

### General Description

The NH90 Hydramotor Series of Linear Actuators features a completely self-contained, hydraulic power system that has been integrally coupled to a hydraulic cylinder. The positive, firm positioning actuators are ideal for providing efficient and precise linear control of valves, dampers, louvers, and a wide variety of other equipment requiring an operating thrust of up to 1,500 lbs. (680 kg), 3,000 lbs (1,360kg), or 4,000 lbs. (1,800 kg).

### Operating Ranges

Range (Stroke)	Thrust(lbs)
0-3.5 in. (89mm)	1,500 (680kg)
0-3.5 in. (89mm)	3,000 (680kg)
0-4.0 in. (102mm)	4,000 (1,800kg)

The NH90 Hydramotor Series of Linear Actuators is qualified as Class IE, safety related equipment for nuclear power generating stations in accordance with IEEE standards 323, 344, 382, and 627.

### Features

- Self contained, intrinsically fail safe, sealed unit; no external pressure lines required
- Self lubrication and fewer moving parts mean less maintenance and longer service life
- Modular design speeds service and maintenance
- Infinite resolution and precise repeatability
- "Hard positioning" eliminates the effects of pipeline pressure surges
- Stem adapters and couplings available for a wide range of applications
- Continuous duty cycle
- Proportional or on-off operation

### Principles of Operation

The NH90 Hydramotors are the result of over 50 years experience in designing, testing, manufacturing, marketing, and servicing electrohydraulically powered actuators.



Pull Type Shown

Units are available in both push or pull power stroke with a choice of either spring-return or lock-in-last position upon loss of power. The spring-return version offers the user "fail-safe" operation as the spring returns the actuator shaft to the de-energized position upon power interruption. The lock-in-last position version allows the user to control the return of the actuator shaft to the de-energized position after loss of supply power.

Considerable field experience has proven NH90 Hydramotors to be extremely reliable, and ensures minimum service requirements and a prolonged service life. The modular design uses few moving internal components and industry proven heat-resistant seals, which are immersed in oil for continuous lubrication.

An enamel finished die cast aluminum exterior housing and hard chrome plated steel output shaft have been selected to allow NH90 Hydramotors to be used in the most demanding, rugged, and hostile industrial environments.

To provide continuous peak output without overheating, the Hydramotor utilizes a rugged 100% duty cycle, single, or three phase electric motor. Single phase motors are of a permanent split capacitor run type. Hydramotors will operate in temperatures from -40°F (-40°C) to +200°F (+93°C).

## Models with Continuous Modulation

The NH90 Series Modulating Actuators feature a unique “force-balance mechanism”, which controls their operation. Here’s how:

When a standard control signal input is supplied to the force motor coil. The coil applies a force to the balance beam. The force is directly proportional to the input signal.

This force on the balance beam is opposed by the actuator stem position feedback spring. Control is achieved as these two forces balance and reposition the flapper assembly and nozzle.

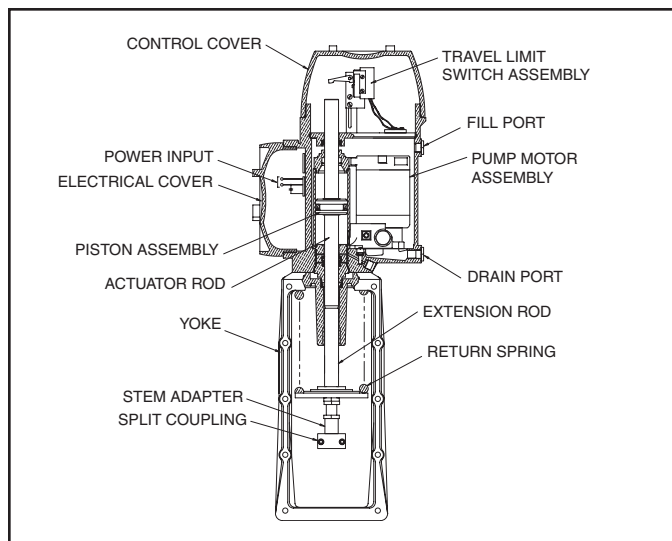
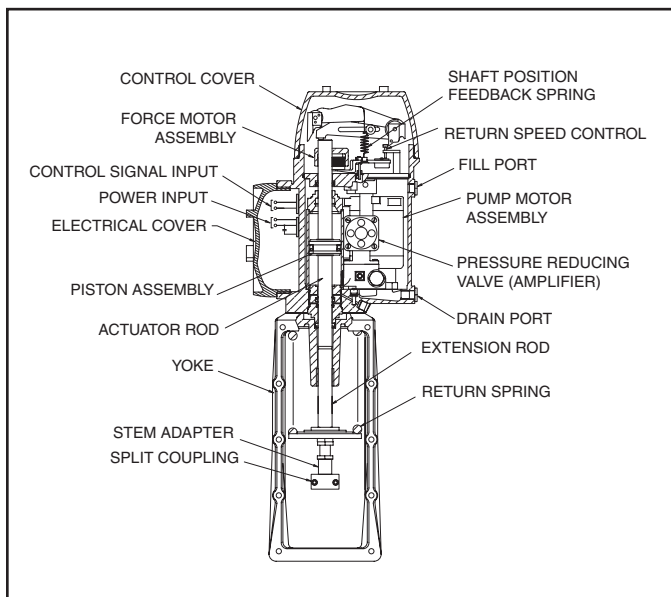
When the control signal input is increased, the force provided by the motor increases. As a result the flapper assembly is repositioned closer to the nozzle.

This repositioning increases the hydraulic pressure in the hydraulic amplifier, which in turn causes a diaphragm-activated lever to restrict fluid flow through the high pressure orifice at the inlet to the hydraulic amplifier.

Restricting the fluid flow at the inlet increases the hydraulic pressure of the oil supplied by the pumps. This also increases the oil pressure in the cylinder, thus forcing the piston to move the output stem.

When the force on the feedback spring equals that of the force motor, the hydraulic system stabilizes and the output stem remains in position.

An increase or decrease in the input signal produces a corresponding repositioning of the output stem.



## NH90 Two-Position (ON-OFF) Models

When power is applied to the actuator’s electrical terminals, the solenoid valve closes. The pump applies hydraulic pressure to the piston. The piston pulls the output stem. When the stem reaches a pre-determined distance, the travel limit switch opens the pump motor circuit, causing the stem to stop.

The solenoid valve remains closed, holding the stem in position until the control circuit is broken. When the circuit is broken, the solenoid valve opens and the yoke-mounted spring returns the stem to its de-energized position.

## What happens if the power fails?

Models NH91, 92, 95, 96

(Modulating and ON-OFF Models with Direct or Reverse Action)

Power failure stops the hydraulic power unit. This causes the normally open solenoid valve to open. Then, the coiled spring returns the output stem to its de-energized position.

## Net Stem Forces

A wide variety of net stem forces are available, ranging from 200 pounds to 4,000 pounds, depending on the choices of return springs.

### Operating Modes

**NH91 Proportional, Spring-Return, Pull-Type:**

Shaft retracts on application of power; spring-return extends shaft on loss of power.

**NH92 Proportional, Spring-Return, Push-Type:**

Shaft extends on application of power; spring-return retracts shaft on loss of power.

**NH93 Proportional, Lock-in-Last Position, Pull-Type:**

Shaft retracts on application of power; lock-in-last position on power failure, spring-return when solenoid valve is energized. (Normally closed solenoid valve wired integrally to the motor circuit.)

**NH94 Proportional, Lock-in-Position, Push-Type:**

Shaft extends on application of power, lock-in-position on power failure: spring-return when solenoid valve is energized. (Normally closed solenoid valve wired integrally to the motor circuit.)

**NH95 Two-Position, Spring-Return, Pull-Type:**

Shaft retracts on application of power; spring-return on loss of power.

**NH96 Two-Position, Spring-Return, Push-Type:**

Shaft extends on application of power; spring-return on loss of power.

### Exterior Construction

**Electrical Housing:** Cast aluminum UNS A13560 (AA-356-T6) with four 3/4" NPT Conduit Connections

**Power Unit:** Cast aluminum UNS A13560 (AA-356-T6)

**Output Shaft:** "Hard chrome plated hardened steel 1144 or 4140"

**Yoke:** Cast aluminum UNS A13560 (AA-356-T6)

### Enclosure Ratings

**Standard**

NEMA 4- Meets watertight requirements

**Optional**

NEMA 4 & 7- Meets watertight and hazardous location requirements; Class I Division 1, Group C & D

### Hydraulic Power Unit

**Hydraulic Oil:** Mobil SHC 824

**Capacity:** 3.26 quarts (3.08 liter)

**Pump:** Two Cylinder, positive displacement with integral check valve

**Filter Capacity:** 10 times pump capacity

**Seals:** Viton fluoroelastomer, and Polyurethane

### Hydraulic System

**Control Valve:** Spring-return, normally-open valve

**Lock-In-Last Position:** normally-closed valve

### Control Signal Output

A. 4-20 mA (400 Ohm) (4-12 mA & 12-20 mA split range)

B. 10-50 mA (100 Ohm)

### Electric Motor

**Type:** Permanent Split capacitor run 2-Pole, Single Phase or Three Phase

**Wiring Classifications:** Class B 105°C (220°F)

**Duty Cycle:** 100 percent

### Actuator Output

**Force Output (gross)** (for net force, consult selector chart or contact ASCO).

a. 1,500 lb. (680kg)

b. 3,000 lb. (1,360kg)

c. 4,000 lb. (1,800kg)

**Maximum Stroke (adjustable)**

a. 1,500 lb. (680kg) and 3,000 lb (1,360 kg) units 3.5" (89mm)

b. 4,000 lb. (1,800kg) units 4" (102mm)

#### Power Stroke Speed (hydraulic)

- a. 1,500lb (680kg) units – 0.376"/sec (9.5mm/sec)
- b. 3,000 lb. (1,360kg) units – 0.188"/sec (4.8 mm/sec)
- c. 4,000 lb. (1,800kg) units – 0.141"/sec (3.6 mm/sec)

#### Spring Return Speed (adjustable or modulating)

- a. 1,500 lb. (680kg) – 4 sec maximum
- b. 3,000 lb. (1,360kg) – 7 sec maximum
- c. 4,000 lb. (1,800kg) – 10 sec maximum

### Crate Storage Environment

#### Short Term up to 3 months:

-40° F (-40° C) to +200° F (+93° C)

#### Long Term as specified per maintenance schedule

(up to 2 years): -20° F (-29° C) to +120° F (+49° C)

### Operating Environment

**Environment:** Nuclear Power Station, outside containment area harsh environment

**Temperature Range:** -20° F (-29° C) to +150° F (+66°C)

**Humidity Range:** 0-100% R. H.

**Mounting:** Any position where the power housing is above the horizontal axis

**Sub-Zero Ambient Start-Up:** The Proportional Control Hydramotor must be energized for 30 minutes prior to application of control signal

**Load Sensitivity:** Within 0.1% of stroke per 100 lb (45.5kg)

### Shaft Adapter and Split Coupling

A shaft adapter and split coupling are normally required when installing a hydramotor on a linear-motion valve. These items are included in the catalog number and should be specified. Contact ASCO for assistance.

### How to order

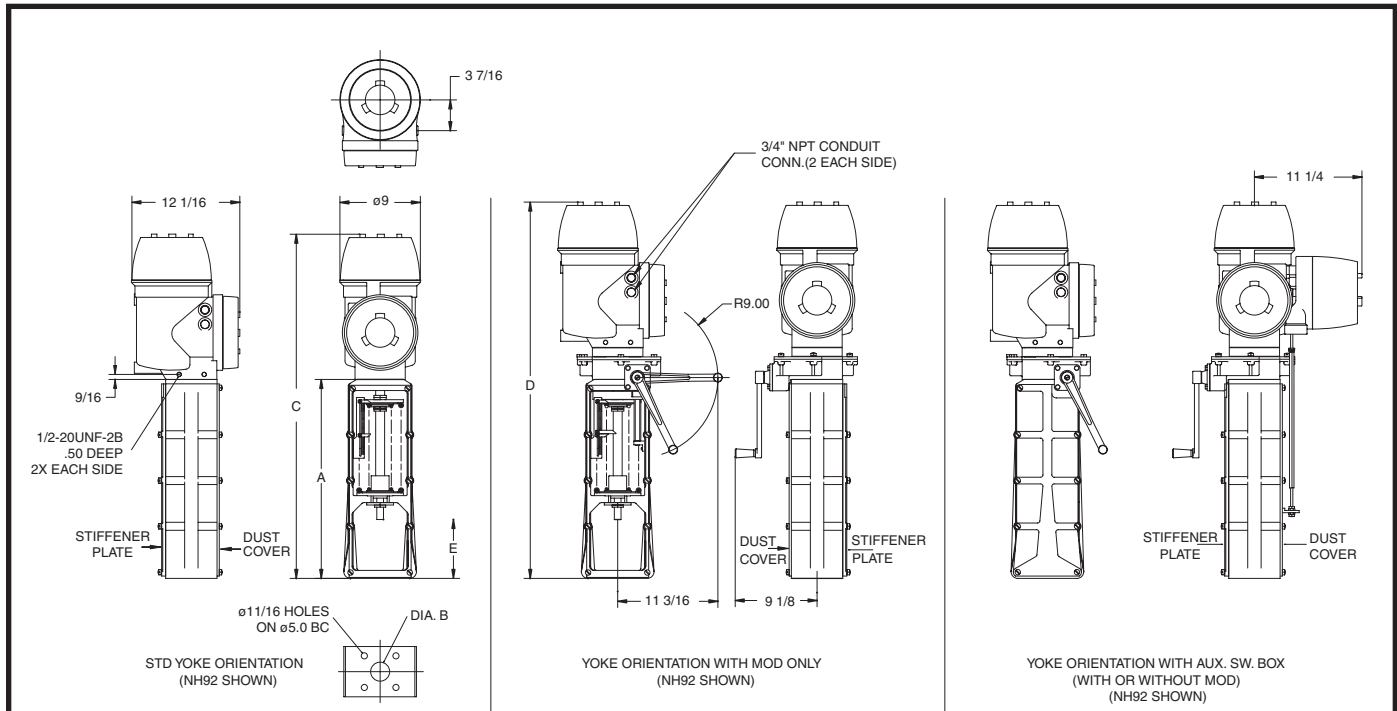
To select the NH90 Series Hydramotor for your application, the operating conditions of the Process Control Device (PCD) must first be identified by determining the following parameters:

- Maximum stem forces at significant stem position
- Available power supply
- Control mode
- Closure mode whether push or pull
- Power failure mode whether opened, closed, or remaining in last position
- PCD interface dimensions, the operating environment, and the feedback instrumentation to be used.

Contact ASCO for specific sizing and selection.

### NH90 Series Hydramotor Actuators

**Nominal Dimensions:** Inches



### NH91/93/95 - PULL TYPE Inches

Yoke Length	Bonnet Mounting Bore	Overall Height	Height With MOD	Stem Mid Position
A	DIA. B	C	D	E
20" (YOKE A)	2 1/8, 2 1/4 2 5/16, 2 3/8 2 1/2, 2 5/8	36-9/16	40-1/8	8.32
17 1/2" (YOKE C)	2 13/16, 3 3 1/4, 3 5/16 3 9/16, 4	34-1/16	37-5/8	5.82

### NH92/94/96 - PUSH TYPE Inches

Yoke Length	Bonnet Mounting Bore	Overall Height	Height With MOD	Stem Mid Position
A	DIA. B	C		E
26 1/2" (YOKE L)	2 1/8, 2 1/4 2 5/16, 2 3/8 2 1/2, 2 5/8	43-1/16	46-5/8	8.31
22" (YOKE N)	2 13/16, 3 3 1/4, 3 5/16 3 9/16, 4	38-9/16	42-1/8	5.31

## Actuator Ordering Tables

NH9 = Electrohydraulic Linear Actuator

### Operating Mode

- 1 = Pull Type, Modulating, Failsafe
- 2 = Push Type, Modulating, Failsafe
- 3 = Pull Type, Modulating, Lock in Position on Power Failure
- 4 = Push Type, Modulating, Lock in Position on Power Failure
- 5 = Pull Type, Two-Position, Failsafe
- 6 = Push-Type, Two-Position (Spring Return)

### Enclosure

- T = Watertight/Raintight
- U = Hazardous Location
- V = Watertight/Raintight with Manual Override
- W = Hazardous Location, with Manual Override

### Power Unit

Gross Shaft Force	Input Signal
40 = 1,500 lbs	4-20 ma signal
41 = 1,500 lbs	10-50 ma signal
46 = 1,500 lbs	Intermittent Operation
60 = 3,000 lbs	4-20 ma signal
61 = 3,000 lbs	10-50 ma signal
66 = 3,000 lbs	Intermittent Operation
80 = 4,000 lbs	4-20 ma signal
81 = 4,000 lbs	10-50 ma signal
86 = 4,000 lbs	Intermittent Operation

### Voltage

- 02 = 120V/60Hz single phase
- 04 = 240V/60Hz single phase
- 08 = 110V/50Hz single phase
- 09 = 220V/50Hz single phase
- 54 = 240V/50Hz single phase
- 69 = 240V/60Hz 3-phase
- 70 = 480V/60Hz 3-phase
- 71 = 380V/50Hz 3-phase
- 72 = 440V/50Hz 3-phase
- 73 = 460V/50Hz 3-phase

### Options

- X0 = None
- E1 = 0-1,000 ohm Feedback Potentiometer
- E2 = 0-5,000 ohm Feedback Potentiometer
- F5 = Aux. Switchbox with 6 ea. DPDT Switches
- H2 = 1K Ohm F.B. Potentiometer + Aux. S.B. with 6 ea. DPDT Switches
- H6 = 1K Ohm F.B. Potentiometer + Aux. S.B. with 6 ea. SPDT Switches

### Tagging

- R = Viton fluoroelastomer Construction without Tag
- P = Viton fluoroelastomer Construction with Tag

### Yoke Length (Overall)

- A = 20" Yoke with 4 Bolt Mount on 5" BCD
- C = 17 1/2" Yoke with 4 Bolt Mount on 5" BCD
- L = 26 1/2" Yoke with 4 Bolt Mount on 5" BCD
- N = 22" Yoke with 4 Bolt Mount on 5" BCD
- X = No Yoke (consult factory)

### Yoke Mount (Diameter)

- A = 2 1/4"
- D = 2 1/8"
- F = 2 3/8"
- G = 2 5/16"
- H = 2 5/8"
- J = 2 1/2"
- K = 2 13/16"
- L = 3"
- N = 3 1/4"
- P = 3 5/16"
- R = 3 9/16"
- V = 4"
- X = No Yoke

All yokes have four (4) bolt mount on 5" Bolt Circle

### Protective Cover

- 3 = Stiffener Plate on Yoke (Standard)

### External Return Spring

- 00 = No Spring (consult factory)
- 01 = #1 Spring (200 lb/in)
- 02 = #2 Spring (125 lb/in)
- 04 = #4 Spring (275 lb/in)
- 05 = #5 Spring (325 lb/in)
- 06 = #6 Spring (400 lb/in)

### Stem Adapter

- BA = 1 5/16"
- BC = 1 9/16"
- BF = 2 1/16"
- BJ = 2 9/16"
- BM = 3 1/6"
- BQ = 3 9/16"
- BT = 4 1/16"
- BW = 4 9/16"
- XX = No Stem Adapter

### Split Coupling\*

- C74 = 5/16" 24 UNF
- E74 = 3/8" 24 UNF
- G70 = 7/16" 20 UNF
- J70 = 1/2" 20 UNF
- L12 = 9/16" 12 UNC
- L68 = 9/16" 18 UNF
- N11 = 5/8" 11 UNC
- N68 = 5/8" 18 UNF
- Q66 = 3/4" 16 UNF
- S66 = 7/8" 16 UNF
- T08 = 1" 8 UNC
- W62 = 1 1/2" 12 UNF
- X00 = No Coupling

### Special Features

- X00 = No Special Features
- X04 = Hi-Rad Capacitor Option (Single on Modulating Actuator, Dual on 2 Position Actuator)
- X06 = Epoxy Paint
- X07 = 120 Volt Solenoid Dump Valve
- X11 = Hi-Rad Capacitor + Epoxy Paint (X04 + X06)
- X12 = Epoxy Paint + 120 VAC Dump Valve (X06 + X07)
- X16 = Dual Hi-Rad Capacitor on Modulating Units for Low Temp.

NH9

25-Digit Catalog Number

\* Contact ASCO for additional variations.