TEIKOKU USA INC
CHEMPUMP

CHEMPUMP™ NC-SERIES

The Standard in Sealless Technology

INSTRUCTION MANUAL

for Installation, Operation, and Maintenance

June 2020

Introduction

Thank you for purchasing a Chempump™ NC-Series pump.
Please carefully read this instruction manual and all Safety Warnings prior to use.

Safety Terms

Please pay close attention to these terms. When you see them in this manual, read the information thoroughly and follow the instructions given.

Attention!

Indicates careful attention is required. The instruction includes protective information for the device and product.

Caution!

Ignoring this warning can cause personal injury and/or damage to the device and product.

Hazard!

Ignoring this warning can cause serious injury or even death. It can also be used to alert against unsafe practices.

NOTE: *Information included in NOTES gives additional helpful information and recommendations.*

Applicable Standards and Regulations

The NC-Series pump conforms to the following standards:

1. American Society of Mechanical Engineers (ASME) B-16.5
2. Canadian Standards Association (CSA): UL 778 CSA 22.2 No 108

Product Warranty Period

This product is warranted for two years from date of delivery. Please refer to Teikoku USA's Terms and Conditions of Sale for additional warranty coverage and restrictions.

Rights

Safety Warnings

Important:
Before operating the canned motor pump, read these Safety Warnings and this entire Instruction Manual to avoid improper operation.
It is essential for your safety and to avoid disaster.

ATTENTION

Attention!

Do not run dry!

If the pump is allowed to run dry, the bearings, sleeves, and other components could be damaged and serious overheating of the motor windings can occur.

ATTENTION

Attention!

Avoid rapid temperature changes!

Large changes in temperature must be avoided. Rapid changes can cause leaks to occur in gaskets. Published procedures for proper heating and cooling must be followed. If published procedures are not available, check with Teikoku before operating the equipment.

CAUTION

Caution!

Hot – Do not touch!

Motor and pump can be hot, even when pumping cold liquids.

CAUTION

Caution!

If motor trips, do not restart before determining the cause!

Restarting the motor before ascertaining the cause may result in excessive heat, causing pump or motor failure.

HAZARD

Hazard!

Do not remove internal bolts in terminal box.

If it is necessary to remove the terminal box for any reason, first loosen the bolts by 2 or 3 turns to check if any internal pressure or liquid is present. You must take measures if the possibility exists that the gas or liquid is toxic or hazardous to personnel or the environment.

HAZARD

Hazard!

Do not remove any bolts on pump, motor, or drain plugs!

The internal pressure can be higher than the atmosphere. Ensure that the pump and motor are properly de-pressurized and decontaminated prior to performing any work. Proper protective measures must be taken if the possibility exists that the gas or liquid is toxic or hazardous to personnel or the environment.

HAZARD

Hazard!

Always assume that there is liquid left in the pump!

There is always the possibility that residual liquid could remain in the pump and motor in spite of thorough decontamination. Pay particular attention to the clearance between the shaft and the impeller, bearings, sleeves, bearing housings, internal bolting and gaskets. You must take adequate precautions to protect personnel and the environment if the liquid could be considered hazardous.

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1. General Information

1.1 General Design and Operation

The Chempump™ NC-Series is a combined centrifugal pump and squirrel cage induction electric motor built together into a single hermetically sealed unit. The pump impeller is a closed type, and is mounted on one end of the rotor shaft which extends from the motor section into the pump casing. The rotor is submerged in the fluid being pumped and is "canned" to isolate the motor parts from contact with the fluid. The stator winding is also "canned" to isolate it from the fluid being pumped. Bearings are submerged in system fluid and are continually lubricated.

Chempump™ pumps have only one moving part, a combined rotor-impeller assembly which is driven by the magnetic field of an induction motor. A portion of the pumped fluid is allowed to recirculate through the rotor cavity to cool the motor and lubricate the bearings. The stator windings are protected from contact with the recirculating fluid by a corrosion resistant, non-magnetic, alloy liner which completely seals or "cans" the stator winding. The recirculating fluid passes through a self-cleaning cylindrical filter (fitted in the discharge nozzle of the pump casing), through the circulation tube, to the motor adapter, entering the motor section at the front bearing. A portion of the pumpage flows across the front bearing and returns to the rear of the impeller. The remainder passes over the rotor, across the rear bearing, and returns to suction through a hollow shaft. See Figure 1-1.

The Chempump™ sealless pump is a precision built unit that, with proper care, will give years of trouble-free, leakproof service. This manual, containing basic instructions for installation, operation and maintenance of Chempump pumps, is designed to assist you in obtaining this service.

It is important that the persons responsible for the installation, operation and maintenance of the pump, read and understand the manual thoroughly. Trouble-free performance begins with proper pump selection and application. If the selected pump does not have the required performance characteristics, or if the materials of construction are not properly specified for the fluid being handled, unsatisfactory operation may result. No amount of maintenance can compensate for this.

If you are in doubt on your NC-Series selection or application, write or call your pump engineering representative or the factory for assistance and advice. Additional copies of this manual are available from Teikoku field representative or from the factory.

1.2 Stator Assembly

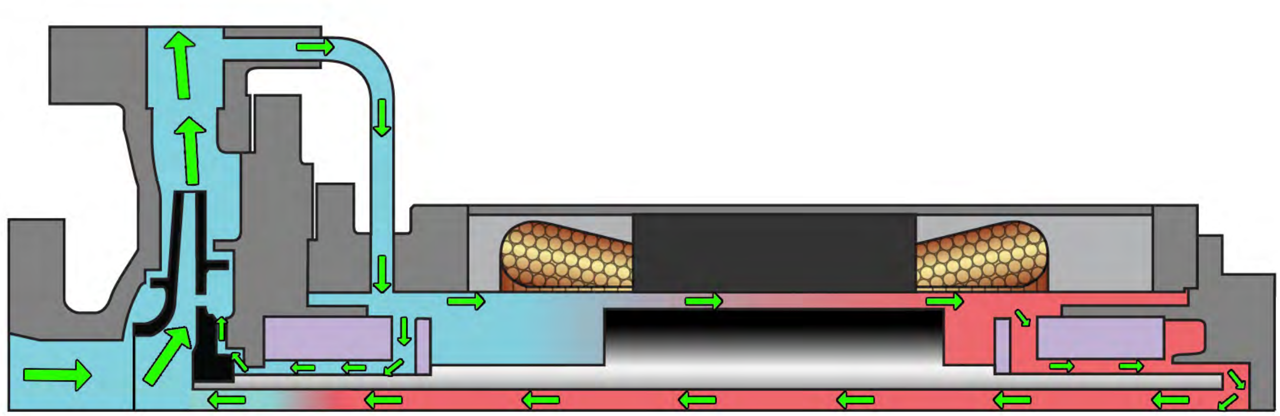
The stator assembly consists of a set of three (3)-phase windings connected in a one (1) circuit wye arrangement. Stator laminations are of low-silicon grade steel. Laminations and windings are mounted inside the cylindrical stator band. End bells, welded to the stator band, close off the ends of the stator assembly. Back up sleeves are provided to strengthen those areas of the stator liner not supported by the stator laminations. The stator liner is a cylindrical "can" placed in the stator bore and welded to the rear end bell and front end bell shroud to hermetically seal off the windings from contact with the liquid being pumped. Terminal leads from the windings are connected to a pressure tight terminal plate isolating the stator cavity from the customer's electrical connections in the Teikoku supplied connection box.

1.3 Rotor Assembly

The rotor assembly is a squirrel cage induction rotor constructed and machined for use in the pump. It consists of a machined corrosion resistant shaft, laminated core with copper bars, end rings, corrosion resistant end covers, corrosion resistant can and an auxiliary impeller. The shaft is provided with an impeller key arrangement at one end to receive the impeller and is threaded at the same end to receive the inducer which retains the impeller.

The rotor end covers are welded to the shaft and also to the rotor can which surrounds the outside of the rotor, thus hermetically sealing off the rotor core from contact with the liquid being pumped. An auxiliary impeller is mounted to the rear end cover

Figure 1-1. Reverse Circulation Type-R (Plan 13-SE)



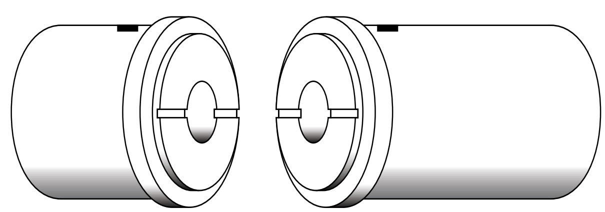
and is used for circulating the process fluid in the rotor cavity and heat exchanger.

The shaft is fitted with replaceable shaft sleeves and thrust bearing collar. These parts are keyed to prevent turning. Axial movement is restricted by the impeller hub in the front and by a retaining nut in the rear.

1.4 Bearings

The bearings for the NC-Series are metal sleeved carbon/graphite and are machined with a special helix groove through the bore to assure adequate fluid circulation at the journal area. Each bearing is manufactured to close tolerances for a high degree of concentricity and is held in a bearing housing by a retaining screw. Bearings are easily replaced by removing the retaining screw and sliding the bearing from its housing. See Figure 1-2.

Figure 1-2. Bearings



1.5 Thrust Surfaces

The pump is equipped with thrust bearings against which axial loads can be carried during upset conditions. The shaft is fitted with a replaceable thrust bearing collar which is keyed to rotate with the shaft. Axial movement is restricted by two (2) thrust bearings located on either side of the thrust bearing collar. Each thrust bearing has a set screw which prevents rotation. This thrust bearing system prevent metal to metal in the event of abnormal pump operation such as running dry or cavitation.

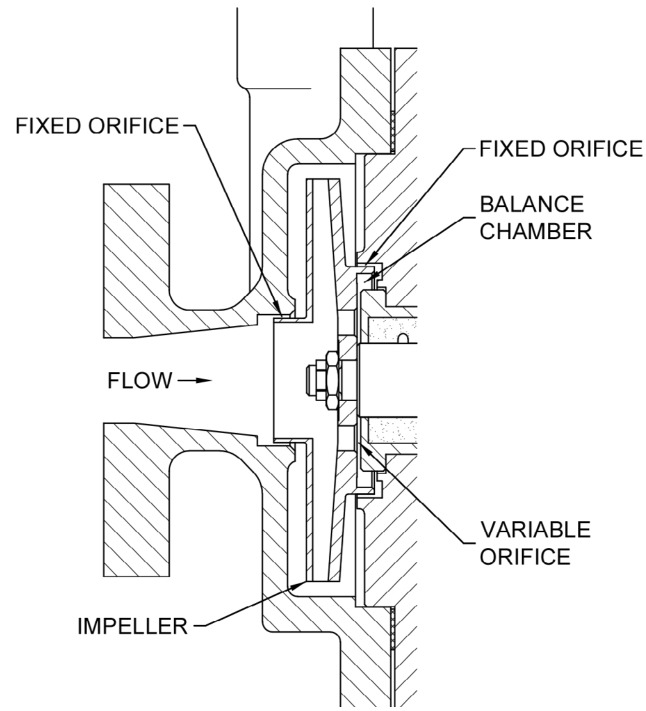
1.6 Internal Cooling Flow

Cooling for stator, rotor, and bearings, as well as bearing lubrication, is provided by circulation of the pumped fluid. A portion of the fluid circulates through the circulation tube to the motor adapter, entering the motor section at the front bearing. A portion of the fluid flows across the front bearing and returns to the rear of the impeller. The remainder passes over the rotor, across the rear bearing, and returns to suction through the hollow shaft. See Figure 1-1.

1.7 Automatic Thrust Balance

Based on hydraulic principles, NC-Series automatic thrust balance is accomplished by the pressure of the pumped fluid itself, operating in a balance chamber on the front and rear of the impeller. When a change in load tends to change the position of the impeller away from the balance condition, there is an equalizing change of hydraulic pressure in the balance chambers which immediately returns the impeller - rotor assembly to the balanced position. See Figure 1-3.

Figure 1-3. Automatic Thrust Balance, Single Ring



2. Installation

2.1 Receipt Inspection

1. Avoid rough handling during loading, transportation and unloading.
2. Visually inspect the shipping container for evidence of damage during shipment.
3. Check unit to see that suction, discharge, and any other connections are covered.
4. Inspect the suction, discharge and any other connections gasket seating surface to be certain that they are clean of foreign matter and free from nicks, gouges, and scratches.
5. Check phase resistance and megger resistance to ground of the motor windings. Refer to Table 4-6.
6. Check all nameplate data against shipping papers.
7. Caution should be observed during handling, so as not to bend the circulation line.

2.1.1 Storage Note

In situations where a pump is to be stored for a period of time prior to installation, and where the climate experiences wide temperature changes and high humidity, the terminal box must be sealed to prevent moisture from entering the motor winding area.

2.2 Structural

The pump design and construction eliminates the need to align the pump and motor. The pump should be supported using the mountings provided and mounted so that its weight is properly supported. Suction and discharge piping must be properly supported and aligned so that no strain is placed on the pump casing.

1. Remove burrs and sharp edges from flanges when making up joints.
2. When connecting flanged joints, be sure inside diameters match within 1/16" so as not to impose a strain on the pump casing.
3. Use pipe hangers or supports at intervals as necessary.

2.2.1 Pump Location

Locate the pump as close as possible to the fluid supply with a positive suction head. Installations with suction lift are possible but not recommended.

Since standard pumps are not self-priming, provide for initial priming and for maintaining a primed condition. Location of the pump and arrangement of the system should be such that sufficient NPSH (Net Positive Suction Head) is provided over vapor pressure of the fluid at the pump inlet. NPSH requirements at the design point are stated on the pump order copy. For additional design points, refer to the corresponding performance curves placed in the Appendix of this manual.

Note: *Experience has proven that most pump troubles result from poor suction conditions including insufficient NPSH. The suction line must have as few pressure drops as possible and available NPSH MUST be greater than required NPSH.*

Depending on job conditions, available NPSH can sometimes be increased to meet the NPSH required by the pump for satisfactory operation. NPSH can be tailored by changes in the piping, in liquid supply level, and by several other methods. Refer to Appx. B. Troubleshooting.

2.2.2 Mounting and Alignment

Chempump combines a pump and motor in a single hermetically sealed unit. No tedious coupling alignment is required because the pump has no external coupling between pump and motor. All models can be mounted in any position.

For mounting with suction and discharge on the side or in any other position, modifications must be made to the standard internal venting arrangement.

High temperature systems normally require expansion joints in the piping to relieve the stresses in the pipe and the pump due to expansion and contraction. The NC-Series, when mounted so that the base can float with the pipe expansion (as opposed to rigidly bolting the pump to a foundation) or using a spring mounted foundation, eliminates the need for the expansion joints, which can save considerable expense in the installation.

Bases are offered on all models. You merely have to set the pumps on a foundation strong enough to support their weight. There is no need to bolt down or grout in a Chempump™. All NC-Series models are provided with a specially made base designed to mount on a standard ANSI baseplate to facilitate inspection and repair.

Be sure that suction and discharge piping is properly aligned so that no strain is placed on the pump casing by out-of-line piping.

2.2.3 Piping Data

ATTENTION

Attention!

It is recommended to install a temporary cone-style strainer near the suction port to trap scale and other foreign particles. Suction strainer to be sized and designed per Teikoku recommendations. The screen can be installed for 24 hours of operation, but must be monitored closely so the pump does not become starved for liquid because of a clogged screen. Remove screen after 24 hours of running.

Observe the standards of the Hydraulic Institute when sizing and making up suction and discharge piping. Follow these procedures:

1. Remove burrs and sharp edges when making up joints.
2. When using flanged joints, be sure inside diameters match properly. When gasketing flanged joints, do not cut flow hole smaller than flange opening.
3. Use pipe hangers or supports at necessary intervals.

4. Provide for pipe expansion when required by liquid temperature.
5. When welding joints, avoid possibility of welding shot entering the suction or discharge line, and thereby entering the pump.

Caution!

CAUTION Do not weld pipe when it is connected to pump.

6. Do not spring piping when making up any connections.
7. Make suction piping as straight as possible, avoiding unnecessary elbows. Where necessary, use 45 degree or long-sweep 90 degree fittings.
8. Make suction piping short, direct, and never smaller in diameter than suction opening of pump. Suction piping should be equal to or larger than pump suction port, depending on pipe length.
9. Ensure that all joints in suction piping are airtight.
10. When installing valves and other fittings, position them to avoid formation of air pockets.
11. Permanently mounted suction filters are not recommended.

It is extremely important to size and layout the suction system to minimize pressure losses and to be sure that the pump will not be "starved" for fluid during operation. NPSH problems are a result of improper suction systems.

If suction pipe length is short, pipe diameter can be the same size as the pump suction port diameter. If suction piping is long, the size should be one or two sizes larger than pump suction port, depending on piping length.

Use the largest pipe size practical on suction piping and keep piping short and free from elbows, tees or other sources of pressure drops. If elbows or tees must be used, locate them from 10 to 15 pipe diameters upstream from suction. When reducing to pump suction port diameter, use eccentric reducers with eccentric side down to avoid air pockets.

When operating under conditions where pump prime can be lost during off cycles, a foot valve should be provided in the suction line to avoid the necessity of priming each time the pump is started. This valve should be of the flapper type rather than the multiple spring type and of ample size to avoid undue friction in the suction line.

When foot valves are used, or when there are other possibilities of fluid hammer, it is important to close the discharge valve before shutting down the pump.

When necessary to connect two or more pumps to the same suction line, provide gate valves so that any pump can be isolated from the line. Install gate valves with stems horizontal to avoid air pockets. Globe valves should be avoided, particularly where NPSH is critical. If discharge pipe length is normal, pipe diameter can be the same size as the pump discharge port diameter. If discharge piping is of considerable length, use larger diameter pipe (one or two sizes larger).

If the pump is to discharge into a closed system or an elevated tank, place a gate valve or check valve in the discharge line close to the pump. The pump can then be opened for inspection without fluid loss or damage to the immediate area.

NOTE: *Install properly sized pressure gauges in suction and discharge lines between the pump and the first block and/or check valve so that operation of the pump and system can be easily observed. Should cavitation, vapor lock, or unstable operation occur, widely fluctuating discharge pressures will be observed. Such gauges provide a positive means of determining actual system conditions and can be used to great advantage in evaluating system problems.*

2.3 Electrical and Instrumentation

2.3.1 TRG Bearing Wear Monitor

The TRG is an electrical meter that continuously monitors the condition of the bearings. The TRG is mounted on the electrical junction box as standard.

The TRG meter operates on the principle of induced voltage. There are two TRG coils located inside the stator 180° apart. A magnetic field is created in the stator by current flowing through the stator windings. In addition, a magnetic field is created by induced currents in the rotor. When the rotor is perfectly centered in the stator, the two magnetic fields are essentially balanced. When bearing wear occurs and the gap between the rotor and stator decreases, an imbalance in the magnetic fields causes a differential induced voltage in the TRG coils. This differential voltage is indicated on the TRG voltmeter.

The initial display of the TRG meter is adjusted in the Teikoku factory, but each meter will show subtle differences. To check bearing wear using the TRG meter, use the color change (Green, Yellow, Red) as a reference. If the increase of TRG readings is 0.3 or more, stop the pump and check bearings.

The Teikoku Rotary Guardian (TRG) signal is affected by motor load. Changes in operating frequency or hydraulic load may increase or decrease signal.

Keeping records of the TRG meter reading in conjunction with motor amp readings will provide a good indication of when the pump will require maintenance.

Figure 2-1. Teikoku TRG Bearing Wear Monitor

Table 2-1. Conditions Indicated on the TRG Meter					
The TRG meter has a colored scale which is divided into three zones: Green (0 to 0.5), Yellow (0.5 to 0.75), Red (0.75 to 1)					
AT TRIAL OPERATION			DURING OPERATION		
Indication	Condition	Solution	Indication	Diagnosis	User Actions
Full scale	incorrect wiring	change power cable connection	Green	Good	No action
Yellow to Red	phase failure	check connection of cables	Yellow or scale increase of > 0.3 from initial indication	Bearings worn to caution level	Plan routine maintenance
Green	normal	connection is correct	Red or scale increased of > 0.5 from initial indication	Immediate maintenance required	Shutdown immediately and replace worn parts

HAZARD **Hazard!** Do not operate if TRG meter condition is RED.

2.3.2 Thermal Cutout

Unless otherwise specified, all Chempump pumps are fitted with thermal cut-outs. The cut-out is a heat-sensitive bimetallic switch mounted in intimate contact with the stator windings. It is to be wired in series with the holding coil in the starter box by removing a jumper. Refer to Table 2-2 for TCO maximum holding coil currents.

Thermal cut-outs in Class R insulated motors are set to open at 415˚F. Depending on the application, specially set TCO's are sometimes provided. The pump order data sheet indicates the TCO setting. If the motor cuts out because of TCO action, there will be a time delay before the motor can be restarted. The motor must be restarted manually. **DO NOT RESTART UNTIL YOU DETERMINE THE SOURCE OF THE OVER-HEATING.**

Table 2-2. TCO Maximum Coil Currents	
115 Volt	3.1 Amps
230 Volt	1.6 Amps
460 Volt	0.8 Amps

CAUTION

Caution!

The thermal cutout switch does not provide protection against fast heat buildup resulting from locked rotor conditions, single phasing, or heavy overloads. This protection must be provided for by the current overload relay heaters in the magnetic starter. The rating of the heaters should be high enough to avoid nuisance cut outs under running loads, but must not be oversized. Refer to Table 2-3 for starting and running electrical characteristics. It is recommended that “quick trip”, class 10 or less, type heaters be used.

2.3.3 Starting Equipment

Motor starters (normally not supplied with Chempump pumps) should be sized to handle the load required per the National Electrical Code (NEC). Start KVA, Full Load KW, Full Load amps and Full Load KVA data are listed in Table 2-3.

Thermal overload to protective devices in the starters should be sized for the amperage shown on the Chempump nameplate. DO NOT size heaters in excess of 10% of full load amp rating. In order to provide complete protection for Chempump motors under all conditions, it is recommended that “quick trip” (Class 10) type Thermal overload to protective devices be used in the starters where available. Standard type thermal overload to protective devices can be used if these “quick trip” type thermal overload to protective devices are not available. Standard thermal overload to protective devices provide adequate protection for Chempump motors under starting or normal running conditions, but require a greater length of time than “quick trip” type thermal overload to protective devices to cut out. This may not protect the meter if the motor is subject to locked rotor or overload conditions. Also, see Tables 2-3, 2-4, 2-5, or 2-6 for additional electrical wiring data for the most common Chempump motor sizes to assist in the electrical installation of the unit.

2.3.4 CASE I - 460 VOLT, 3-PHASE TEIKOKU. See Figure 2-2.

Typical 3-phase across-the-line magnetic starter with start-stop push button station shown. Thermoswitch (thermal cut-out inside Teikoku motor) is wired in series with holding coil circuit by removing jumper between over load cut-outs as shown.

Be sure to size heaters properly. Rating should be as close as possible to current draw noted on pump nameplate.

2.3.5 CASE II - All other voltages (not to exceed 600 volts), 3-PHASE TEIKOKU. See Figure 2-3.

Use transformer with primary and 115 volt secondary. Use properly rated holding coil (115 volt). Wire Thermoswitch as for 460 volt systems described in Case 1.

2.3.6 Variable Frequency Drive (VFD) Power Supply

NC-Series pumps can be operated with a VFD power supply. The VFD should be a Pulse Width Modulated Drive selected for the appropriate voltage class of the motor, i.e. 400V class for 460V motors, and suitable to handle the full load current of the motor. The VFD should always be sized based on full load nameplate current and not the listed horse power (hp). Sizing based on hp could lead to an undersized drive being selected. The drive should be programmed to ensure a linear relationship between voltage to frequency (V/F) and frequencies should be limited to the range of 25-65 Hz. Operation at 65 Hz assumes the motor will not oper-

Figure 2-2. Wiring Diagram 230/460 Volt, 3 Phase

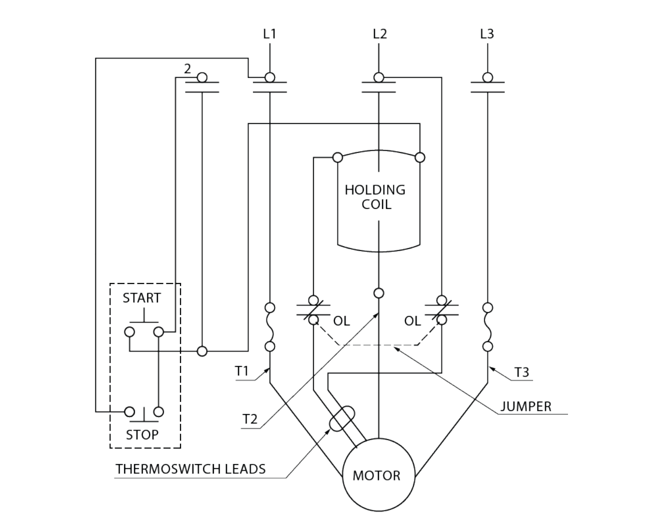
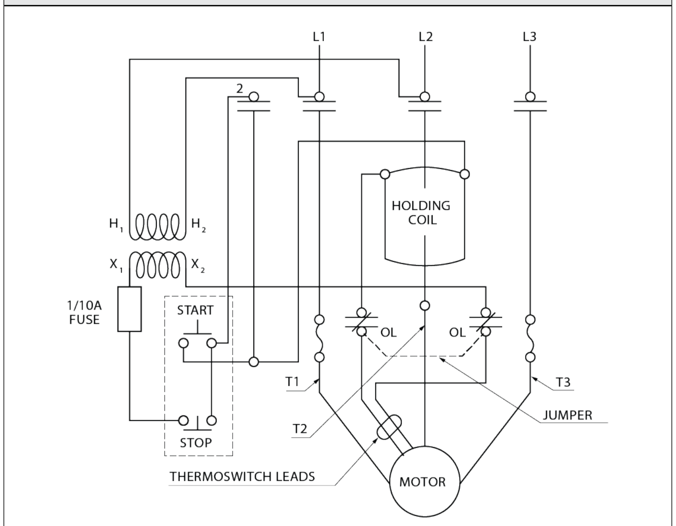


Figure 2-3. Wiring Diagram 575 Volt, 3 Phase



ate in an overload condition. For frequencies beyond these limits please consult Applications and Engineering.

2.3.7 Oil Filled Stator

Chempump™ pumps are designed to give long, trouble free service without having their stator cavities oil filled. Solid filled or non-oil-filled options are available for many applications. In order to facilitate the dissipation of heat from the motor section, the stator cavity on standard NC-Series pumps can be filled at the factory with a heat conductive dielectric oil. This oil filling provides better conductivity and allows the heat generated in the motor to be conducted to the outside of the unit, thereby maintaining a lower temperature in the motor section than would be possible if the stator cavity were not oil filled. When storing or installing oil filled stators, be sure that the motor lead or connection box nipple is maintained in an upright vertical position.

2.3.8 Electrical Isolation

To eliminate electrolytic corrosion when handling solutions during an electrolysis or plating operation, the NC-Series pump should be electrically isolated. Insulated couplings or nonconductive plastic piping must be used in the primary suction and discharge lines. The pump must be isolated electrically from the tank, and separately grounded.

2.3.9 Water and Steam Jackets

When handling fluids at controlled temperatures, additional motor cooling or heating must be provided. For temperature control, jackets are provided for water, steam, or other heat transfer media. In addition, the pump can be submerged into the pumped fluid, thus providing an additional means of temperature control.

All NC-Series pumps can be provided with removable type water jackets (See Figure 2-5). This type jacket is easily removable from the stator band to allow for inspection and replacement. Removable-type water jacket kits are available from the factory for provision or already installed in the field when additional stator cooling is required. These jackets are suitable only for heating mediums compatible with the gasket and jacket material, with maximum inlet pressure of 50 psi and with maximum temperature of 150° F. They should not be used as steam jackets. Jackets welded to the stator band are available for use as steam jackets and for liquid mediums which exceed the temperatures and pressures noted above. Normally welded type jackets are suitable for steam pressures to 50 psi and liquid medium pressures to 100 psi. However, welded type jackets specially fabricated are also available for higher pressures.

2.3.10 Heat Exchanger

Similar to the water jacket in every respect except for the provision of corrosion-resistant tubing, heat exchangers, whether removable, or welded-on, are provided on Chempump applications that require heating or cooling the fluid before it enters the rotor chamber. Heat exchangers are especially recommended for liquids with low specific heat characteristics.

All NC-Series pumps can be provided with removable wrap around heat exchangers when specified. This type jacket is easily removed from the stator band to allow for inspection and replacement. These heat exchangers are suitable for maximum inlet pressure of 50 psi and maximum temperature of 150° F. See Figure 2-6.

Welded on heat exchangers are available on all NC-Series pumps. These heat exchangers are suitable for steam pressure of 50 psi and liquid medium pressures to 100 psi, where maximum temperatures vary depending upon existing motor insulation and TCO setting as indicated on the pump nameplate. Refer to Table 2-8 for coolant rates.

2.3.11 Jacketed Circulation Tube

The jacketed circulation tube acts as a heat exchanger in that it permits a heat transfer medium to circulate around the tubing and heat or cool the fluid before it enters the rotor chamber. The jacketed circulation tube is suitable for maximum inlet pressures of 50 psi liquid, or 15 psi steam. Higher pressures are available on special models.

Table 2-3. NC-Series Electrical Data 60 hz (Oil Filled)

Motor Size	Start KVA	Full Load KW	Full Load BHP	Full & No Load Current at 230 Volts	Full & No Load Current at 460 Volts	Full & No Load Current at 575 Volts	Max Process Fluid Temp (˚F) at Full Load
N1	31.1	6.9	6.8	20.8 / 7.2	10.4 / 3.6	8.3 / 2.9	300
N2	47.2	13.4	13.5	39.2 / 9.8	19.6 / 4.9	15.7 / 3.9	300
N3	89.2	21.7	23.0	63.0 / 16.8	31.5 / 8.4	25.2 / 6.7	280
N4	119.5	30.9	32.3	88.0 / 24.0	44.0 / 12.0	35.2 / 9.6	260
N5	227.1	48.0	50.8	133.8 / 35.0	66.9 / 17.5	53.5 / 14.0	290
N6	283.3	85.9	87.4	259.6 / 36.8	129.8 / 18.4	103.8 / 14.7	265
N7	344.7	107.3	104.8	311.6 / 66.0	155.8 / 33.0	124.6 / 26.4	250
N8	729.0	150.2	154.8	416.0 / 111.8	208.0 / 55.9	166.4 / 44.8	245
NL1	15.8	3.3	3.4	11.0 / 6.0	5.5 / 3.0	4.4 / 2.4	300
NL2	23.5	6.3	6.4	21.0 / 7.6	10.5 / 3.8	8.4 / 3.0	300
NL3	37.4	10.2	11.5	33.6 / 19.8	16.8 / 9.9	13.4 / 7.9	280
NL4	69.0	13.0	14.1	43.0 / 16.4	21.5 / 8.2	17.2 / 6.6	260
NL5	72.8	23.9	25.4	75.2 / 22.2	37.6 / 11.1	30.1 / 8.9	290

Table 2-4. NC-Series Electrical Data 60 hz (Dry)

Motor Size	Start KVA	Full Load KW	Full Load BHP	Full & No Load Current at 230 Volts	Full & No Load Current at 460 Volts	Full & No Load Current at 575 Volts	Max Process Fluid Temp (˚F) at Full Load
N1	31.1	7	6.8	20.8 / 7.2	10.4 / 3.6	8.3 / 2.9	300
N2	47.2	9.3	9.5	27.6 / 9.8	13.8 / 4.9	11.0 / 3.9	290
N3	89.2	15.4	16.1	45.0 / 16.8	22.5 / 8.4	18.0 / 6.7	290
N4	119.5	20.2	20.8	57.4 / 24.0	28.7 / 12.0	23.0 / 9.6	275
N5	227.1	37	37	95.0 / 35.0	33.6 / 17.5	38.0 / 14.0	280
N6	283.3	62	56.5	173.0 / 36.8	86.5 / 18.4	69.2 / 14.7	260
N7	344.2	76	68.4	216.0 / 66.0	108.4 / 33.0	86.7 / 26.4	245
N8	729.0	96.5	88	266.0 / 111.8	133.0 / 55.9	106.4 / 44.8	250
NL1	15.8	3.5	3.4	11.0 / 6.0	5.5 / 3.0	4.4 / 2.4	300
NL2	23.5	4.7	4.7	15.2 / 7.6	7.6 / 3.8	6.1 / 3.0	300
NL3	37.4	7.9	8.1	24.2 / 19.8	12.1 / 9.9	9.7 / 7.9	280
NL4	69.0	9.5	10.4	28.0 / 16.4	14 / 8.2	11.2 / 6.6	260
NL5	72.8	17.5	18.5	48.8 / 22.2	24.4 / 11.1	19.5 / 8.9	290

NOTES:

1.) *SELECT CLASS 10 HEATERS BASED ON START KVA WITH A 12 SECOND MAX TRIP TIME.*

2.) *( ) INDICATES REDUCTION IN SWITCH SIZE WHEN DUAL-ELEMENT FUSES ARE USED FOR MOTOR BRANCH CIRCUITS.*

3.) *(EXCEPT WHERE NOTED), THE SWITCH SIZES ARE THE SAME FOR ALL TYPES OF FUSES.*

4.) *CURRENT RATINGS BASED ON THREE CONDUCTOR 75O C INSULATED COPPER WIRE AT 30O C AMBIENT.*

5.) *INDUCTION MOTOR, SYNCHRONOUS SPEED 3600 RPM.*

Table 2-5. Electrical Wiring Data 230 Volt, 3 Phase, 60 Hz NC-Series									
Motor Size	**Switch Size AMPs**	**Breaker Size AMPs**	**Starter NEMA Size**	**Conductor Size for Motor Leads**	**Conduit Size for Motor Leads**	**Conduit Size For Motor, PB and TCO Leads**	**Fuse Size Code and Current Limiting AMPs**	**Fuse Size Dual Element AMPs**	**Max Setting Time Limit Protection AMPs**
N1	60	40	2	10	3/4	1	50	35	23.9
N2	100	70	3	6	1	1 1/4	80	70	45.1
N3	150	125	3	4	1 1/4	1 1/4	125	110	72.5
N4	200 (150)	175	4	3	1 1/4	1 1/2	150	125	101.2
N5	400	300	5	2/0	2	2 1/2	300	250	153.9
N6	600	500	6	350	2 1/2	3	450	400	298.9
N7	800 (600)	600	6	600	4	4 1/2	700	500	358.3
N8	1000 (750)	800	6	700	4 1/2	4 1/2	800	600	478.4
NL.5	30 (15)	15	0	14	1/2	3/4	15	10	9.0
NL1	30	20	1	14	1/2	3/4	20	15	12.7
NL2	60	40	2	10	3/4	1	50	35	24.2
NL3	60	60	2	10	3/4	1	50	45	38.6
NL4	100	80	3	6	1	1 1/4	80	70	49.5
NL5	150	110	4	3	1 1/4	1 1/2	110	110	86.5

Table 2-6. Electrical Wiring Data 460 Volt, 3 Phase, 60 Hz NC-Series									
Motor Size	**Switch Size AMPs**	**Breaker Size AMPs**	**Starter NEMA Size**	**Conductor Size for Motor Leads**	**Conduit Size for Motor Leads**	**Conduit Size For Motor, PB and TCO Leads**	**Fuse Size Code and Current Limiting AMPs**	**Fuse Size Dual Element AMPs**	**Max Setting Time Limit Protection AMPs**
N1	30	20	1	14	1/2	3/4	50	35	12.0
N2	60	35	2	10	3/4	1	50	35	22.5
N3	100 (60)	60	3	8	1	1	60	50	36.2
N4	100	80	3	8	1	1	80	70	50.6
N5	150	125	4	4	1 1/4	1 1/4	125	1120	76.9
N6	400	300	5	2/0	2	2 1/2	250	200	149.3
N7	400	300	5	3/0	2 1/2	2 1/2	350	300	179.2
N8	600 (400)	400	5	4/0	3	3	450	300	239.2
NL.5	15	6	00	14	3/4	3/4	6	3	4.5
NL1	15	10	0	14	3/4	3/4	10	6	6.3
NL2	30	20	1	14	3/4	3/4	25	15	12.1
NL3	60 (30)	30	2	14	3/4	3/4	35	20	19.3
NL4	60	40	2	10	1	1	50	35	24.7
NL5	100	50	3	8	1	1	60	60	43.2

NOTES:

1.) *SELECT CLASS 10 HEATERS BASED ON START KVA WITH A 12 SECOND MAX TRIP TIME.*

2.) *( ) INDICATES REDUCTION IN SWITCH SIZE WHEN DUAL-ELEMENT FUSES ARE USED FOR MOTOR BRANCH CIRCUITS.*

3.) *(EXCEPT WHERE NOTED), THE SWITCH SIZES ARE THE SAME FOR ALL TYPES OF FUSES.*

4.) *CURRENT RATINGS BASED ON THREE CONDUCTOR 75O C INSULATED COPPER WIRE AT 30O C AMBIENT.*

5.) *INDUCTION MOTOR, SYNCHRONOUS SPEED 3600 RPM.*

Table 2-7. Electrical Wiring Data 575 Volt, 3 Phase, 60 Hz NC-Series									
Motor Size	**Switch Size AMPs**	**Breaker Size AMPs**	**Starter NEMA Size**	**Conductor Size for Motor Leads**	**Conduit Size for Motor Leads**	**Conduit Size For Motor, PB and TCO Leads**	**Fuse Size Code and Current Limiting AMPs**	**Fuse Size Dual Element AMPs**	**Max Setting Time Limit Protection AMPs**
N1	30	15	1	14	1/2	3/4	20	15	9.6
N2	60 (30	30	2	12	3/4	3/4	40	25	18.0
N3	100 (60)	50	3	10	3/4	1	60	45	29.0
N4	100 (60)	70	3	8	1	1	60	50	40.5
N5	150 (100)	100	4	6	1	1 1/4	100	90	61.5
N6	200	200	5	1	1 1/2	2	175	150	119.4
N7	400	250	5	2/0	2	2 1/2	300	200	143.3
N8	400	300	5	3/0	2 1/2	2 1/2	350	300	191.4
NL.5	15	6	00	14	1/2	3/4	6	3	3.6
NL1	15	6	0	14	1/2	3/4	6	6	5.1
NL2	30	15	1	14	1/2	3/4	20	15	9.7
NL3	30	25	2	14	1/2	3/4	25	15	15.5
NL4	60 (30)	30	2	12	3/4	3/4	40	25	19.8
NL5	60	45	3	8	1	1	45	45	34.6

Table 2-8. Coolant Flow Rates (Value based on 70˚ F (21˚ C)	
Motor Size	**Coolant Flow Rate (GPM)**
N1	3.0
N2	3.7
N3	4.5
N4	5.3
N5	7.2

NOTES:

1.) *SELECT CLASS 10 HEATERS BASED ON START KVA WITH A 12 SECOND MAX TRIP TIME.*

2.) *( ) INDICATES REDUCTION IN SWITCH SIZE WHEN DUAL-ELEMENT FUSES ARE USED FOR MOTOR BRANCH CIRCUITS.*

3.) *(EXCEPT WHERE NOTED), THE SWITCH SIZES ARE THE SAME FOR ALL TYPES OF FUSES.*

4.) *CURRENT RATINGS BASED ON THREE CONDUCTOR 75O C INSULATED COPPER WIRE AT 30O C AMBIENT.*

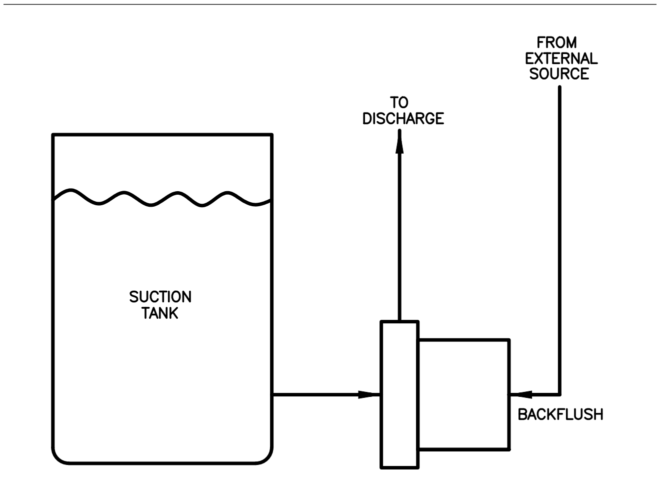
5.) *INDUCTION MOTOR, SYNCHRONOUS SPEED 3600 RPM.*

2.4 Special Conditions & Features

2.4.1 Backflushing 32-S

For normal clear fluid applications, Chempump™ NC-Series are cooled and lubricated by fluid being pumped through the system. For slurry and other "dirty" applications, backflushing is recommended. Backflushing is noted on the order when recommended. See Figure 2-4 for a typical back flush installation.

Figure 2-4. Back-Flush System



Pumps using backflush are normally supplied without circulating tubes. Clear fluid is brought to the fitting at the front of the motor section by customer's piping as shown in Figure 2-4. The amount of clear base fluid introduced in this manner should approximate the standard flow rates listed in Table 2-9.

Table 2-9. Recirculation Flow Rate

MODEL	RECIRCULATION FLOW RATE (GPM)	RECIRCULATION FLOW RATE (M3/HR)
NC-AA-6	2.5 - 4.5	0.57 - 1.0
NC-AA-8	3 - 6	0.68 - 1.36
NC-AB-6	3.5 - 4.5	0.79 - 1.0
NC-A50-8	5 - 7	1.14 - 1.59
NC-A60-8	5 - 7	1.14 - 1.59
NC-A05-10	7 - 9	1.59 - 2.04
NC-50-10	7 - 9	1.59 - 2.04
NC-A60-10	8 - 10	1.82 - 2.27

Backflush pressure should be suction pressure plus 20-30% of the pressure developed by the pump. Excessive backflush pressure will destroy the thrust balanced operation built into the NC-Series by causing excessive forward thrust.

Procedure:

1. Remove the circulation tube and plug off the port in the discharge neck of the pump casing. (This is done at the factory if specified in the order).
2. Supply clear liquid to the port in the adapter normally used for the circulating tube size.
3. If the back flushing liquid is hot, auxiliary cooling methods, such as water jacketing the stator must be employed. The temperature of the backflush fluid should not be close to its boiling point and should not exceed 300° F.

2.4.2 Reverse Circulation 13-SE

For normal clear fluid applications, Chempump™ NC-Series are cooled and lubricated by the fluid being pumped. However, when the fluid being pumped is at or near its boiling point, the additional heat picked up from the motor combined with the recirculation fluid returning to the low pressure at impeller suction may cause vaporization inside the pump. In these cases the reverse circulation method of lubricating the bearings and cooling the motor should be used. Flow rates should duplicate those shown in Table 2-9.

In reverse circulation the cooling and lubricating fluid is forced from behind the impeller into the motor section. It passes through the front bearing, over the rotor, and across the rear bearing. The fluid then exits the rear of the pump and is piped back to the suction vessel (not the suction line).

By this method, the fluid in the motor section is maintained at a pressure close to discharge pressure. Flow through stator-rotor cavity must be controlled to allow for good balance of pressure and temperature without excessive flow.

Procedure:

1. Connect tubing (minimum 1/2") to the port provided in the outboard bearing housing.
2. Run the tubing from the connection port fitting in the rear back to the suction receiver, preferably above the liquid level.
3. Use large size suction line and gate valve for low pressure drop and thus improve Available NPSH.

2.4.3 Internal Circulation 1-S

Internal Circulation is available on all NC-Series pumps. A unit modified for internal circulation requires the elimination of the circulation tube, fittings and discharge filter. Internal flow paths are provided to direct the fluid circulation through the motor and bearings.

NOTE: *Please contact the factory prior to any modification to internal circulation.*

Figure 2-5. Removable Water Jacket

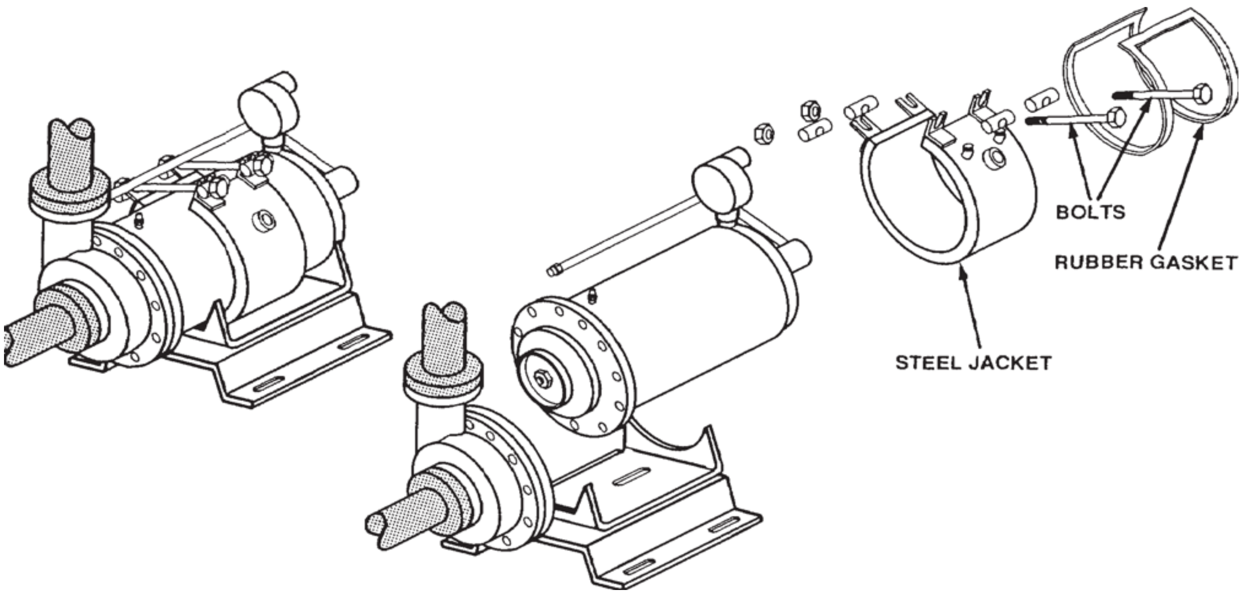
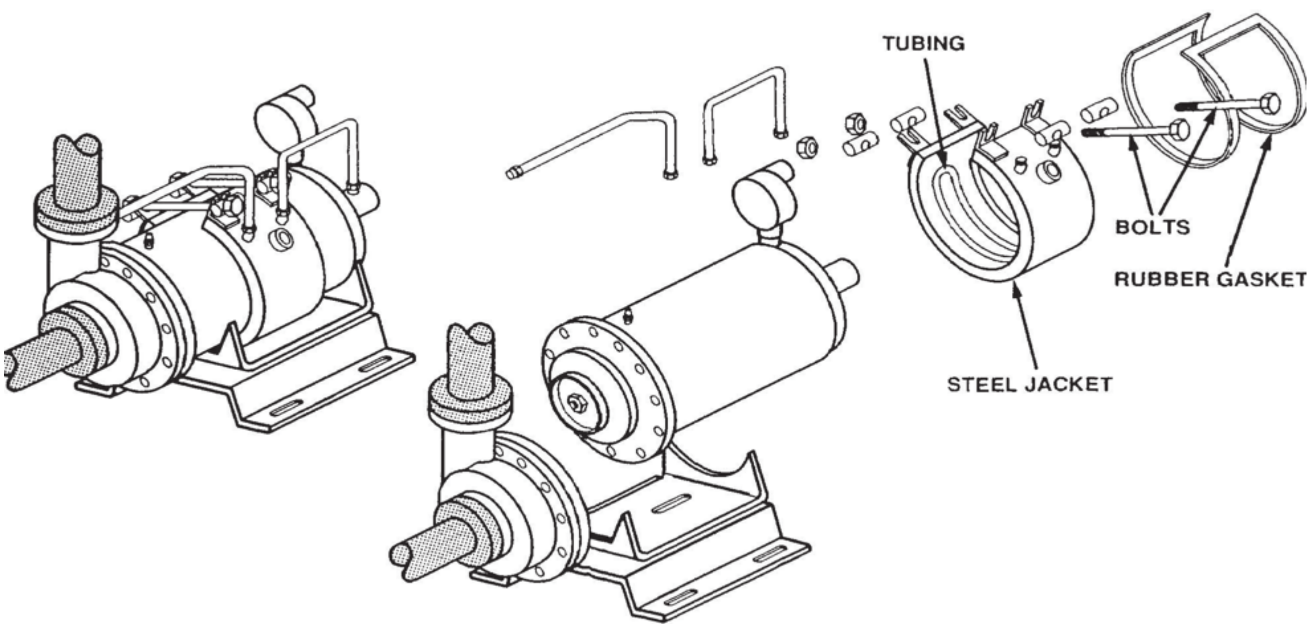


Figure 2-6. Removable Heat Exchanger



3. Operation

> **IMPORTANT!** *NRTL certified per UL 778 & CAN/CSA C22.2 No. 108-14 for operation between 25 HZ to 65 HZ with Pulse Width Modulated (PWM) Variable Frequency Drive (VFD) power.*

3.1 Procedure Before Initial Start

Attention!

Before starting the pump for the first time, make sure suction and discharge piping are free of tools, nuts, bolts, or other foreign matter. Save time and money by checking before start-up.

Attention!

It is recommended to install a temporary cone-style strainer near the suction port to trap scale and other foreign particles. Suction strainer to be sized and designed per Teikoku recommendations. The screen can be installed for 24 hours of operation, but must be monitored closely so the pump does not become starved for liquid because of a clogged screen. Remove screen after 24 hours of running.

3.2 Preparation and Trial Operation

The following procedures are recommended for protection of canned motor pumps in industrial services.

Teikoku USA recommends monitoring the differential pressure and the power monitor for total protection of the pumps. Teikoku recommends using both as differential pressure works best for cavitation protection and the power monitor works best for no flow, loss of flow and excessive flow. If only one method is going to be applied then differential pressure would be the preferred method.

The preferred method for differential pressure monitoring is to install pressure transducers in the suction line between the pump and the block valve and in the discharge line between the pump and the first valve (either check or block). The signals from the pressure transducers are then sent to the control system and the pressure and time delay limits can be set within the control system program. Calibration of the transducers should always be checked as part of the installation process and startup of the system.

Recommended set points are:

- Differential Pressure (DP): 15 to 20 PSI below normal operating differential pressure
- Time Delay (TD): 20 seconds or less

When using an automatic control system, the following parameters are recommended:

A. Single pump:

- 20 Second Delay: Low differential pressure trip
- 60 Second Delay: Pump Restart

Repeat above timing sequence for a maximum of 3 starts. If low differential continues after 3 starts a manual reset of the process controller is required.

B. Dual pumps:

- 20 Second Delay: “A” Pump low differential pressure trip
- 60 Second Delay: “B” Pump start
- 20 Second Delay: “B” Pump low differential pressure trip
- 60 Second Delay: “A” Pump start

Repeat above timing sequence for a maximum of 3 starts per pump (6 starts combined total). If low differential continues after 3 starts per pump (6 starts combined total) a manual reset of the process controller is required.

Commercially available differential pressure switches are available with little to no adjustment. These switches will work but with no adjustment in the time frame or differential pressure set points they typically will not meet Teikoku’s pressure and time delay recommendations.

The preferred method to monitor the input power to the pump would be to use a power monitor like the Load Controls PMP-25. The power monitor prevents failures due to loss of prime, no flow and excessive flow. The performance curve of the pump is used to set the low power and high power warnings and trip set point. Actual operating data can be used to make the final adjustments to the initial set points.

3.2.1 Setting of Thermal Overload Protective Device

Set the thermal overload protective device at the rated current indicated on the nameplate. It is effective as a protecting device for canned motors to set the thermal overload protective device at as low current as possible. When operating current is far lower than rated current, set the thermal overload protective device just above the operating current not the rated current. Generally, it is recommended to set the thermal overload protective device at the following values:

- Variation of voltage and load is small: operating current times 1.1
- Variation of voltage and load is big: operating current times 1.25

Attention!

Do not set the thermal overload protective device at more than the full load amps (FLA) listed on the name tag.

3.2.2 Priming and Venting

Complete priming should be carried out in the following order:

1. Open suction valve 100%
2. Open discharge valve 100%
3. If applicable: open reverse circulation line valve 100%
4. Open discharge pipe vent valve 100%
5. Open minimum flow valve (if required)

Caution!

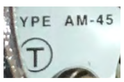
All valves in the reverse circulation line must remain fully open while the pump is in operation. Verify that the correct restriction orifice is properly installed in the reverse circulation line.

3.2.3 Rotation Check

Centrifugal pump impellers must rotate in the proper direction to deliver rated head and capacity. The impeller must rotate in the same direction as the arrow cast on the pump casing.

Caution!

Pump and motor must be fully primed, vented, and liquid full prior to checking direction of rotation.



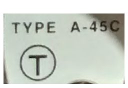
3.2.3.a Rotation Check using Type-M TRG Meter AM-45

The Type-M TRG Meter AM-45 is designed to provide a verification of direction of rotation. If the TRG Meter immediately pegs full scale, the direction of rotation is not correct.

1. Verify suction valve is 100% open.
2. Set discharge valve 10% to 20% open.
3. Check that valves in reverse circulation piping are open. Verify that the correct restriction orifice is installed in the reverse circulation line.
4. Switch on the pump for 3 to 5 seconds.

If applicable: Check indication of TRG meter. If TRG meter is pegged full scale red, the pump is rotating in the reverse direction. See Section 2.3.1 and Table 2-1.

5. If direction of rotation is not correct, swap any two of the electrical supply leads and repeat rotation check.
6. Once direction of rotation has been verified, stop the pump and leave it for several minutes.
7. Once you have determined correct rotation, tag correctly connected main power leads, in accordance with motor lead markings.



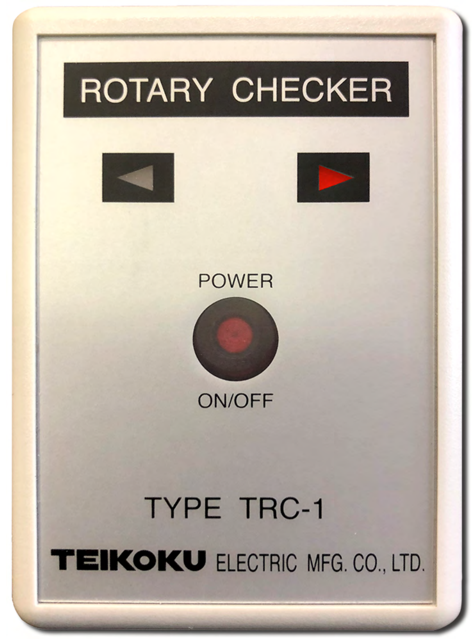
3.2.3.b Rotation Check using Type-L TRG Meter A45 C

The Type-L TRG Meter A45 C does not provide direction of rotation. The Teikoku TRC-1 hand-held direction of rotation indicator is available from Teikoku USA. This portable device can be used to confirm the rotation of any motor.

1. Verify suction valve is 100% open.
2. Set discharge valve 10% to 20% open.
3. If applicable: Check that valves in reverse circulation piping are open. Verify that the correct restriction orifice is installed in the reverse circulation line.
4. Switch on the pump for 3 to 5 seconds.

Check indication of TRC-1 hand-held rotation indicator. See Figure 3-1.

Figure 3-1. Teikoku Rotary Indicator TRC-1



5. If direction of rotation is not correct, swap any two of the electrical supply leads and repeat rotation check.
6. Once direction of rotation has been verified, stop the pump and leave it for several minutes.
7. Once you have determined correct rotation, tag correctly connected main power leads, in accordance with motor lead markings.

3.2.3.c Rotation Check using Pressure & Amps

1. Open suction valve 100%.
2. Set discharge valve 10% to 20% open.
3. If applicable: Check that valves in reverse circulation piping are open. Verify that the correct restriction orifice is installed in the reverse circulation line.
4. Switch on the pump for 3 to 5 seconds.
5. Note the motor amps and the discharge pressure at a pressure gauge, which should be installed between the pump casing and discharge valve.
6. Reverse any two of the three power leads and read the amps and the pressure gauge again. The higher amps and pressure is the correct direction of rotation.
7. Once direction of rotation has been verified, stop the pump and leave it for several minutes.
8. Once you have determined correct rotation, tag correctly connected main power leads, in accordance with motor lead markings.

Attention!

It is recommended that the unit be run as little as possible with a closed discharge valve in order to prevent excessive overheating of the liquid circulating within the unit.

3.3 Starting Procedure

After priming and checking the direction of rotation, put the pump in operation as follows:

1. Set the valve in the suction line to 100% open.
2. Set the valve in the discharge line to 20% open.
3. Start the pump. Pump should operate with very low noise and vibrations. Excessive or abnormal noise or vibrations should be corrected immediately.
4. Open discharge valve to desired flow position.
5. Care should be taken in process design to assure there can be no operation at shutoff or deadhead conditions (zero flow). All canned motor pumps require a minimum flow that assures adequate motor cooling circulation. Please consult the factory for any application specific guidance on minimum flow that may be required.

Once pump is operational, check the reading of the TRG meter. Record initial reading for comparison to future readings. See Table 2-1.

6. During any startup sequence, caution must be exercised not to exceed full load ampere rating indicated on the nameplate.
7. If the unit has not been run for a period of two weeks or more, the following inspections should precede its operation:

A. Check terminal box for moisture.

B. Upon starting, check for excessive noise, vibration, erratic speeds or excessive amp draw.

! CAUTION

Caution!

The pump should not be allowed to run for more than one minute with the discharge valve fully closed.

NOTES:

1. *If the suction and discharge lines are completely filled with system fluid and adequate suction head is available the pump can be started without closing the discharge valve. During any startup sequence, caution must be exercised not to exceed full load amperage rating indicated on the nameplate.*

2. *If the unit has not been run for a period of two weeks or more, the following inspections shall precede its operation:*

- **a)** *Check secureness of base hold down bolts if supplied.*
- **b)** *Check terminal box for moisture and tightness of fittings.*
- **c)** *Upon starting, check for excessive noise, vibration, or erratic speeds.*

! CAUTION

Caution!

If the pump appears to be airbound as a result of the unit not being properly primed, do not continue operation. Locate and correct the conditions that prevent proper priming before attempting to start the unit.

3.4 Operation Details

TRG Meter should be checked periodically during operation. If the initial reading (TRG) was not recorded, then the color coding system shown in Table 2-1 may be used to determine bearing changing intervals.

! HAZARD

Hazard!

Do not operate if TRG meter conditions is RED.

Discharge pressure should be checked frequently during operation. Pressure should be stable in a non-variable closed loop although the discharge pressure gauge needle may show small fluctuations. Check motor amps at normal operations. Verify motor amps are within the expected range. Pump should never be operating above the rated full load amps listed on the nameplate.

In some cases, the liquid supply may contain an excessive amount of air or gas, which will tend to separate from the liquid and remain in the passages of the pump. This results in the pump losing its prime and becoming air bound with marked reduction in capacity. The discharge pressure gauge will show large fluctuations if this occurs. Stop the pump and vent per Section 3.2.1.

If any abnormal noise or vibration is observed, stop the pump and check for the possible causes, see Appx B. Troubleshooting.

3.5 Shutdown Procedure

Shutdown as follows:

1. Stop the pump (de-energize the motor).
2. If pump is to be removed from service, shut all valves.

! ATTENTION

Attention!

If the pump is to be shut down for a long period of time or if there is danger of freezing, after stopping the pump, shut all valves and drain the entire pump and connected piping.

4. Maintenance

4.1 Recommended Tools for Disassembly, Reassembly, and Inspection

Table 4-1. Recommended Tools Disassembly and Reassembly	
Size	**Description**
9/16"	Open end wrench for circulation tube fittings.
3/4: and 15/16"	Open end, box end wrench for pump casing and adapter bolt.
3/4"	Open end, box end wrench for rear bearing housing bolts and pump casing drain bolts.
1 3/8"	Spanner wrench with 1/8" pin for shaft sleeve retainer.
3/4"	Socket wrench for impeller nut (N1 and N2 motors)
1 1/8"	Socket wrench for impeller nut (N3 and N4 motors)
1 5/16"	Socket wrench for impeller nut (N5 motors)
1/2" and 9/16"	Open end, box end wrench for base cradle bolts.
1/8"	Allen wrench for bearing retainer screws.
Wheel Puller	To assist in the removal of the impeller assembly.

Table 4-2 Recommended Tools for Inspection	
Size	**Description**
Dial Indicator	Dial Indicator (.200 travel) for determining end play
Verniers	
Telescopic gauges	5/16"-3"

4.2 Disassembly

(Please refer to cross section drawing located in the appendix)

1. Close discharge valve, shutdown pump, and then close the suction valve.
2. Disconnect the power cables from the connection box prior to disassembly. Follow Lock Out Tag Out.

! CAUTION

Caution!

SAFETY HAZARD TO PERSONNEL WILL EXIST IF THIS STEP IS NOT FOLLOWED.

4. Drain pump and connecting piping.

NOTE: *The NC-Series is designed to drain the majority of fluid in the pump and motor, however a small amount of fluid will still be present. Also, some fluid may remain in the heat exchanger piping. Follow your plant safety regulations for flushing and neutralizing the fluid in the pump prior to disconnecting pump from the piping.*

5. Begin disassembly, carefully examining each part for corrosion or wear.
6. Remove heat exchanger cooling inlet and drain connections.
7. Remove circulating piping.

! CAUTION

Caution!

Process fluid may be present when removing the piping.

9. Remove the four (4) bolts and nuts attaching the pump assembly to the stand. Lift the pump off the stand utilizing the four (4) eye bolts located on the pump casing. Support the pump in the horizontal position.
10. Remove the screws holding the pump casing to the pump casing adapter and remove the pump casing.
11. Remove the screws holding the rear cover plate to the stator assembly and remove the coverplate
12. Insert two (2) ¼ - 20 puller screws into the rear bearing housing and remove the rear bearing housing.
13. Remove the screw holding the rear bearing in the rear bearing housing and remove the rear bearing
14. Remove the inducer by inserting a ¼" round bar into the hole located on the body of the inducer. Use a strap wrench to keep the impeller from rotating. Threads are right handed.
15. Remove the impeller and impeller key.
16. Remove the screws holding the balance plate assembly to the pump casing adapter assembly and remove the balance plate assembly. Note: The throttle bushing is located in the balance plate assembly. To remove the throttle bushing compress and remove the retaining ring.
17. Remove the screws holding the pump casing adapter to the front end bell of the stator assembly and remove the pump casing adapter.
18. Remove the screw holding the front bearing housing to the front end bell and remove the front bearing housing.
19. Remove the screws holding the front bearing and the forward thrust bearing and remove both items.
20. Remove the spacer sleeve, shaft sleeve and shaft key located on the front end of the rotor assembly.

Note: *Sleeves are centered with "o" rings which may present some resistance.*

21. Remove the thrust bearing housing from the front end bell by pushing the rotor assembly forward until the thrust bearing housing is accessible. Note: the thrust bearing collar can also be removed at this time.
22. Remove the screw holding the rear thrust bearing to the thrust bearing housing and remove the rear thrust bearing.
23. Withdraw the rotor assembly from front of motor section taking care not to allow rotor to drop, allowing shaft to hit stator liner.

24. Remove the rear shaft sleeve by removing the shaft sleeve retainer in the rear with a spanner wrench (Do not use a pipe wrench). Note: This is a left hand thread.

Pull the shaft sleeve off the shaft. Sleeves are centered with "o" rings which may present some resistance. Remove the shaft key and "o" rings from the shaft.

4.3 Periodic Inspection

The TRG meter should be checked periodically during operation. If the initial reading (TRG) was not recorded, then the color coding system discussed in Table 2-1 may be used to determine bearing changing intervals.

4.3.1 Bearings

Since the bearings in this pump are lubricated by the process fluid, it is essential that bearing inspection and replacement periods be based on experience in each particular installation. Bearing life will depend, to some extent, on variable factors including lubrication quality, temperature, number of starts and stops, viscosity, and suspension content of the fluid being pumped, as well as ambient temperature and atmospheric conditions of the operational area. Each time one of these factors is changed, compensation must be applied in bearing inspection periods.

As noted above, the TRG meter should be checked periodically during operation. If the initial reading (TRG) was not recorded, then the color-coding system in Table 2-1 may be used to determine bearing changing intervals. This inspection is necessary to determine the rate of bearing wear, thereby enabling setup of a proper inspection and replacement schedule. See Table 4-3 for the maximum wear allowable.

If the inspection indicates that bearings are not wearing or are wearing very slightly, the next inspection may be put off for an additional 1,500 running hours, or three months of operation, whichever occurs first. If inspection indicates only slight wear, the interval may be lengthened.

If bearings must be changed at the initial inspection, they will need to be changed again in the time period which necessitated a change at the initial inspection, i.e., 1,500 running hours.

Frequency of periodic bearing inspection can best be determined by experience, and from these inspections, the time for replacement can best be indicated.

Bearings can be inspected and replaced without removing the pump casing from the line. No main piping connections need to be broken. Refer to Section 4.2 for Disassembly and Section 4.5 for Reassembly.

In the event the TRG bearing wear monitor indicates bearing wear on the wear indicator:

1. Measure the inside diameters of the front and rear bearings and compare to the diameter of the rotor shaft journal. If the difference in diameters is greater than that indicated in Table 4-3, replace the bearings.
2. Inspect the thrust faces of the front and rear bearings. If any scoring wear is visualized, measure the length of the bearings. Replace the bearing if the measured length is less than that indicated in Table 4-3.
3. Examine the bearings for any grooving or scoring, particularly on the inside diameter and thrust faces. The existence of grooving or scoring indicates the presence of solids or foreign matter in the system which should be eliminated prior to beginning operation again.

4.3.2 Automatic Thrust Balance and End Play Inspection

The provision of automatic thrust balance design in the NC-Series, with its close running seal faces and wearing rings to insure proper balance chamber pressures, requires that a detailed visual inspection be made of the impeller, adapter/bearing housing, front and rear thrust washer and the pump casing, at the time of bearing inspection. During disassembly for bearing inspection, measure the unit end play and compare with the following value:

Table 4-4. End Play

Model	Motor Size	End Play (inches)
ALL	ALL	0.072 to 0.096 (0.18 to 0.24 CM)

If the end play exceeds the maximum allowable movement, then the bearings and/or thrust washers are worn and must be replaced. (It should be noted that under proper operating conditions, wear on these parts due to axial thrust forces will be negligible). **It is not necessary to check the end play with the pump casing mounted on the pump.**

4.3.3 Rotor Assembly Inspection

The complete rotor assembly should be visually inspected for cracks, breaks, pitting, or corrosion which might destroy the effectiveness of the hermetically sealed rotor end covers and sleeve.

Check the rotor assembly for straightness of the shaft. The shaft should be running true and the sleeved rotor core within .003" (.08 mm) of the shaft.

The rotor assembly shaft sleeves and thrust surfaces should also be visually inspected at the bearing contact area for general appearance and uniform wear. Excessive undercutting, pitting, or scoring is cause for replacement.

4.3.4 Stator Assembly Inspection

The complete stator assembly should be visually inspected for cracks, breaks, pitting, or corrosion in the stator liner which might

Table 4-3. NCT- Series Bearing and Journal Dimensions

Model	Unit	Shaft Sleeve	Bearing Inside DIA	Diametrical Clearance	Max Allowable	Length
ALL	INCHES	1.6220 - 1.6213	1.626 - 1.627	0.004 - 0.0057	.014	3.0
ALL	CM	6.38	6.4	0.02	0.005	11.8

destroy the effectiveness of the barrier. Inspect the wiring of the stator assembly by checking the visible portion of the connector leads for cracked, broken, or frayed insulation, then check the condition of the motor windings by taking resistance readings with an ohmmeter and a megger. If the ohmmeter readings are not within 20% of the values shown in Table 4-6, the stator assembly must be replaced.

4.3.5 General Inspection

1. Inspect the impeller nut threads on the rotor shaft to ensure they are not damaged. NC-Series have right hand threads.
2. Be sure that all mating faces are free of nicks and burrs so that they will have a smooth face ensuring a good seal. Clean off any trace of old gasket material.
3. Make sure all parts are clean. Inaccessible areas may be cleaned with a small brush or pointed tool. The circulation line should be blown out with filtered, oil free, compressed air.
4. The impeller face should be inspected for wear. If excessive grooving or scoring of the wear rings is evident, the impeller must be repaired or replaced.

4.4 Lubrication/Cooling

The NC-Series pump requires no external lubrication. Bearing surfaces and other parts are lubricated and cooled by the fluid being pumped.

Cooling

The motor rear bearing housing temperature is a direct indication of the efficiency of the cooling and lubrication functions of the fluid circulation through the motor section of the pump. If, at anytime during operation the rear bearing housing appears overheated, check the temperature of the fluid being pumped. Check rear bearing housing temperature with a thermocouple to assure that it does not exceed the pumped fluid temperature by more than 15˚F. (Assuming that no auxiliary means of cooling the recirculation flow is used, such as heat exchangers, jacketed circulation tubes, etc.) Rear bearing housing temperature can be checked by using a pyrometer or a standard thermometer held against the retainer by putty.

If the fluid temperature is satisfactory, overheating is most probably caused by a restriction in the circulation system. Shutdown pump, drain unit, remove the circulation tube and clean it with clean, oil-free, compressed air. If the unit still runs hot or if tube was clear, the discharge filter may be clogged. Disconnect pipe connection and inspect.

! CAUTION

Caution!

Between cycles of pumping fluids which may solidify, such as caustic soda, flush the system with steam, water or the proper solvent to prevent the piping and internal passages of the pump from plugging up. Where the Chempump™ is fitted with a discharge filter, flush pump during off cycles and check discharge filter for plugging.

4.5 Reassembly

1. Reassemble pump by reversing the disassembly procedure. Replace all worn or corroded parts, and "o" rings throughout the pump.

   A. Before reassembly of the shaft sleeves and thrust washers, clean the shaft of dirt, corrosion products, or residue.

   B. Insert key.

   C. Put the thrust washer on the shaft.

   D. Put "o" rings on shaft.

   E. Slide shaft sleeve on shaft, engaging the key, until it is seated against the thrust washer.

   F. Replace the shaft sleeve retainer in the rear and the impeller in the front.
2. Complete reassembly. However, before bolting the motor section to the pump casing, spin the rotor impeller assembly by hand to insure that it does not bind.
3. In reassembling the inducer, care must be taken to completely tighten the impeller nut against the impeller to insure that it securely holds the impeller against the shaft shoulder. A strap wrench is recommend to hold the impeller assembly while tightening the impeller nut.

4.6 Service Policy

Any pump, damaged or inoperative for any reason, will be repaired at the factory at minimum cost and returned to the customer as quickly as possible.

! CAUTION

Caution!

Before returning units to the factory for examination or repair, **clean and decontaminate the pump or parts thoroughly to prevent corrosive attack during shipment or injury to personnel handling returned equipment. Tag pump with information regarding the fluid it was handling and operating conditions at the time of failure.** Proper service will be facilitated with the proper submittal of a Teikoku Field Service Report Form. These forms are available from the factory , from the Teikoku field representatives, and from this instruction manual Appendix.

4.7 Spare Parts

Have on hand at least two extra sets of bearings, two extra sets of "o" rings, and one extra rotor assembly for each NC-Series that is installed.

When ordering spare parts, give the serial number and model designation; then give the part name which is noted on Cross Section Drawing in the Appendix.

When ordering an impeller, include the impeller diameter which can be noted from the pump order acknowledgment or from the pump nameplate.

Please note, spare part kits, that include all the components listed on the opposite column, packaged together are available. Please contact your Teikoku representative/distributor or contact the factory for more information.

It is recommended that the following parts listed on the opposite column be maintained as "on-hand" spare parts for each NC-Series model installed.

Table 4-5. Parts

Parts	Quantity
Pump casing gasket	2
Adapter/bearing housing gasket	2
Rear bearing housing "o" ring	2
Shaft sleeve "o" ring	2 sets
Shaft Sleeves	2 sets
Thrust washers	2 sets
Thrust washer key	2 sets
Bearings	2 sets
Impeller nut, key, & lockwasher	2 sets
Bearing retaining screw	2 sets

Table 4-6. Coil Resistance Values

Motor Size	Voltage	Insulation Class	Resistance (ohms)	Max Ohm var (Motor - Motor) (+/-)
N1	575	R	3.46	0.28
	460	R	2.22	0.18
	230	R	0.55	0.05
	208	R	0.45	0.04
N2	575	R	2.23	0.18
	460	R	1.46	0.12
	230	R	0.37	0.03
	208	R	0.30	0.02
N3	575	R	1.23	0.10
	460	R	0.79	0.06
	230	R	0.20	0.02
	208	R	0.16	0.01
N4	575	R	0.86	0.07
	460	R	0.55	0.04
	230	R	0.14	0.01
	208	R	0.11	0.01
N5	575	R	0.45	0.04
	460	R	0.29	0.02
	230	R	0.07	0.01

* Resistance values 25˚ C

Table 4-7. L Motor Coil Resistance Values

Motor Size	Voltage	Insulation Class	Resistance (ohms)	Max Ohm var (Motor - Motor) (+/-)
NL1	575	R	11.41	0.91
	460	R	7.30	0.58
	230	R	1.83	0.15
	208	R	1.49	0.12
NL2	575	R	5.27	0.42
	460	R	3.37	0.27
	230	R	0.84	0.07
	208	R	0.69	0.06
NL3	575	R	2.28	0.18
	460	R	1.46	0.12
	230	R	0.36	0.03
	208	R	0.30	0.02
NL4	575	R	1.89	0.15
	460	R	1.21	0.10
	230	R	0.30	0.02
	208	R	0.25	0.02
NL5	575	R	1.13	0.09
	460	R	0.72	0.06
	230	R	0.18	0.01
	208	R	0.15	0.01

* Resistance values 25˚ C

Appendix

TEIKOKU USA INC
CHEMPUMP

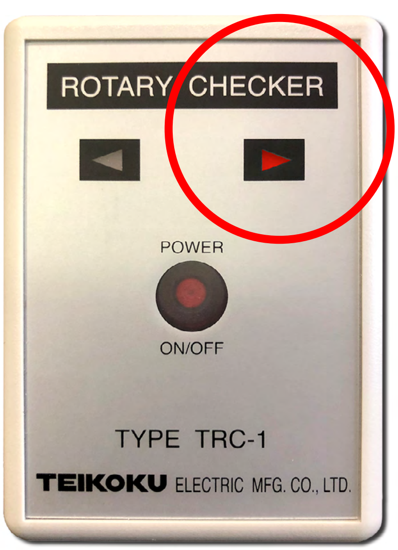
TRC-1

Teikoku Rotary Checker
Hand-held Direction of Rotation Indicator

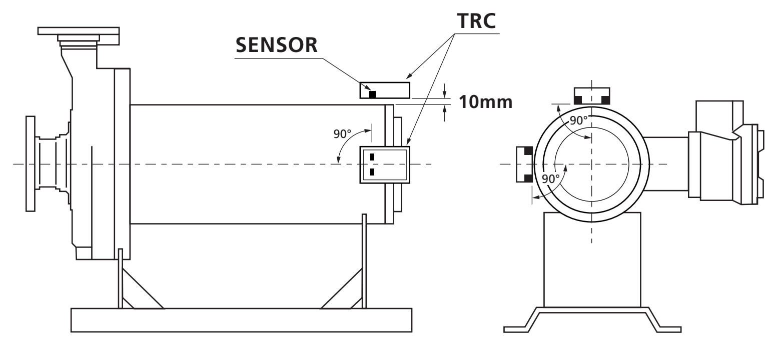
The design of canned motor pumps is such that the rotating element cannot be seen while it is in operation. For this reason, Teikoku supplies an internal rotation indicator with a majority of our pumps. However, there are some instances where this device is not supplied, so we recommend purchasing the TRC-1. This simple device takes the guesswork out of confirming the correct rotation of the motor. It is light, compact, and easy to use. Not only can this be used on Teikoku canned motors, but other three-phase induction motors as well.

- **Place TRC-1 on an operating motor as illustrated below.**
- **The arrow that lights up indicates the direction of rotation.**
- **There is an arrow on the pump case that indicates the correct direction of rotation.**

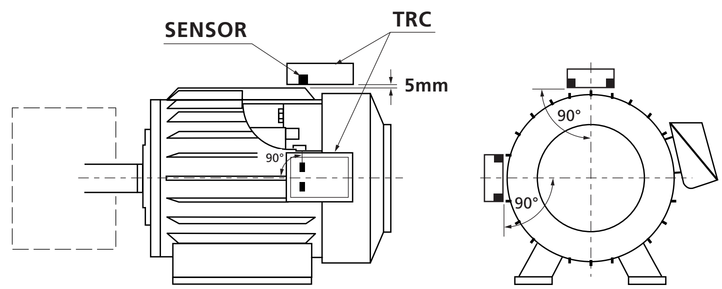
Specifications:
Size: 2.6"W x 3.6"L x 1.1" H (66.mm x 92mm x 28mm)
External Case : ABS plastic
Battery operated : 9V



TEIKOKU CANNED MOTOR PUMP



THREE-PHASE INDUCTION MOTOR

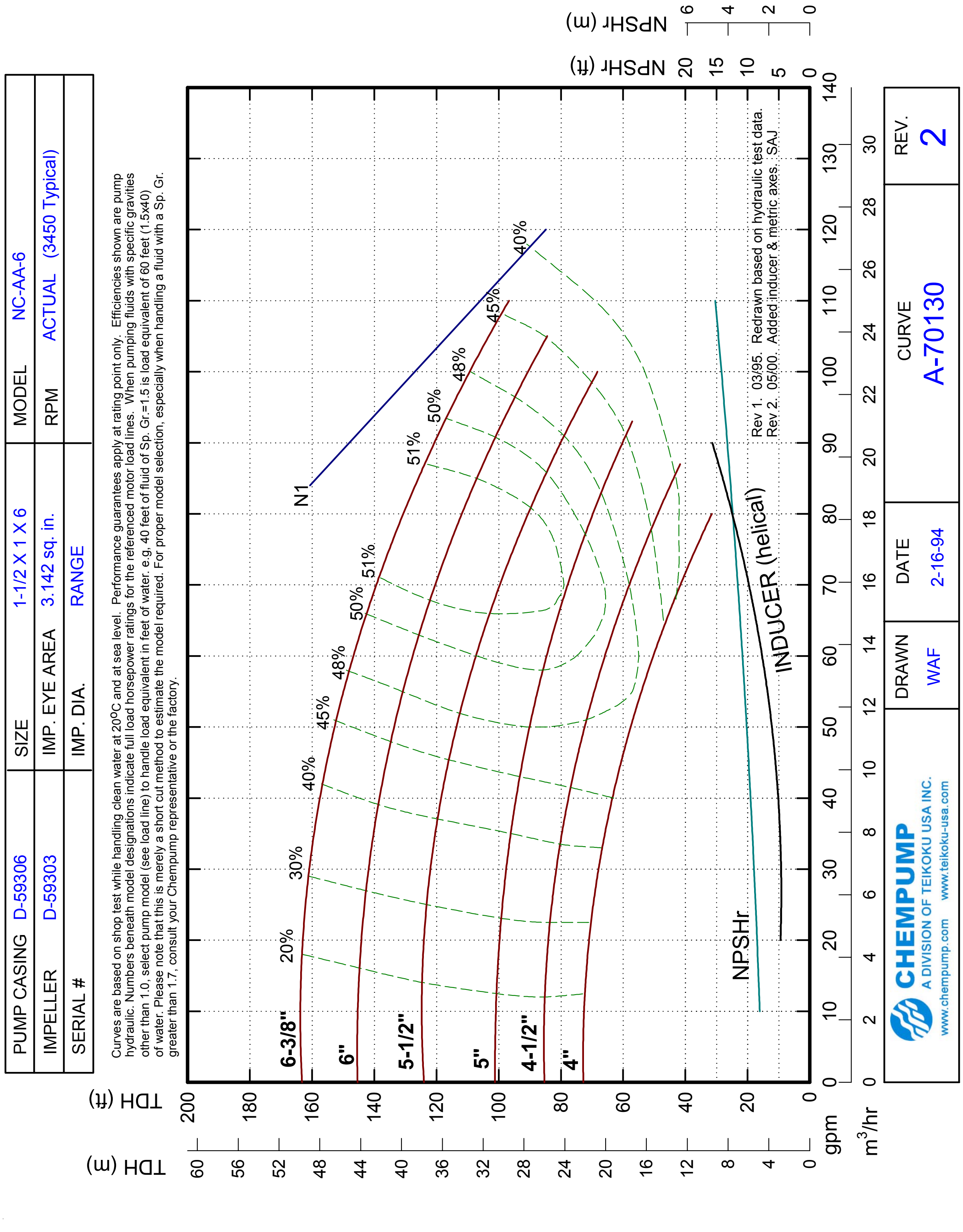


Appx. B. Troubleshooting

Chempump NC-Series Pump

Problem	Probable Cause	Suggested Solution
Failure to deliver required capacity	Pump not primed.	Reprime pump in accordance with Section 3.2.2.
	Air leaks in suction piping.	Locate leaks and eliminate.
	Motor not energized.	Check motor wiring. See Section 2.3
	Motor windings burnt-out or grounded.	Check electrical continuity of windings and is negative response, stator assembly needs to be replaced.
	Low suction head.	Correct suction side of system to ensure availability of design NPSH.
	Discharge head too high.	Correct discharge side of system to ensure proper operating conditions.
	Discharge valve closed or partially opened.	Open discharge valve until rated discharge pressure is obtained.
	Impeller clogged.	Remove obstructions in impeller.
	Wrong direction of rotation.	Reverse any two motor leads and check with phase sequence meter. See Section 3.2.3.
	Damaged impeller	Impeller must be repaired or replaced.
Insufficient pressure	Pump not primed.	Reprime pump in accordance with Section 3.2.2.
	Air leaks in suction piping.	Locate leaks and eliminate.
	Motor not energized.	Check motor wiring. See Section 2.3.
	Motor windings burnt-out or grounded.	Check electrical continuity of windings and is negative response, stator assembly needs to be replaced.
	Low suction head.	Correct suction side of system to ensure availability of design NPSH.
	Discharge valve open too wide.	Close down discharge valve until rated discharge pressure is obtained.
	Impeller clogged.	Remove obstructions in impeller.
	Wrong direction of rotation.	Reverse any two motor leads
	Damaged impeller	Impeller must be repaired or replaced.
Pump loses prime after starting	Pump not properly primed at starting.	Reprime pump in accordance with Section 3.2.2.
	Excessive change in suction vessel pressure.	Locate source pressure fluctuations and correct as required.
	Air or gas in liquid.	Locate source of gas or air entrainment and correct.
	Low suction head.	Correct suction side of system to ensure availability of design NPSH.
Pump takes too much power	Shaft bent.	Replace rotor assembly or straighten shaft if bend not too great.
	Rotating element binds.	Replace bearings (see Section 4) as a result of excessive wear or check for presence of foreign material in rotor chamber
	Electrical short.	Check electrical continuity of all phases of the motor winding and replace stator assembly if necessary
Pump vibrates	Foundation not sufficiently rigid.	Tighten all bolts on the pump base and base supporting structure.
	Impeller partially clogged.	Remove obstructions in the impeller.
	Shaft bent.	Replace rotor assembly or straighten shaft if bend is not too great.
	Worn bearings.	Replace bearings (see Section 4). Check for presence of foreign material.
	Rotating element rubbing stator liner.	Replace bearings (see Section 4), Check stator liner and rotor can for wear. Repair and/or replace as required.
Motor running hot	Motor operating at overload condition.	Make sure pump is operating at design point and conditions specified when purchased.
	Pump is operating below minimum flow.	Increase flow through the pump.
	Pump is running dry.	Check suction line for obstructions and closed valves

Appx. C. NC-AA-6 Curve



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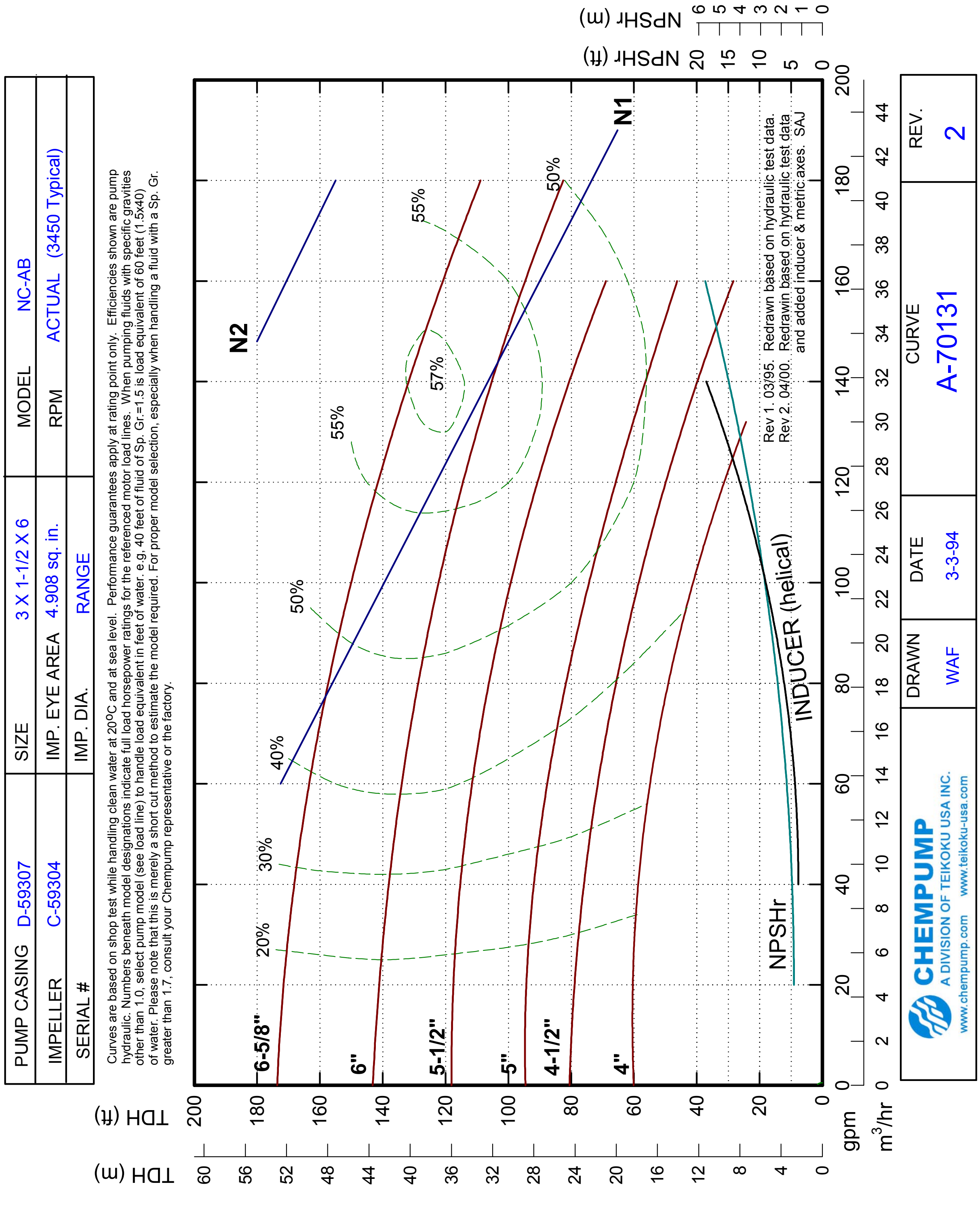
PUMP CASING D-59307
IMPELLER C-59304
SERIAL #
SIZE 3 X 1-1/2 X 6
IMP. EYE AREA 4.908 sq. in.
IMP. DIA. RANGE
MODEL NC-AB
RPM ACTUAL (3450 Typical)
Curves are based on shop test while handling clean water at 20°C and at sea level. Performance guarantees apply at rating point only. Efficiencies shown are pump hydraulic. Numbers beneath model designations indicate full load horsepower ratings for the referenced motor load lines. When pumping fluids with specific gravities other than 1.0, select pump model (see load line) to handle load equivalent in feet of water. e.g. 40 feet of fluid of Sp. Gr.=1.5 is load equivalent of 60 feet (1.5x40) of water. Please note that this is merely a short cut method to estimate the model required. For proper model selection, especially when handling a fluid with a Sp. Gr. greater than 1.7, consult your Chempump representative or the factory.
TDH (ft)
TDH (m)
NPSHr (ft)
NPSHr (m)
gpm
m3/hr
6-5/8"
6"
5-1/2"
5"
4-1/2"
4"
20%
30%
40%
50%
55%
57%
N1
N2
NPSHr
INDUCER (helical)
Rev 1. 03/95. Redrawn based on hydraulic test data.
Rev 2. 04/00. Redrawin based on hydraulic test data and added inducer & metric axes. SAJ
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DRAWN WAF
DATE 3-3-94
CURVE A-70131
REV. 2

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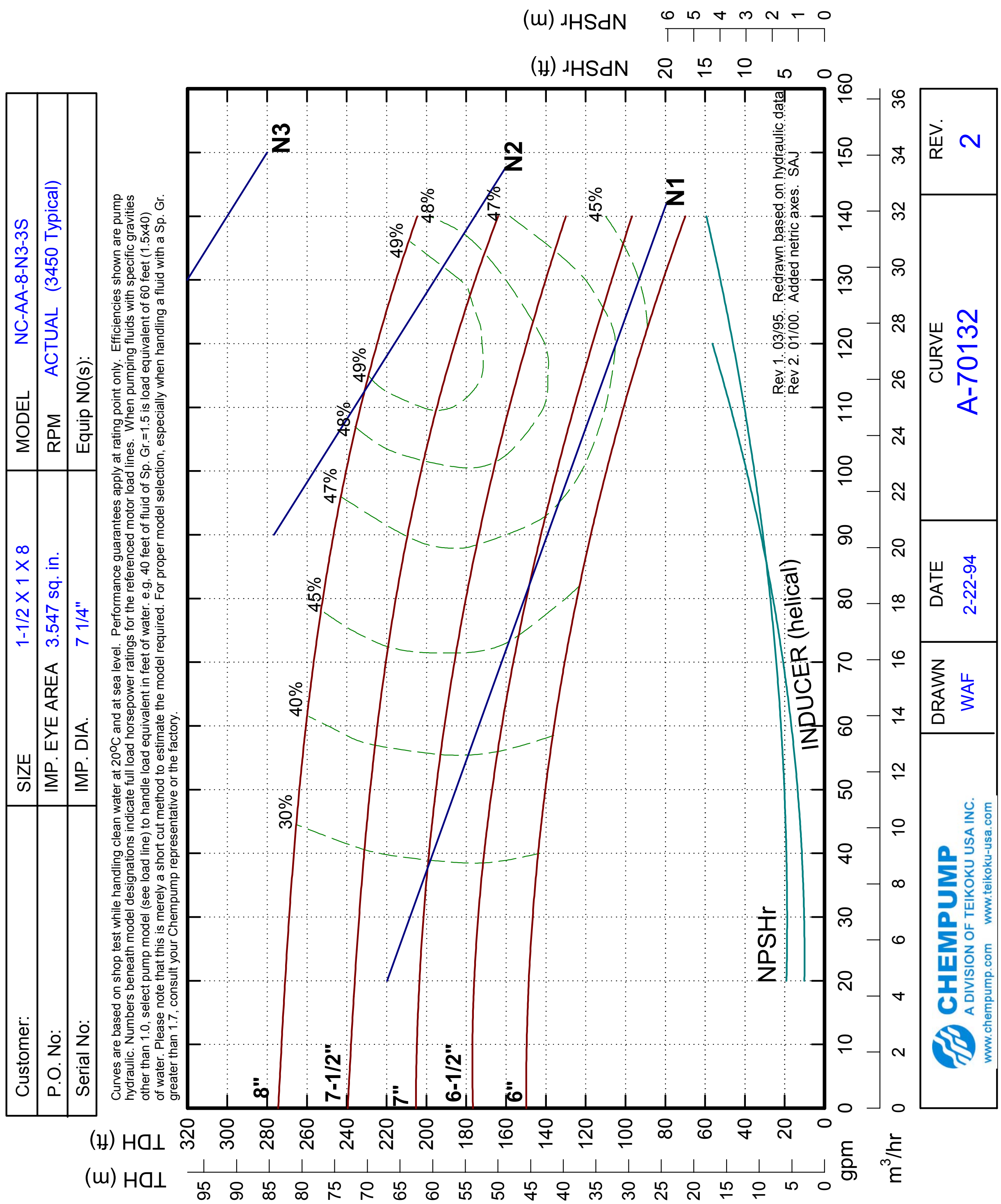
Appx. E. NC-AA-8 Curve



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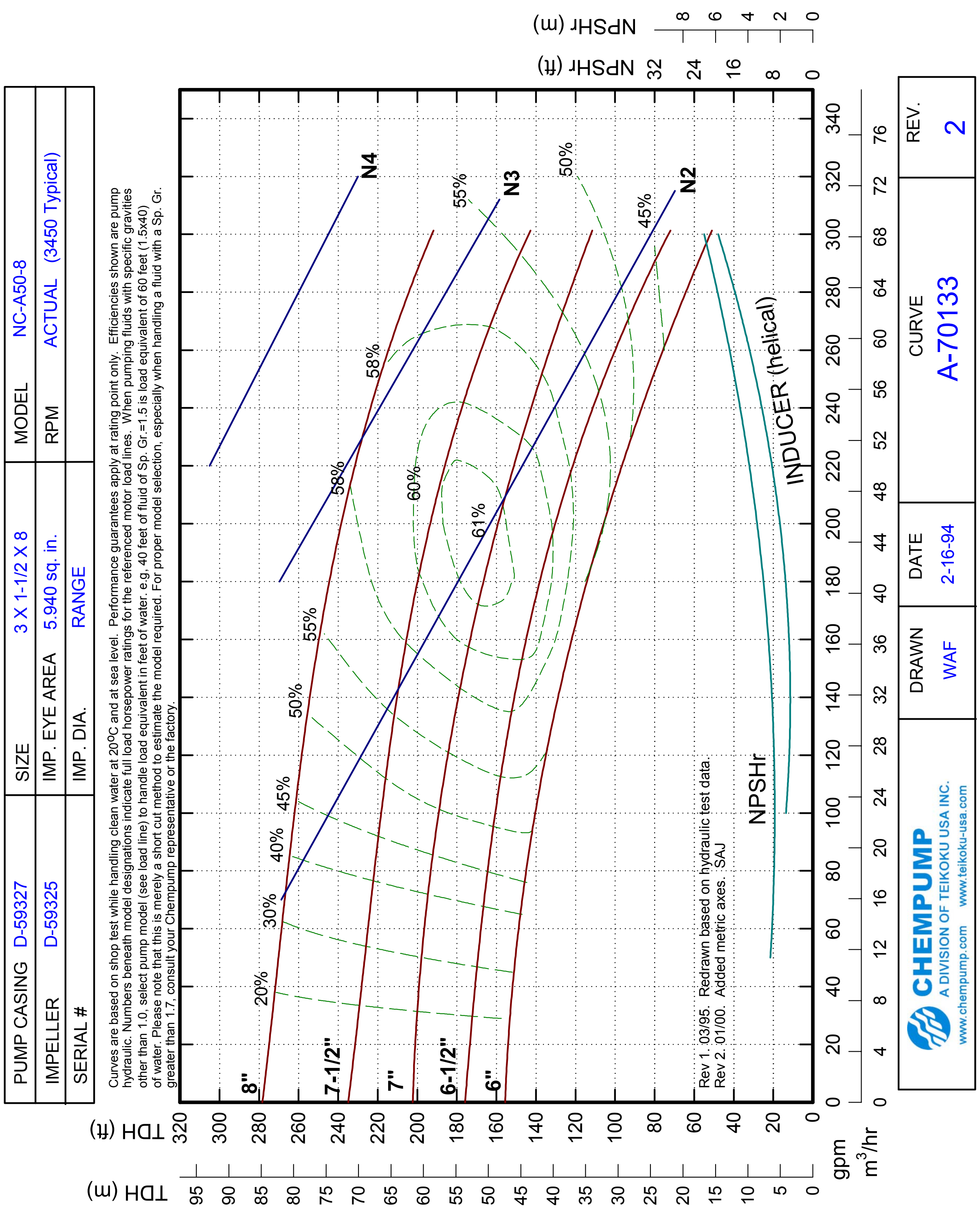
Appx. F. NC-A50-8 Curve



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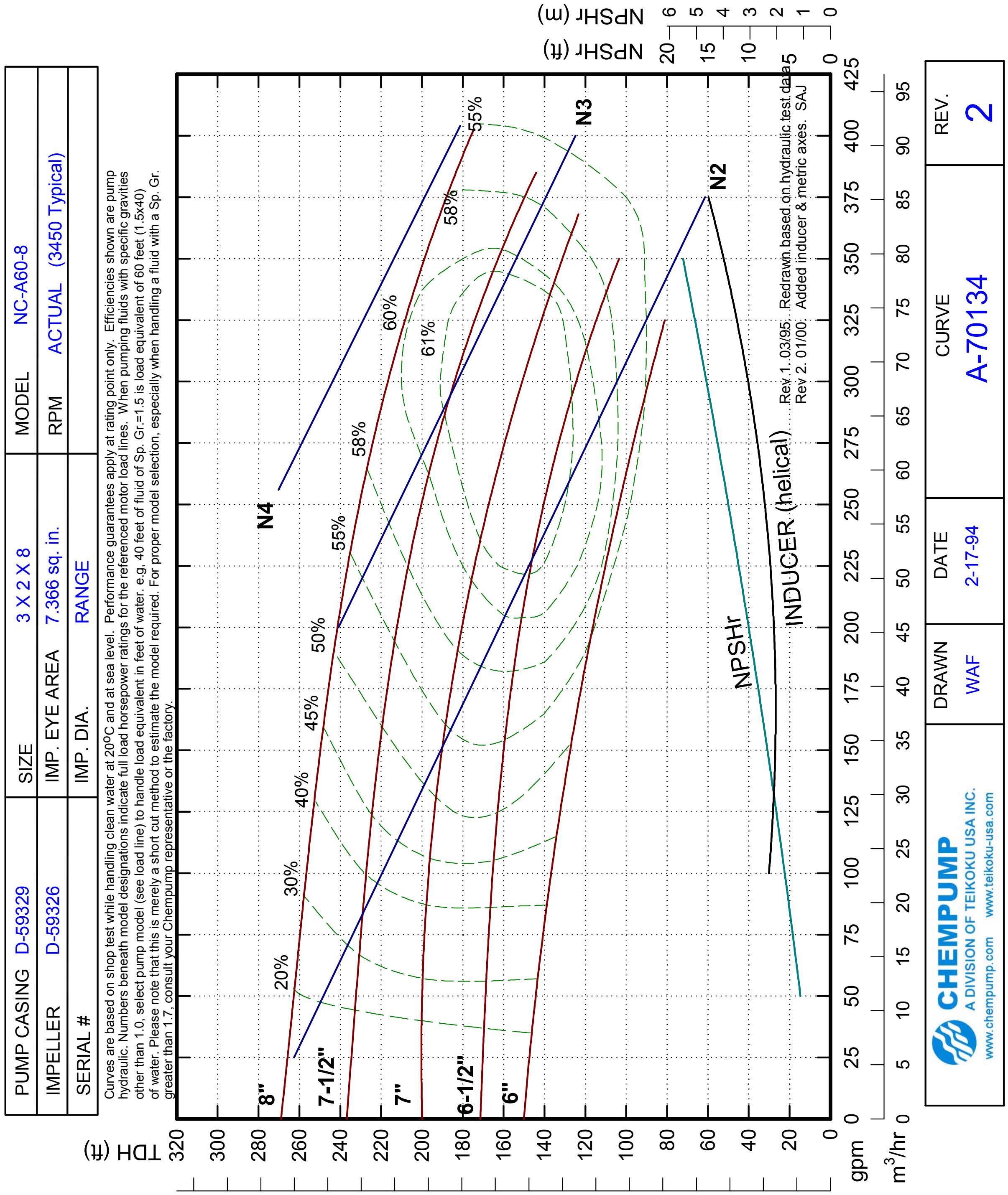
Appx. G. NC-A60-8 Curve



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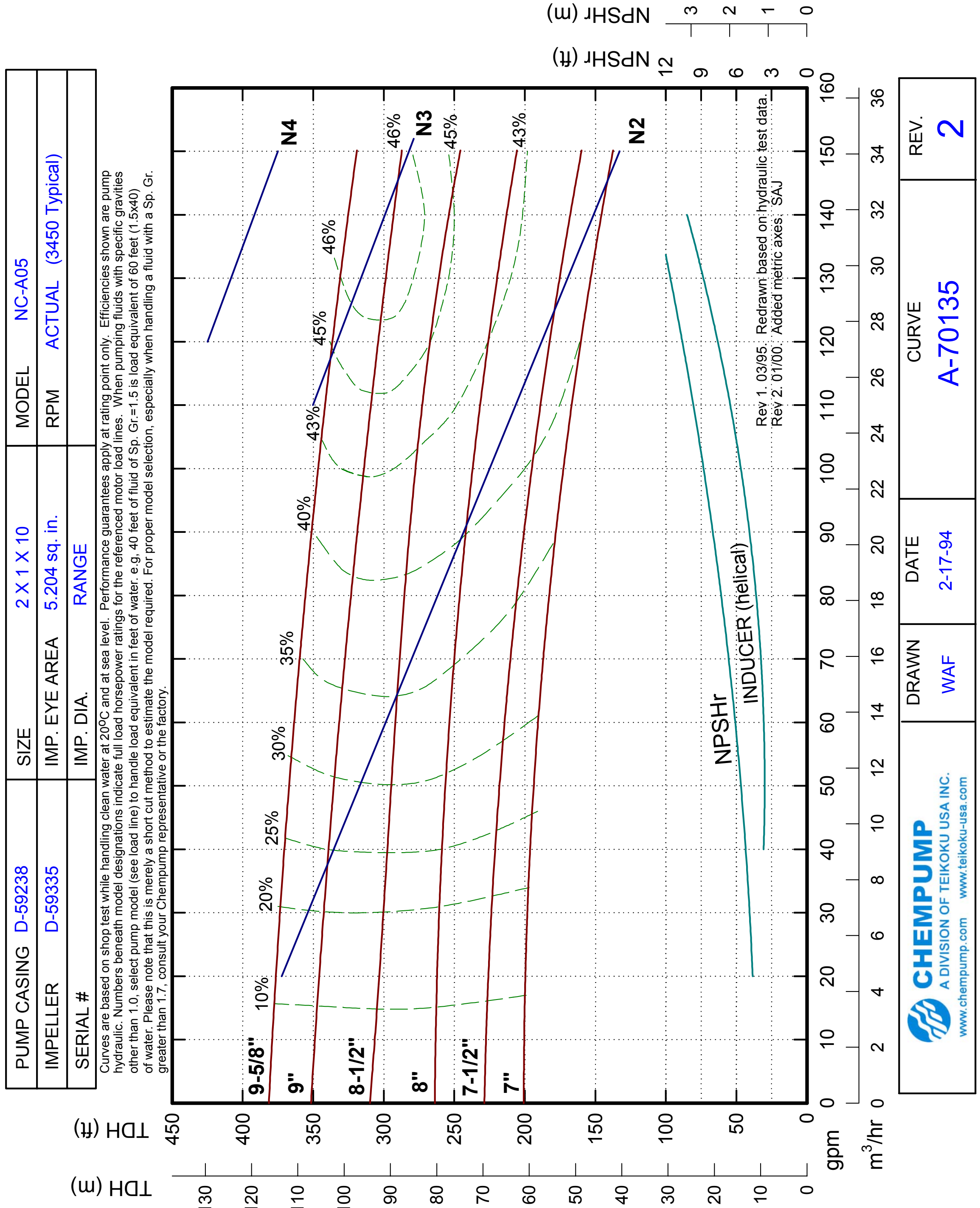
PUMP CASING D-59238
SIZE 2 X 1 X 10
MODEL NC-A05
IMPELLER D-59335
IMP. EYE AREA 5.204 sq. in.
RPM ACTUAL (3450 Typical)
SERIAL #
IMP. DIA. RANGE
Curves are based on shop test while handling clean water at 20°C and at sea level. Performance guarantees apply at rating point only. Efficiencies shown are pump hydraulic. Numbers beneath model designations indicate full load horsepower ratings for the referenced motor load lines. When pumping fluids with specific gravities other than 1.0, select pump model (see load line) to handle load equivalent in feet of water. e.g. 40 feet of fluid of Sp. Gr.=1.5 is load equivalent of 60 feet (1.5x40) of water. Please note that this is merely a short cut method to estimate the model required. For proper model selection, especially when handling a fluid with a Sp. Gr. greater than 1.7, consult your Chempump representative or the factory.
9-5/8"
9"
8-1/2"
8"
7-1/2"
7"
N4
N3
N2
NPSHr
INDUCER (helical)
TDH (ft)
TDH (m)
NPSHr (ft)
NPSHr (m)
gpm
m3/hr
Rev 1. 03/95. Redrawn based on hydraulic test data.
Rev 2. 01/00. Added metric axes. SAJ
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DATE 2-17-94
CURVE A-70135
REV. 2

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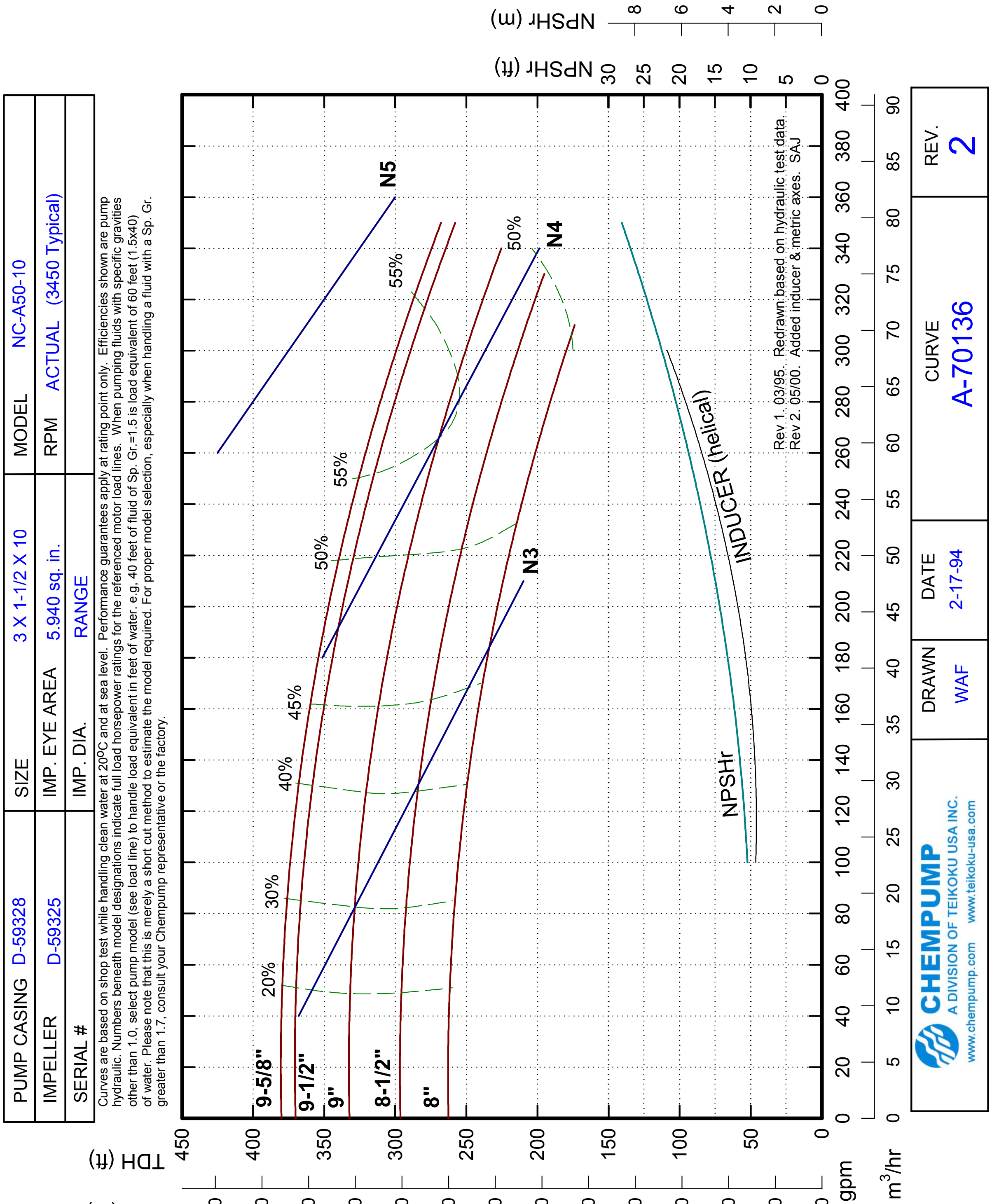
PUMP CASING D-59328
IMPELLER D-59325
SERIAL #
SIZE 3 X 1-1/2 X 10
IMP. EYE AREA 5.940 sq. in.
IMP. DIA. RANGE
MODEL NC-A50-10
RPM ACTUAL (3450 Typical)
Curves are based on shop test while handling clean water at 20°C and at sea level. Performance guarantees apply at rating point only. Efficiencies shown are pump hydraulic. Numbers beneath model designations indicate full load horsepower ratings for the referenced motor load lines. When pumping fluids with specific gravities other than 1.0, select pump model (see load line) to handle load equivalent in feet of water. e.g. 40 feet of fluid of Sp. Gr.=1.5 is load equivalent of 60 feet (1.5x40) of water. Please note that this is merely a short cut method to estimate the model required. For proper model selection, especially when handling a fluid with a Sp. Gr. greater than 1.7, consult your Chempump representative or the factory.
9-5/8"
9-1/2"
9"
8-1/2"
8"
20%
30%
40%
45%
50%
55%
50%
55%
N3
N4
N5
NPSHr
INDUCER (helical)
Rev 1. 03/95. Redrawn based on hydraulic test data.
Rev 2. 05/00. Added inducer & metric axes. SAJ
TDH (ft)
TDH (m)
NPSHr (ft)
NPSHr (m)
gpm
m³/hr
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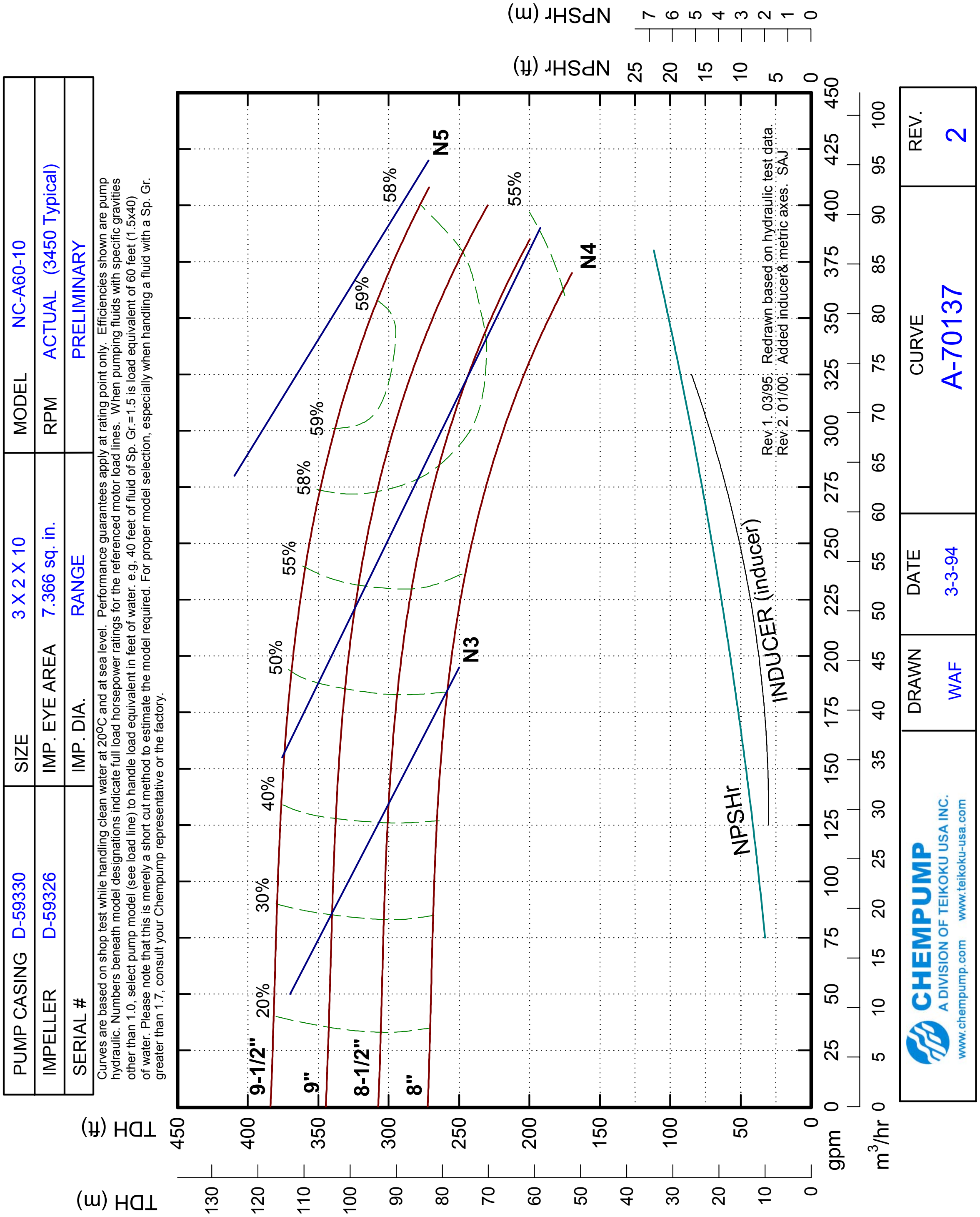
Appx. J. NC-A60-10 Curve



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REV. 4-17-20

TEIKOKU USA INC
CHEMPUMP

DECONTAMINATION CERTIFICATION AND FLUSHING PROCEDURE

CUSTOMER ____________________________________ **DATE:** ______________________________

ADDRESS: ___________________________________ **PHONE:** _____________________________

___________________________________ **EMAIL:** ______________________________

CONTACT: ___________________________________ **RMA #:** _____________________________

Please complete the items below. By providing this information, you will allow us to work as quickly and safely as possible.

PUMP MODEL: _________________________________ **SERIAL NUMBER:** ______________________

PART NUMBER:_________________________________ **DATE INSTALLED:**______________________

DATE PURCHASED: _____________________________ **INDOOR / OUTDOOR:**___________________

REASON FOR RETURN: ☐ WARRANTY REQUEST ☐ FACTORY SERVICE

FAILURE INFORMATION:

☐ Failure To Deliver Required Capacity ☐ Vibration ☐ Motor Burnout
☐ Loses Prime After Starting ☐ Bearing Failure ☐ Other: ______________________
☐ Axial Wear Due To Thrust ☐ Insufficient Pressure ☐ Bearing Monitor Reading

BRIEF DESCRIPTION OF PUMP FAILURE: ____

____

____

DECONTAMINATION INFORMATION

All pumps/parts must be completely decontaminated and all information in this section must be completed prior to shipment to our factory or service center. Shipments received without this documentation will not be accepted and will be returned to the point of shipment.

CHECK ONE OF THE FOLLOWING:

☐ Pump is new/unused and never subjected to process fluid.

☐ The pump has been flushed by following the applicable steps in section A of the Teikoku USA Flushing Procedure on page 2 of this form. No liner rupture is suspected.

☐ Both the complete pump and the stator assembly have been flushed by following the applicable steps in section A, plus section B, C or D of the Teikoku USA Flushing Procedure on pages 2 and 3 of this form. The motor must be rewound.

FLUID PUMPED: __________________________ **WHAT FLUID DID YOU FLUSH WITH:** ______________

Attach completed material safety data sheets (MSDS) for these fluids. *If either fluid is proprietary, please attach a description of any characteristics that will assist Teikoku USA in safe handling. Without detailed and complete information on the pumped fluid, we will not be able to process your order.*

PROTECTION EQUIPMENT RECOMMENDED FOR SAFE HANDLING OF THE PROCESS FLUID: ____________

____

DECONTAMINATION CERTIFIED BY: ____________________________ **DATE:**______________________

TITLE: ____ **PHONE:** ____________________

RETURN COMPLETED FORM AND PUMP/PART TO:

☐ TEIKOKU USA
Factory Service Center
959 Mearns Road
Warminster, PA 18974
Phone: (215) 343-6000
Fax: (267) 486-1037

☐ TEIKOKU USA
Midwest Service Center
27881 State Route 7
Marietta, OH 45750
Phone: (740) 538-5332
Fax: (740) 538-5015

☐ TEIKOKU USA
Sales and Service Center
5880 Bingle Road
Houston, TX 77092
Phone: (713) 983-9901
Fax: (713) 983-9919

TEIKOKU USA INC
CHEMPUMP

DECONTAMINATION CERTIFICATION
AND FLUSHING PROCEDURE

FLUSHING PROCEDURES FOR TEIKOKU USA PRODUCTS

THE FOLLOWING FLUSHING PROCEDURES ARE REQUIRED TO ALLOW FOR MAXIMUM REMOVAL OF PROCESS FLUIDS.

A. COMPLETE PUMPS AND PARTS

Pumps and parts that are returned for service are to be thoroughly decontaminated and free of process and flushing fluids.

Some pumps handle a fluid that may solidify and cannot be removed by flushing the pump. These pumps should be fully disassembled for removal of all traces of fluids to avoid solidification of the fluids in the pump.

SUGGETIONS FOR DECONTAMINATION

1. With the suction flange down, introduce an appropriate neutralizing fluid through the discharge flange. Flush the pump in this manner for a sufficient time to allow for the removal of all process fluid.
2. Introduce an appropriate neutralizing fluid to the rear of the pump for a sufficient time to allow for the removal of all process fluid. The method of fluid insertion depends on the pump design. Access may be through a circulation line, vent, drain or flush connection. In some cases, the rear bearing housing needs to be removed to thoroughly flush the pump internals.

Remove as much of the neutralizing fluid as possible using compressed air or inert gas.

For pumps with shaft sleeves, complete disassembly will be required to remove trapped fluid.

Flush all auxiliary tubing, piping and equipment such as heat exchangers.

For any questions on decontamination, contact your Teikoku service representative.

See sections "B" through "D" for stator assembly decontamination requirements where a liner breach is suspected. Pumps with the TRG bearing wear monitor will have a wear meter visible on the pump terminal box.

B. G series without TRG and J-series stator assembly (if equipped with a relief valve).

If a stator liner rupture is suspected, follow this section to flush the stator cavity. **Caution:** if this step is followed, the motor must be rewound.

Remove the relief valve. Insert a screwdriver into the relief valve adapter and pry the Lisk filter to one side. Remove the connection box from the lead nipple and chip away the potting compound from the lead nipple.

Position the stator assembly with the lead nipple down and introduce an appropriate neutralizing fluid to the relief valve adapter. The fluid will exit through the lead nipple. Flush the stator cavity in this manner for a sufficient time to allow for the removal of all process fluid and stator oil.

Remove as much of the neutralizing fluid as possible by purging the stator cavity with compressed air or inert gas for 3 - 5 minutes.

If the connection box is to be returned, assure that all components have been decontaminated.

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Page 2 of 3

TEIKOKU USA INC
CHEMPUMP

DECONTAMINATION CERTIFICATION
AND FLUSHING PROCEDURE

C. NC-series stator assembly without TRG

If a stator liner rupture is suspected, follow this section to flush the stator cavity. Caution: if this step is followed, the motor must be rewound.

Drill a hole through base cradle mounting hole located in rear end bell, drill this hole just deep enough to break through end bell. Drill a second hole through stator liner on the opposite end of the stator.

Position the stator assembly with rear end bell up and introduce an appropriate neutralizing fluid through drilled hole in rear end bell. The fluid will exit through the drilled hole on opposite end. Flush the stator cavity for a sufficient time to allow for the removal of all process fluid.

Remove as much of the neutralizing fluid as possible by purging the stator cavity with compressed air or inert gas for 3 - 5 minutes.

If the connection box is to be returned, assure that all components have been decontaminated.

D. For all Teikoku pumps, LE stators, G and NC stators with TRG.

If a stator liner rupture is suspected, follow this section to flush the stator cavity. Caution: if this step is followed, the motor must be rewound.

There might be a case in which pressure is released when terminal box cover or terminal plate is removed. Take the necessary precautions and follow Teikoku's terminal box removal procedure, that is available upon request. With the terminal box up, remove the cover and the terminal plate. Drill a hole through the stator liner on the opposite end of the stator.

Position the stator assembly with the rear end bell up and introduce an appropriate neutralizing fluid through the junction box port. The fluid will exit through the drilled hole in the opposite end. Flush the stator cavity for a sufficient time to allow for the removal of all process fluid. After washing is completed, drain all the fluid.

Remove as much of the neutralizing fluid as possible by purging the stator with compressed air or inert gas for 3 – 5 minutes. If the terminal box and terminal plate are to be returned, assure that all components have been decontaminated.

NOTE ON DECONTAMINATION:
TEIKOKU USA RESERVES THE OPTION TO RETURN PUMPS, AT THE CUSTOMER'S EXPENSE,
IF THEY HAVE NOT BEEN PROPERLY DECONTAMINATED.

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TEIKOKU USA INC
CHEMPUMP

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Repair Receipt Policy

Teikoku USA policy requires that an RMA be generated prior to the shipment of pumps or components to any Teikoku USA facility. With the shipment Teikoku USA also requires a copy of the RMA, a completed Teikoku USA Decontamination Form, an SDS for the process fluid to which the pumps or parts were subjected and an SDS on the decontamination flush fluid that was used to decontaminate the equipment.

THESE DOCUMENTS MUST ACCOMPANY THE SHIPMENT. IF THESE DOCUMENTS ARE NOT PROVIDED, TEIKOKU USA PERSONNEL WILL REFUSE THE SHIPMENT AND INFORM BOTH THE CARRIER AND CUSTOMER OF THE REFUSAL.

These requirements are essential to Teikoku USA's safety practices and reviews that serve to protect all of Teikoku USA's associates, visitors and customers. Teikoku USA thanks you in advance for your adherence to our policy regarding returns for evaluation and/or service. Please feel free to contact the service center personnel at the Teikoku USA facility to which the pump was sent for repair.

As part of its ongoing process improvement policy, Teikoku USA continually reviews business processes to ensure that a safe work environment is provided for all employees, associates, visitors, customers and the community. As such this policy is subject to change without prior notice. To check for any changes to this policy, please use the contact numbers for each facility as listed in the above letterhead.

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