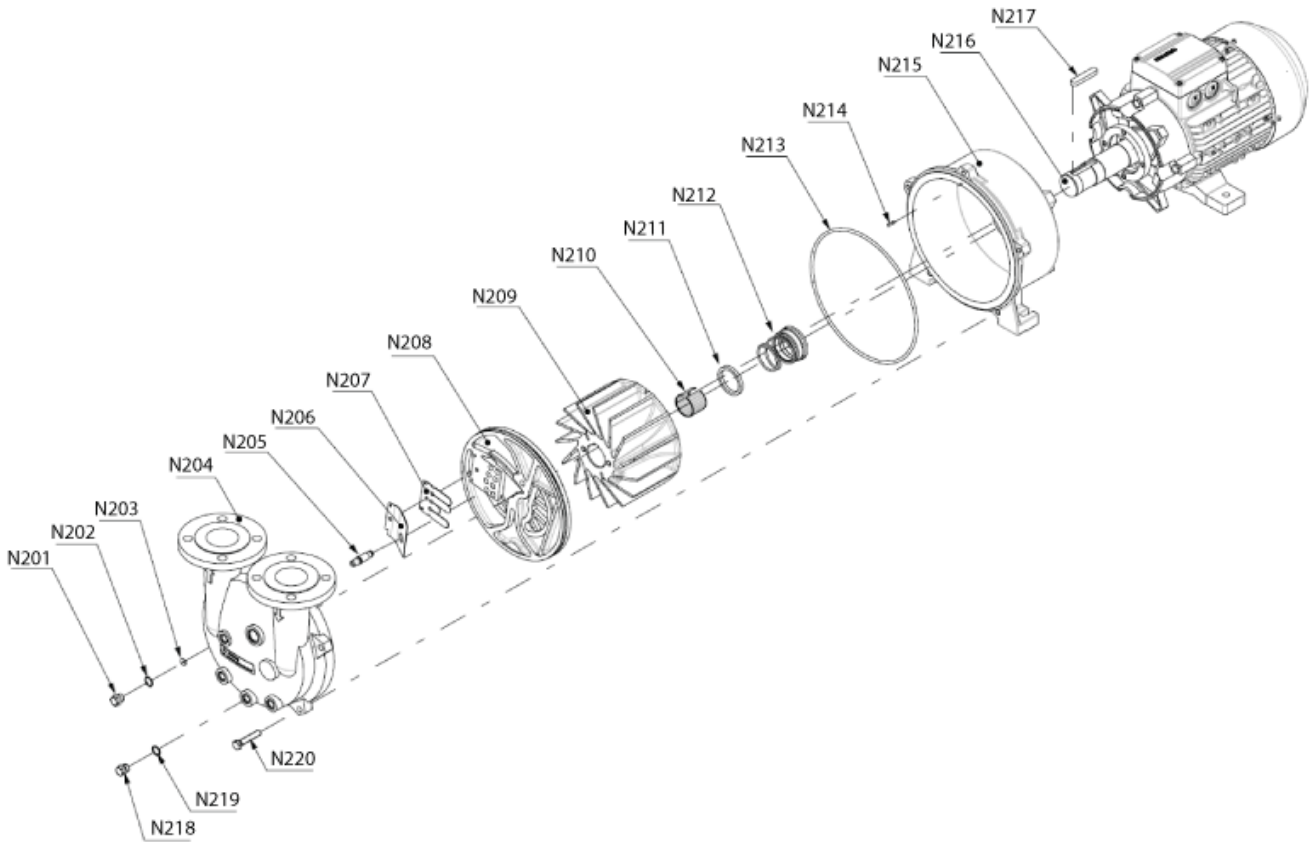


Figure A2: NCC-115 Thru NCC-350 Exploded View

P/N	Description	Material
N201	Plug Screw	Machining Steel
N202	Sealing Ring	Teflon
N203	Washer for Cavitation Protection	Chrome Nickel Steel
N204	Cover	Grey Cast Iron
N205	Cavitation Protection Pipe	Chrome Nickel Steel
N206	Intercepting Plate	Chrome Nickel-Molybdenum Steel
N207	Valve Plate	Teflon
N208	Port Plate	Ceramic
N209	Impeller	Cast Aluminum Bronze
N210	Tolerancing Ring for Impeller	Chrome Nickel Steel
N211	Washer	Chrome Nickel Steel
N212	Mechanical Seal	Carbon/Ceramic/ NBR
N213	Cover Gasket	Nitrile-butadiene-caotchouc
N214	Set Screw	Chrome Nickel Steel
N215	Casing	Grey Cast Iron
N216	Pump Shaft	Chrome Steel
N217	Feather Key	Chrome Steel
N218	Plug Screw	Machining Steel
N219	Sealing Ring	Teflon
N220	Screw	Steel