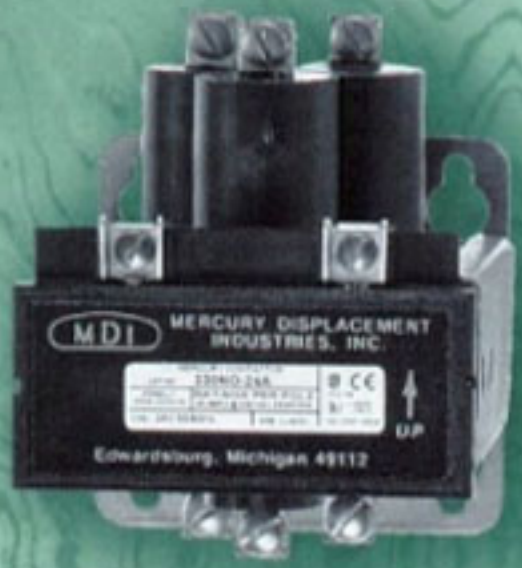
NPH

National Plastic Heater

Contactors / Relays / Switches & Liquid Level Control Floats



Catalog V

GENERAL INFORMATION FEATURES AND SELECTION FACTORS

GENERAL INFORMATION

Mercury Displacement Relays are all designed and built to meet the most exacting demands of industry. They have won their high place in the electrical field by doing the tough and tricky jobs that ordinary equipment could at best do in an uncertain manner. They have proved their ability to stand up under the most adverse conditions of temperature, dust and moisture, in all types of applications. All the care required for the manufacture of high-grade instruments is used in the manufacture of the switches. All switch parts are specially cleaned, and contamination is avoided by use of tweezers, gloves, etc., when making assemblies.

Contactors are hermetically sealed with high quality glass to metal seals.

The stainless steel tube is totally encapsulated in high grade UL approved epoxy to prevent moisture damage and voltage breakdown through the protective coating.

The coils are wound on compact nylon bobbins and molded on to the metal tube to provide minimum power loss. This allows for low coil power required to actuate the contactor. This also enables the units to handle high loads with minimum derating due to higher ambient temperatures. (See de-rating graphs.)

Inert gases internally prevent excessive arcing between the mercury and the electrodes which enables the unit to function for millions of cycles with very low contact resistance, and minimum deterioration of the internal parts.

Available in all standard coil voltages, in single, two and three pole arrangements. Other coil voltages available upon request.

In multiple pole units each tube is actuated by its own coil. This eliminates pull-in variation between contact tubes, assuring consistent switching.

FEATURES

1) **ADVANTAGES OVER ELECTROMECHANICAL AND SOLID STATE RELAYS**
   - A) Superior Performance and Reliability
     - (a) Long life
     - (b) Durable
   - B) Compact Size
   - C) Low, Predictable Contact Resistance
   - D) Reduced RFI for Improved Interface Capability
   - E) Handles a Variety of Loads
     - (a) Increases design flexibility
   - F) Rapid On-Off Cycling Capability
     - (a) Mercury quickly dissipates contact heat
   - G) Low Coil Power Requirements
   - H) Minimal Derating Due to Higher Ambient Temperatures
   - I) Quiet Action
2) **DESIGN & CONSTRUCTION**
   - A) Contacts are within a hermetically sealed steel body
     - (a) Impervious to adverse conditions
     - (b) No external arcing
   - B) Arcing is in a gaseous atmosphere
     - (a) Quenches the arc
     - (b) Extends relay life
   - C) Only one moving part (the plunger)
     - (a) No buttons to pit, weld or burn out
   - D) One coil for each set of contacts
     - (a) Assures consistent switching
     - (b) Minimizes pull-in variation between contacts
   - E) Epoxy encapsulated
     - (a) Moisture resistant
     - (b) High dielectric strength
     - (c) Permanently fixes contacts to coil; eliminating possible misalignment
     - (d) Helps dissipate heat and noise
     - (e) Rugged (impact resistant)
3) **BENEFITS**
   - A) Reduction of Operational and Maintenance costs
   - B) Increases Utilization and Productivity of equipment
     - (a) By reducing down-time
   - C) Installation and service is a routine operation
     - (a) Simple to install
     - (b) No sophisticated equipment is required
     - (c) Easy to trouble-shoot

For constant duty applications, contact the Factory. (See Glossary)

SELECTION FACTORS

In order to get the right relay for your job — the relay that will give you the best performance — it is essential that certain information, concerning the conditions under which the relay must perform, be carefully considered. We therefore recommend that answers to the following questions be forwarded to us with your inquiry or order.

1. **APPLICATION**
   - a. What kind of job is relay to do?
   - b. Is application special in any way?
   - c. Will mounting be stationary?
2. **TYPE OF LOAD**
   - a. What is the voltage in the load circuit?
   - b. What is the amperage in the load circuit?
   - c. Is it A.C. or D.C.? If A.C., what is the frequency?
   - d. What is the nature of the load?
     - Heater load?
     - Lamp load?
     - Motor load?
     - Current inrush and running current?
     - Other types of inductive load?
3. **CONTACT ARRANGEMENT**
   - a. Do you require a relay which has a normally open or normally closed contact?
4. **DUTY**
   - a. How often is relay to be operated?
   - b. How long is relay to be energized in each operation?
5. **TIME DELAY CHARACTERISTICS**
   - a. What operating time do you want to achieve, maximum and minimum seconds?
   - b. Is timing to be on closing or opening of the contacts?
6. **COIL RATING**
   - a. What is your maximum and minimum coil operating voltage or current?
   - b. Is coil to be operated from an A.C. or a D.C. circuit? If A.C., what frequency?
7. **MOUNTING SPACE**
   - a. Are there any limitations on space for applying relay?

National Plastic Heater Sensor & Control Co.
phone: 416.491.8436 toll free: 1.877.674.9744 fax: 416.491.2433
Toronto, Ontario Canada e-mail: sales@nphheaters.com website www.nphheaters.com

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GLOSSARY OF TERMS & EXPRESSIONS

AMBIENT: The temperature of air or liquid surrounding any electrical part or device.

CONSTANT DUTY: If the contactor will remain "on" in normal use for indefinite periods of time, in excess of 100 hours.

CONTACTOR: 1.) A device for the purpose of repeatedly establishing or interrupting an electric power circuit; 2.) A heavy duty relay used to control electrical circuits. Relays rated at 15 to 30 amps and up are generally referred to as contactors.

CONTACT: 1.) One of the current-carrying parts of a relay, switch or connector that is engaged or disengaged to open or close the associated electrical circuits. 2.) To join two conductors or conducting objects in order to provide a complete path for current flow. 3.) The juncture point to provide the complete path.

CONTACTS: Mercury to Metal: The contacts of a standard mercury displacement relay or contactor. The upper contact is metal and stationary. The lower contact is a pool of mercury that gets displaced by the plunger assembly, thereby coming in contact with the metal electrode during operation. (See page 4.)

Mercury to Mercury: The contacts of a standard mercury timer relay. This contact arrangement utilizes a cup, which has the electrode in it, and is filled with mercury. When the mercury at the bottom of the unit is displaced, it floods over the sides of the cup, completing the circuit. This provides a clean make and break with no chatter and little erosion. (See page 15.)

CONTINUITY: A continuous path for the flow of current in an electric circuit.

DERATE: To reduce the voltage, current, or power rating of a device to improve its reliability or to permit operation at high ambient temperatures.

DIELECTRIC: The insulating material between the metallic elements of an electronic component.

DROP-OUT: The current, voltage, or power value that will cause an energized relays contacts to return to their normal denergized condition.

GAUSS: The centimeter-gram-second electromagnetic unit of magnetic induction. One gauss represents one maxwell per square centimeter.

HEAT RISE: In a mercury displacement relay; The heat developed from the coil and contacts as a unit.

HERMETIC SEAL: A mechanical or physical closure that is impervious to moisture or gas, including air.

HERTZ: Cycles per second.

INRUSH CURRENT: In a solenoid or coil, the steady-state current drawn from the line with the armature, or plunger, in its maximum open position.

LOAD, CONTACT: The electrical power encountered by a contact set in any particular application.

MAXWELL: The cgs electromagnetic unit of magnetic flux, equal to one gauss per square centimeter, or one magnetic line of force.

OPERATE TIME: In a mercury displacement relay; the amount of time that passes when power is applied to the coil, to when the contacts close in a normally open set of contacts, or when the contacts open in a normally closed set of contacts.

Quick Operate is when the operate time is less than the stated release time. Slow operate is when the operate time is longer than the stated release time.

PLUNGER: In a mercury displacement relay; The device used to displace mercury. The plunger is lighter than mercury so it floats on the mercury. The plunger also contains a magnetic shell or sleeve, so it can be pulled down into the mercury with a magnetic field. The plunger does the same job ina mercury displacement relay as an armature in a mechanical relay.

POLE: 1.) Output terminals on a switch. 2.) A single set of contacts; (i.e., three sets of contacts equal three poles.)

POWER FACTOR: Ratio of the actual power of an alternating or pulsating current to the apparent power.

PULL-IN: (Pick-up): The minimum current, voltage, power or other value which will trip a relay or cause it to operate.

RELAY: An electromechanical or electronic device in which continuity is established or interrupted in one circuit by a control circuit. Typically used to switch large currents by supplying relatively small currents to the control circuit. Also see Contactor.

RELEASE TIME: In a mercury displacement relay; The amount of time that passes when power is removed from the coil, until the contacts of a normally open unit reopen, or when contacts of a normally closed unit reclosed.

Quick Release is when the release time is less than the stated operate time. Slow Release is when the release time is longer than the stated operate time.

STEADY-STATE: A condition in which circuit values remain essentially constant, occurring after all initial transients or fluctuating conditions have settled down.

TRANSIENT (Transient Phenomena): Rapidly changing action occurring in a circuit during the interval between closing of a switch and settling to steady-state conditions, or any other temporary actions occurring after some change in a circuit or its constants.

VOLT-AMPERE: A unit of apparent power in an AC circuit containing reactance. It is equal to the potential in volts multiplied by the current, in amperes, without taking phase into consideration.

VOLTAGE SPIKES: An abrupt transient which comprises part of a pulse but exceeds its average amplitude considerably.

VOLTAGE WITHSTAND: The amount of electromotive force (volts) that can be applied to two points before a current will flow (leakage or breakdown.)

WATT: A unit of electrical power. One watt is expended when one ampere of direct current flows through a resistance of one ohm. In an AC circuit, the true power in watts is effective volt-amperes multiplied by the circuit power factor. There are 746 watts in one horsepower.

ABBREVIATIONS

A.C.	Alternating Current	Hg	Mercury
D.C	Direct Current	Hz	Hertz
M.D.R.	Mercury Displacement Relay	N.C.	Normally Closed
D.P.S.T.	Double Pole Single Throw	N.O.	Normally Open
S.P.S.T.	Single Pole Single Throw	Q	Quick
T.P.S.T.	Triple Pole Single Throw	S	Slow

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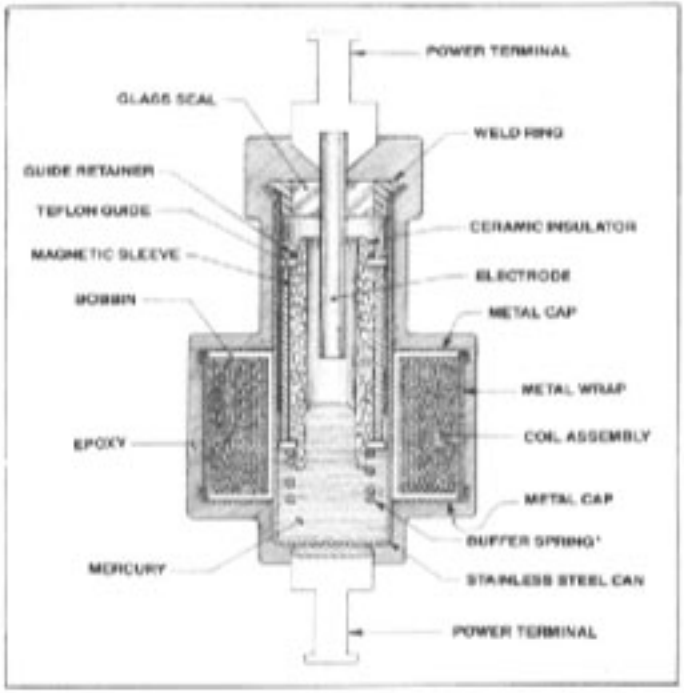
phone: 416.491.8436 toll free: 1.877.674.9744 fax: 416.491.2433
Toronto, Ontario Canada e-mail: sales@nphheaters.com website www.nphheaters.com

STANDARD MERCURY TO METAL CONTACTORS & RELAYS



DESCRIPTION

MERCURY TO METAL CONTACTOR: The load terminals are isolated from each other by the glass in the hermetic seal. "The plunger assembly," which includes the ceramic insulator, the magnetic sleeve and related parts, floats on the mercury pool. When the coil is powered causing a magnetic field, the plunger assembly is pulled down into the mercury pool which is in turn displaced and moved up to make contact with the electrode, closing the circuit between the top and bottom load terminal which is connected to the stainless steel can.

To make the unit function as a "Hybrid" time delay we add a solid state circuit to the coil to delay the power to the coil. (See page 14.)

*For constant duty applications.
A return spring is used in place of the buffer spring.
Contact the factory.

HOW TO ORDER

SPECIFY AS SHOWN BELOW

EXAMPLE #1

335NO—120A THN—18

- 3 — NUMBER OF POLES: 2, 3, 4 OR BLANK IF SINGLE POLE (4 POLE ON 35 & 60 ONLY)
- NO — CONTACTS: "NO" = NORMALLY OPEN "NC" = NORMALLY CLOSED (H NOT SPECIFIED IN SUFFIX)
- 120A — COIL VOLTAGE FOLLOWED BY "A" FOR ALTERNATING CURRENT OR "D" FOR DIRECT CURRENT.
- 18 — OPTIONS SEE NOTE 1
- N — BRACKET OTHER THAN STANDARD "A, B, N, P or U" ON 35 & 60-AMP UNITS (BLANK IF STANDARD BRACKET IS USED.) SEE PAGE 12.
- H — "H" IS FOR LOADS OTHER THAN AC RESISTIVE & TUNGSTEN ON NORMALLY OPEN UNITS.
- T — "T" FOR TOP TERMINATION, "TS" FOR TOP SCREW TERMINATION ON 35-AMP UNITS. (BLANK IF STANDARD TERMINATION.) SEE PAGES 7 & 12.
- 35 — A.C. RESISTIVE LOAD RATING (30, 35, 60, or 100-AMP.)

NOTE: 1) Other designations are -1 thru -99. These are suffix numbers, and are reserved for units with special detail, construction and/or features. -11 MOV on coil (page 13), -13 MOV & metal strap, -17 DIN rail mount (page 12), -18 metal strap (page 8), -20 DIN rail & metal strap. (See Example #2).

EXAMPLE #2

100NO—120AH—6A

The -6A stands for HIGH VOLTAGE contactor.
Used in ultraviolet curing ovens and other high voltage applications.
See page 10 for ratings.

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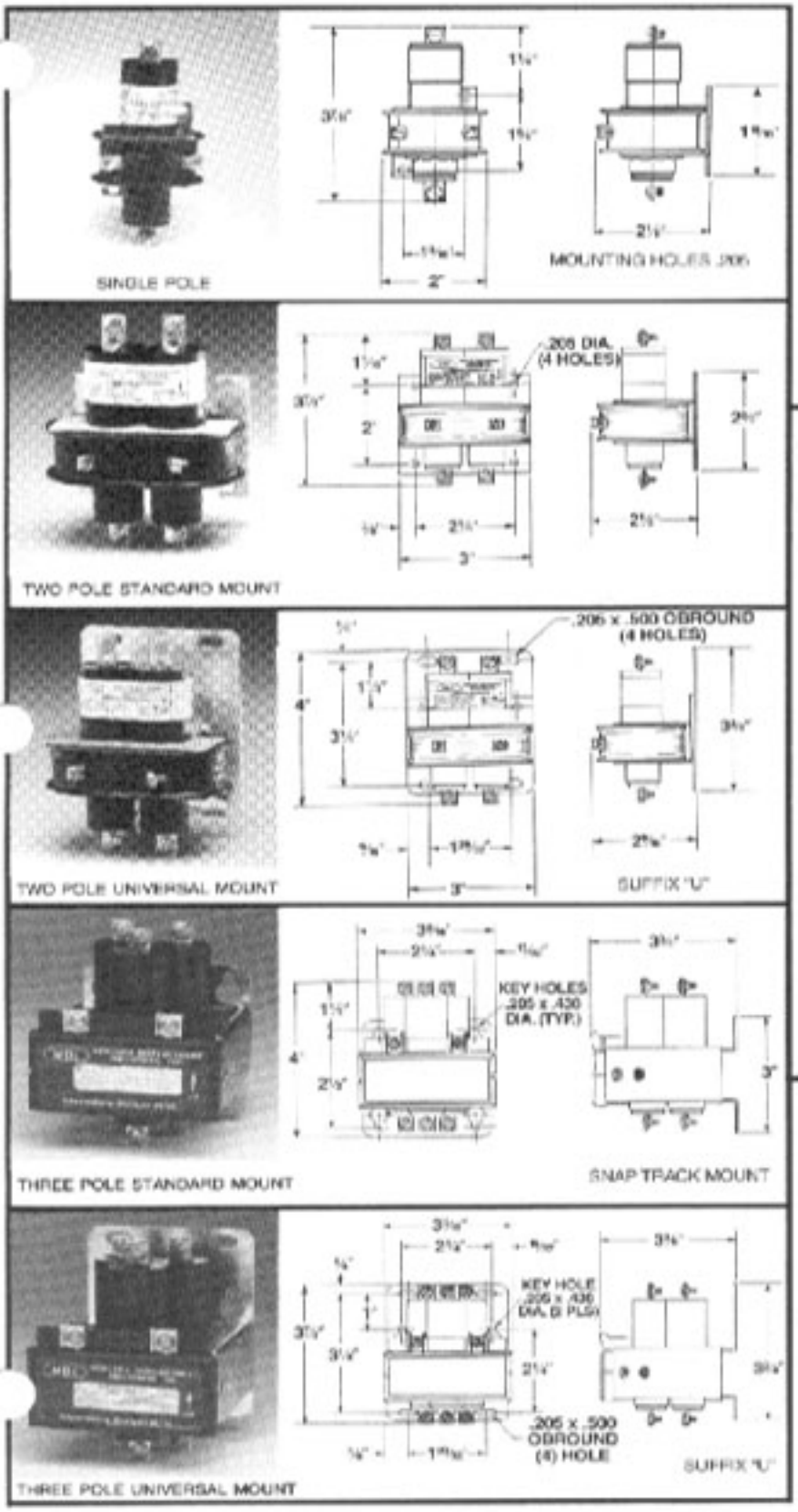
30-AMP NORMALLY OPEN CONTACTORS

GENERAL INFORMATION



The 30 Amp model is designed to save space and simplify mounting methods. The standard mounting bracket on the three pole model allows the unit to be mounted in standard 3" snap track channel. If you do not use snap track mounting, the standard three pole bracket has key hole slots for easy mounting in any panel arrangement. The universal three pole mounting bracket has various mounting holes and key hole slots to meet a variety of mounting centers.

The 30 Amp series is a more compact line with a well proven switch which is the heart of mercury relays. It is the same switch design that is in our 35 and 60 Amp encapsulated MDR's, which have withstood the test of time and millions of cycles in many different applications.

TYPICAL SPECIFICATIONS

- ON NORMALLY OPEN UNITS:
  OPERATE TIME: 50 milliseconds
  RELEASE TIME: 80 milliseconds
- CONTACT RESISTANCE:
  30-AMP = .003 ohm*
- DIELECTRIC WITHSTAND:
  2500 VAC RMS
- LONGEVITY:
  MILLIONS OF CYCLES
- TEMPERATURE RANGE:
  -35°C TO 85°C
- COIL TERMINALS:
  #6 BINDING HEAD SCREWS
- LOAD TERMINALS:
  #8 BINDING HEAD SCREWS
- UL LISTING: FILE #E62767
- C.S.A.: FILE #LR41198
- TO ORDER SEE PAGE 4

* AFTER CYCLING UNDER LOAD.

COIL DATA

CATALOG NO.	COIL RESISTANCE (OHMS)	COIL CURRENT (MILLIAMPS)	VA	WATTS
30NO-24D	180	133	3.2	3.2
230NO-24D	131	180	4.5	4.5
330NO-24D	73	329	7.9	7.9
30NO-24A	29	516	7.8	2.8
230NO-24A	12.6	610	14.0	4.7
330NO-24A	7.6	815	19.8	6.0
30NO-120A	725	65	7.8	3.1
230NO-120A	317	116	14.2	4.4
330NO-120A	210	163	19.5	5.6
30NO-220A	3150	27	5.9	2.2
230NO-220A	1300	58	12.3	4.1
330NO-220A	728	85	18.9	5.5

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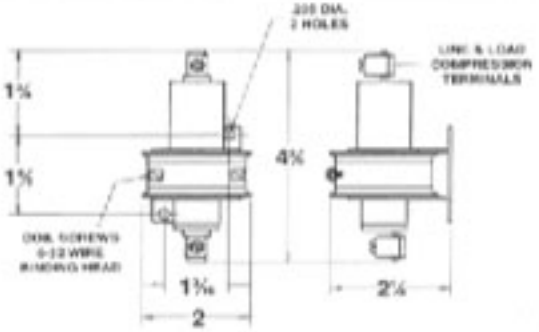
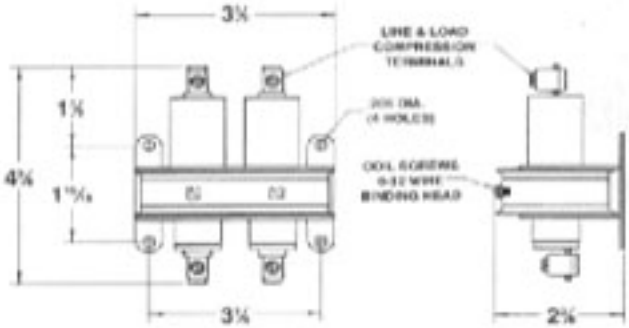
L35/L60-AMP NORMALLY OPEN CONTACTS

SINGLE POLE – NORMALLY OPEN



TWO POLE – NORMALLY OPEN



The "L" version of the 35 and 60 amp normally open contractors are designed and manufactured to the same high quality specifications as the standard 35 and 60 amp models. The contactor switch is the same well proven design that has been manufactured since 1975. The mounting centers and physical size are identical to the standard single and two pole 35 and 60 amp molded versions.

The new design provides a cleaner appearance, and is a more economical design. It is available in the single and two pole models only, with top and bottom load terminals or with lead wires. Noted are the typical specifications and UL and CSA file numbers.

COIL DATA APPLIES TO L35 AND L60 AMP SERIES. TO ORDER THE L60 SERIES, CHANGE THE CATALOG NUMBER FROM L35NO-_____ TO L60NO-_____

COIL DATA

CATALOG NO.	COIL RESISTANCE (OHMS)	COIL CURRENT (MILLIAMPS)	VA	WATTS
L35NO-24D	168	135	3.3	3.3
L235NO-24D	60	260	6.2	6.2
L35NO-24A	28	305	7.8	3.0
L235NO-24A	10.3	550	15.8	4.5
L35NO-120A	725	75	9.0	4.0
L235NO-120A	350	115	13.8	4.6
L35NO-220A	3150	27	5.9	3.2
L235NO-220A	1000	69	15.2	4.6

TYPICAL SPECIFICATIONS

- ON NORMALLY OPEN UNITS:
  OPERATE TIME: 50 milliseconds
  RELEASE TIME: 80 milliseconds
- CONTACT RESISTANCE:
  35-AMP = .003 ohm*
  60-AMP = .002 ohm*
- DIELECTRIC WITHSTAND:
  2500 VAC RMS
- LONGEVITY:
  MILLIONS OF CYCLES
- TEMPERATURE RANGE:
  -35°C TO 85°C
- COIL TERMINALS:
  #6 BINDING HEAD SCREWS
- LOAD TERMINALS:
  PRESSURE CONNECTORS FOR A.W.G. #4-#14 ON 35-AMP AND A.W.G. #2-#8 ON 60-AMP UNITS
- UL LISTING:
  FILE #E62767 FOR L35 AND L60-AMP N.O. UNITS 1-2 POLES
- C.S.A.:
  FILE #LR41198 FOR L35 AND L60-AMP N.O. UNITS 1-2 POLES

*AFTER CYCLING UNDER LOAD

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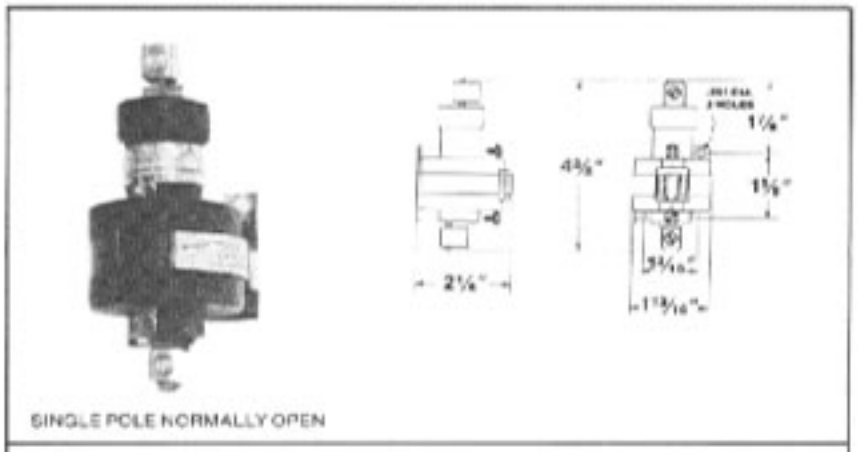
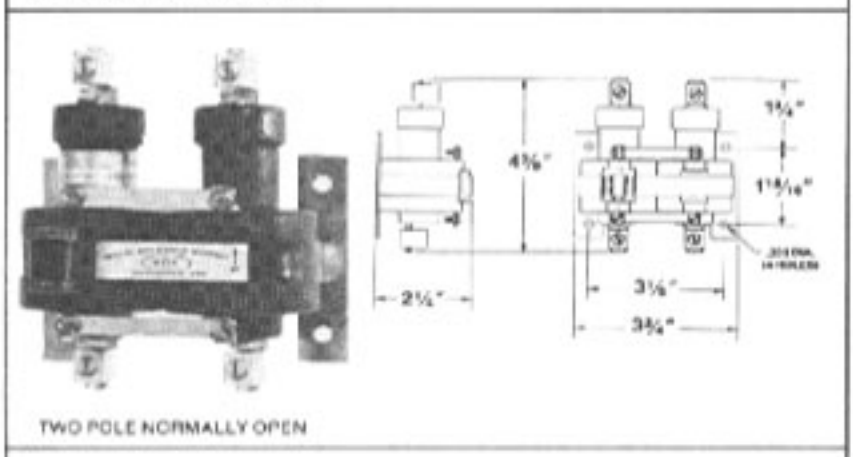
35 / 60-AMP NORMALLY OPEN CONTACTORS



SINGLE POLE NORMALLY OPEN



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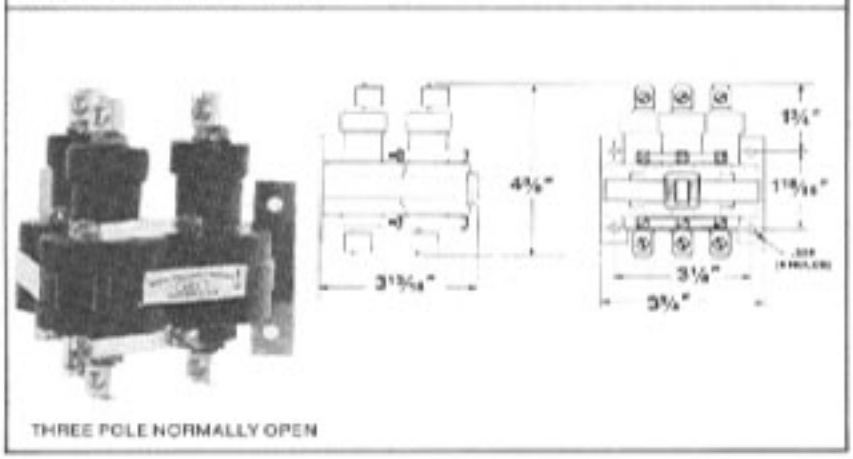


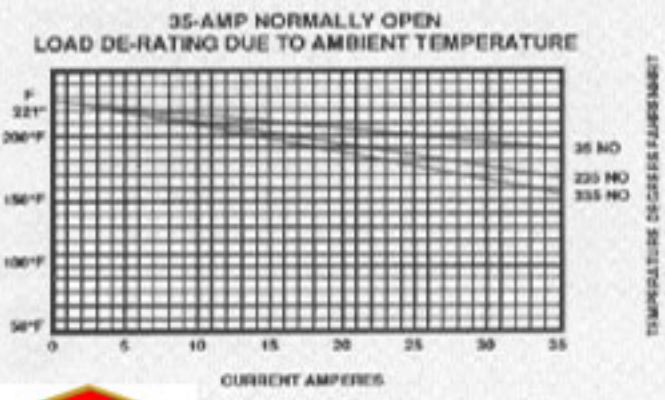
THREE POLE NORMALLY OPEN

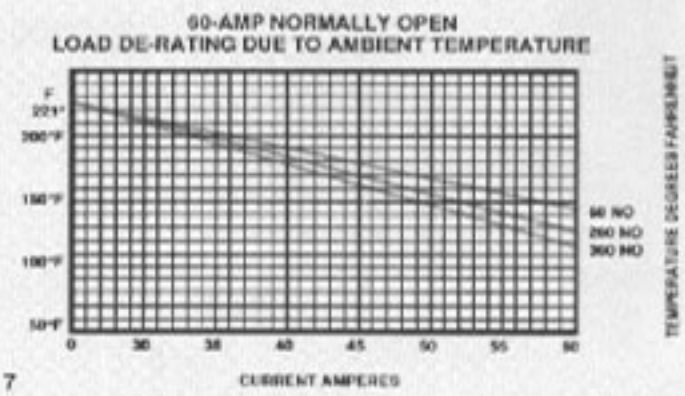
STANDARD MOUNTING SHOWN — SEE PAGE 12 FOR OPTIONS.

TYPICAL SPECIFICATIONS

- ON NORMALLY OPEN UNITS:
  OPERATE TIME: 50 milliseconds
  RELEASE TIME: 80 milliseconds
- ON NORMALLY CLOSED UNITS:
  OPERATE TIME: 30 milliseconds
  RELEASE TIME: 35 milliseconds
- CONTACT RESISTANCE:
  35-AMP = .003 ohm*
  60-AMP = .002 ohm*
- DIELECTRIC WITHSTAND:
  2500VAC RMS
- LONGEVITY:
  MILLIONS OF CYCLES
- TEMPERATURE RANGE:
  -35°C TO 85°C
- COIL TERMINALS:
  #6 BINDING HEAD SCREWS
- LOAD TERMINALS:
  PRESSURE CONNECTORS FOR A.W.G. #4-#14 ON 35-AMP UNITS AND A.W.G. #2-#8 ON 60-AMP UNITS
- RATINGS:
  SEE PAGE 10 FOR CONTACTS
  SEE PAGE 11 FOR COIL DATA
- UL LISTING: FILE #E62767 FOR 35 AND 60-AMP N.O. UNITS 1-4 POLES
- C.S.A.: FILE #LR41198 FOR 35 AND 60-AMP N.O. UNITS (HEATER LOADS) 1-3 POLES
- TO ORDER SEE PAGE 4
- AUXILIARY DEVICES FOR USE IN HAZARDOUS LOCATIONS. UL FILE #E71867 N.O. UNITS APPROVED FOR CLASS 1, GROUPS A, B, C AND D, DIVISION 2 ONLY. TO ORDER FOR HAZARDOUS LOCATIONS ADD THE SUFFIX -X TO PART NUMBER

* AFTER CYCLING UNDER LOAD.





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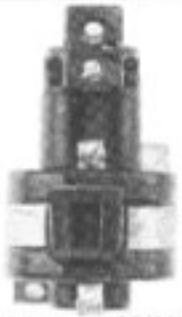
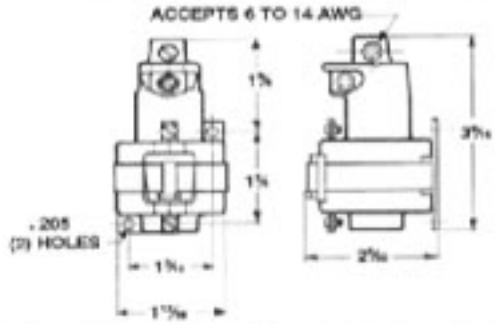
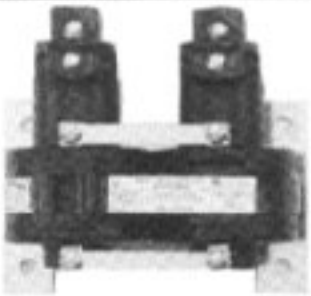
35-AMP T — TOP CONTACTORS

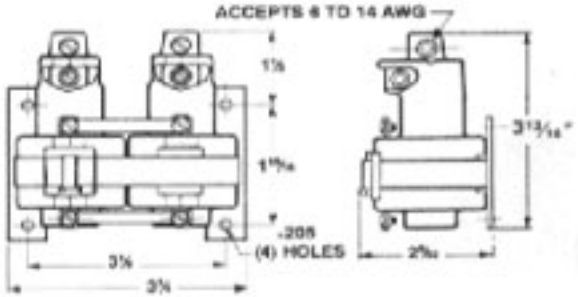


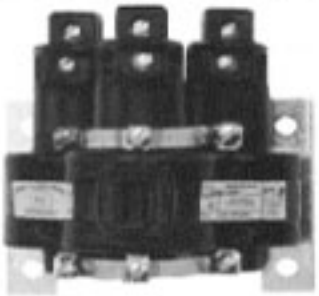
SINGLE POLE — NORMALLY OPEN



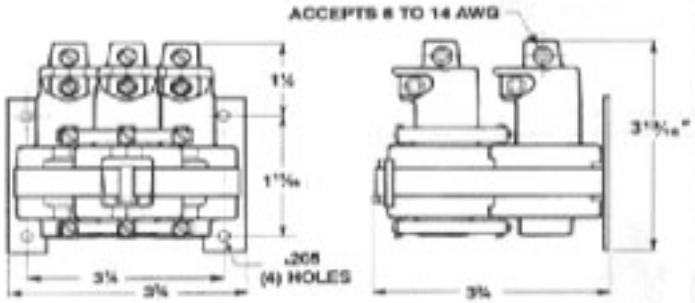


TWO POLE — NORMALLY OPEN





THREE POLE — NORMALLY OPEN



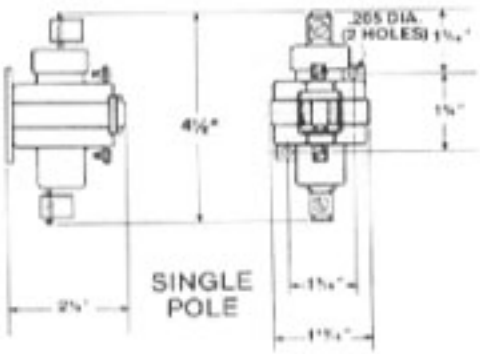
FILE # E-62797

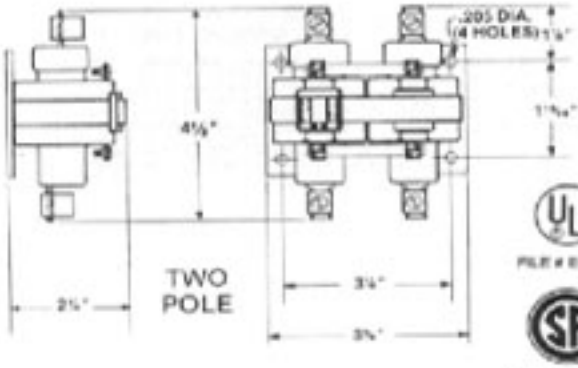
FILE # LR-41108

CE

35/60-AMP NORMALLY CLOSED CONTACTORS

SIMILAR CONSTRUCTION AS THE NORMALLY OPEN UNITS BUT WITH THE COIL POSITIONED CLOSER TO THE TOP OF THE CONTACTOR AND A NORMALLY CLOSED CONTACTOR IN PLACE OF A NORMALLY OPEN CONTACTOR. ALSO AVAILABLE IN THREE AND FOUR POLE UNITS.





FILE # E-62797

FILE # LR-41108

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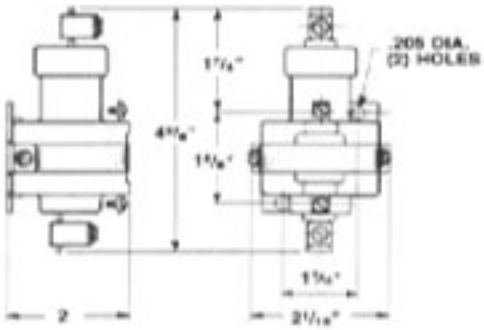
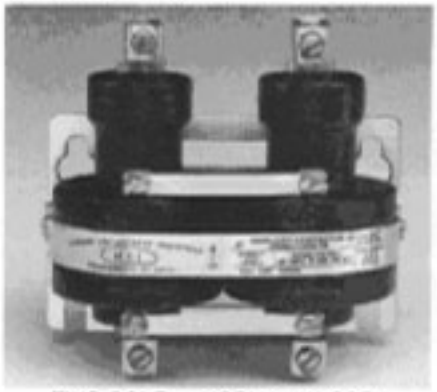
35/60-AMP METAL STRAPPED CONTACTORS

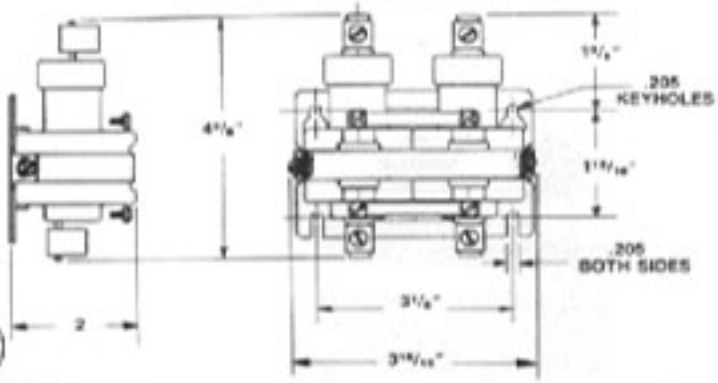
Add suffix –18 to catalog number for metal strap, i.e. 335NO–120A–18

SINGLE POLE — NORMALLY OPEN





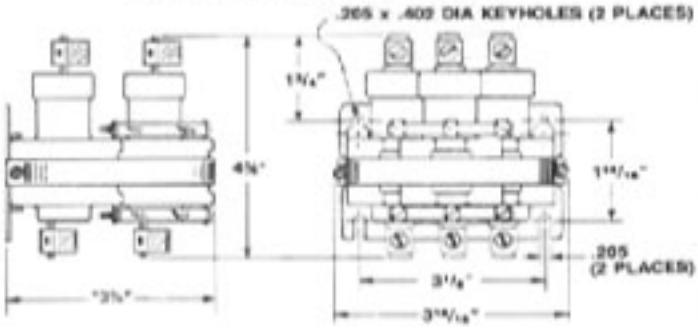
TWO POLE — NORMALLY OPEN

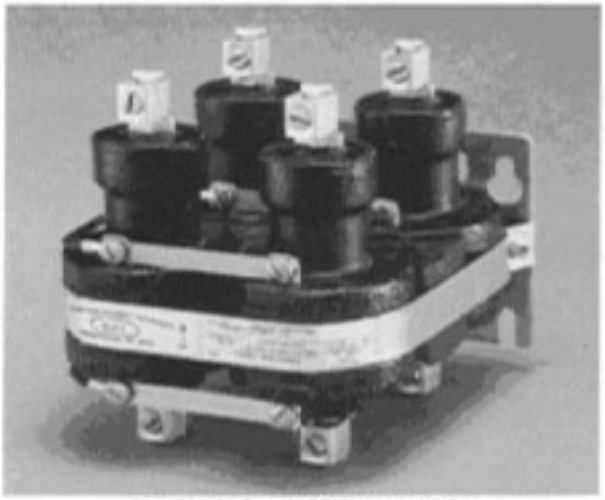


FILE # E-69757 FILE # LR-41199

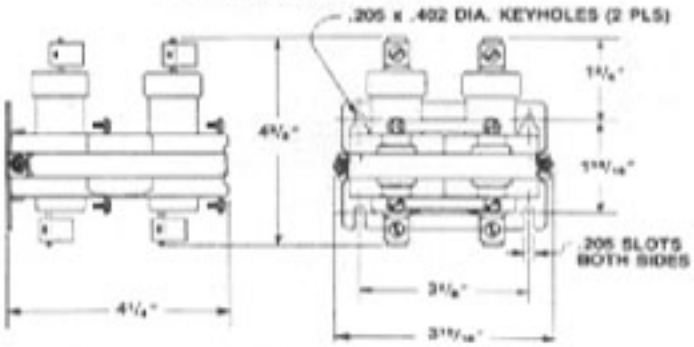
CE

THREE POLE — NORMALLY OPEN





FOUR POLE — NORMALLY OPEN



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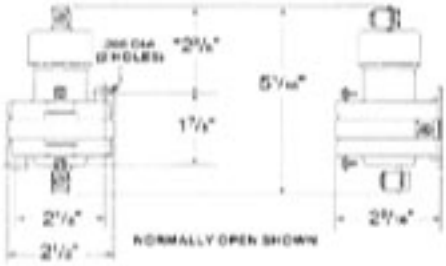
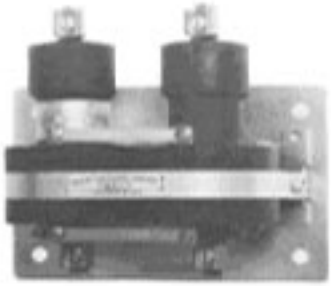
100-AMP CONTACTORS

NORMALLY OPEN UNIT

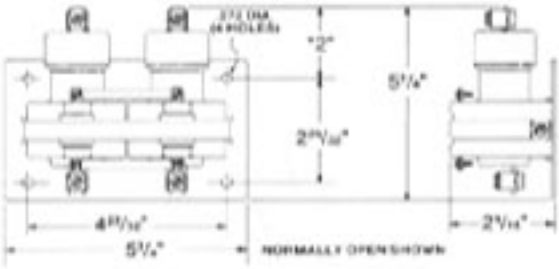
NORMALLY CLOSED UNIT



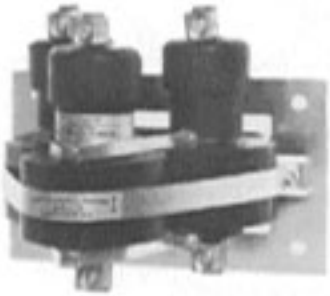
*THIS DIMENSION IS 1½" FOR NORMALLY CLOSED SINGLE POLE UNITS.



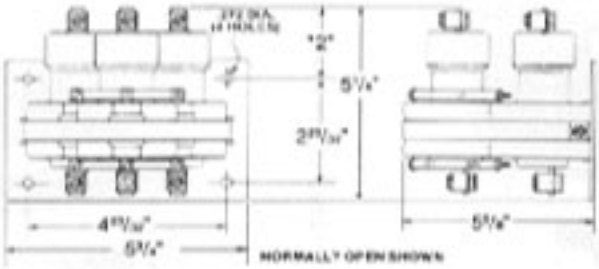
TWO POLE NORMALLY OPEN



*THIS DIMENSION IS 1½" ON NORMALLY CLOSED TWO POLE UNITS.



THREE POLE NORMALLY OPEN

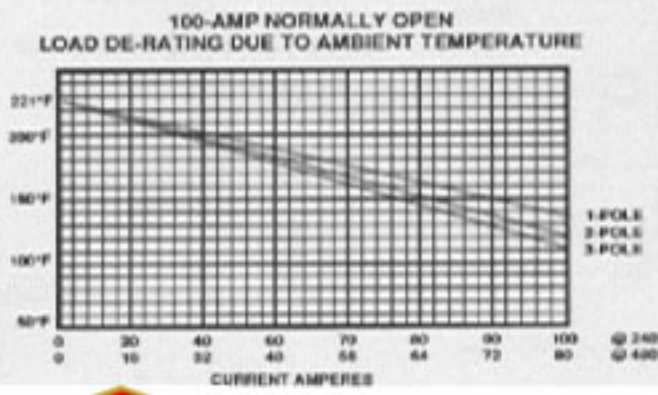


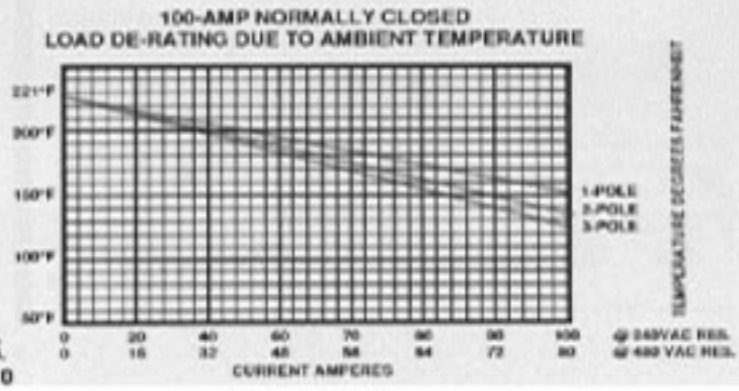
*THIS DIMENSION IS 1½" ON NORMALLY CLOSED THREE POLE UNITS.

TYPICAL SPECIFICATIONS

- ON NORMALLY OPEN UNITS:
  OPERATE TIME
  50 milliseconds
  RELEASE TIME:
  80 milliseconds
- ON NORMALLY CLOSED UNITS:
  OPERATE TIME:
  45 milliseconds
  RELEASE TIME:
  60 milliseconds
- CONTACT RESISTANCE:
  .001 ohm*
- DIELECTRIC WITHSTAND:
  2500VAC RMS
- LONGEVITY:
  MILLIONS OF CYCLES
- TEMPERATURE RANGE:
  -35°C TO 85°C
- COIL TERMINALS:
  #6 BINDING HEAD SCREWS
- LOAD TERMINALS:
  PRESSURE CONNECTORS. STANDARD ACCEPTS A.W.G. #2 to #12. FOR A.W.G. #1 to #8, ADD SUFFIX —5 to CATALOG NUMBER (i.e. 100NO-120A-5)
- RATINGS:
  Derate over 240VAC Res.
  See Page 10 for Contacts.
  See Page 11 for Coil Data.
- TO ORDER SEE PAGE 4.
- UL FOR UL RATINGS SEE LOAD CHART, PAGE 10

*AFTER CYCLING UNDER LOAD





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RATINGS

RATINGS ARE IN AMPS UNLESS OTHERWISE SPECIFIED

TYPE OF LOADS			30 NO	35 NO	35 NO (H)	35 NC	60 NO	60 NO (H)	60 NC	100 NO	100 NO (H)	100 NC
A.C. RESISTIVE		240V	30	35	35	35	60	60	60	100	100	100
		480V	30	35	35	35	60	60	60	80	80	
		600V	30	35	—	—	48	—	—	70	70	
A.C. INDUCTIVE P.F. .4 OR GREATER		120V	—	—	25	25	—	30	30	—	100	
		240V	—	—	15	15	—	20	20	—	100	
GENERAL PURPOSE P.F. .7 OR GREATER		240V	—	—	35	35	—	60	60	—	100	80
		480V									80	
D.C. RESISTIVE HEATING		48V	—	—	35	35	—	60	60	—	100	
		125V	—	—	16	16	—	40	40	—	50	
		250V	—	—	12	12	—	20	20	—	30	
TUNGSTEN LAMP		120V	30	35	35		60	60		100	100	
MOTOR LOADS	SINGLE PHASE	120V	—	1 HP	2 HP		—	3 HP		—	7.5 HP	
		240V	—	1 HP	3 HP		—	5 HP		—	10 HP	
	THREE PHASE	240V	—	—	5 HP		—	7.5 HP		—	15 HP	
		480V	—	—	7.5 HP		—	10 HP		—	20 HP	

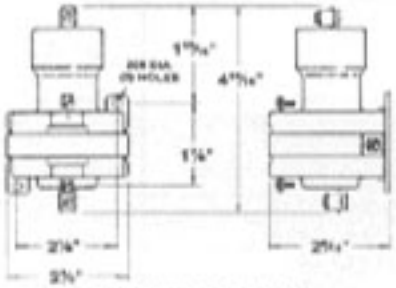
KEY: SHADED AREA FOR UL LISTING AND/OR COMPONENT RECOGNITION.

— NOT RECOMMENDED FOR THIS TYPE OF LOAD.

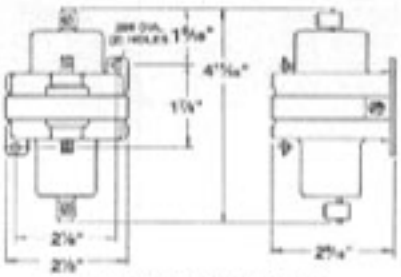
— HIGH VOLTAGE CONTACTORS —

For UV Curing, and Various High Voltage applications. Available in Single Pole, Normally Open, and Normally Closed Units. The coils utilize 6–32 Wire Binding Screws, and the Contacts use Compression type terminals for #4 thru #14 AWG wire.

RATINGS ARE: 10 AMPS @ 3500 VAC, 15 AMPS @ 2500 VAC
AC INDUCTIVE - Power Factor .7 or Greater.



NORMALLY OPEN



NORMALLY CLOSED

COIL DATA

Catalog Number	Coil Voltage	Resistance	Current Draw	Wattage	V.A.
100NC-24D-6A	24VDC	121 Ω	198 ma	4.8	4.8
100NC-120A-6A	120VAC	380 Ω	125 ma	5.9	15.0
100NC-220A-6A	220VAC	1400 Ω	76 ma	8.1	16.7
100NO-12DH-6A	12VDC	16 Ω	750 ma	9.0	9.0
100NO-24AH-6A	24VAC	16 Ω	760 ma	9.2	18.2
100NO-24DH-6A	24VDC	65 Ω	370 ma	8.9	8.9
100NO-120AH-6A	120VAC	380 Ω	158 ma	9.5	19.0
100NO-220AH-6A	220VAC	1400 Ω	90 ma	11.3	19.8

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COIL DATA PER POLE RATINGS ON STANDARD COILS

CATALOG NUMBER	VOLTAGE	RESISTANCE (D.C. OHMS)	CURRENT (MILLIAMPERES)	VOLT AMPERES V/A	POWER (WATTS)
30 AMP SERIES (SEE PAGE 5)	SEE PAGE 5	SEE PAGE 5	SEE PAGE 5	SEE PAGE 5	SEE PAGE 5
35NO-24A	24 VAC	50	242	5.8	2.9
35NO-120A	120 VAC	1250	53	6.4	3.5
35NO-208A	208 VAC	3400	30	6.2	3.1
35NO-220A	220 VAC	4800	28	6.2	3.8
35NO-277A	277 VAC	7900	20	5.5	3.2
35NO-480A	480 VAC	20000	12	5.9	3.0
35NO-6D	6 VDC	13	462	2.8	2.8
35NO-12D	12 VDC	36	333	4.0	4.0
35NO-24D	24 VDC	176	136	3.3	3.3
35NO-48D	48 VDC	860	56	2.7	2.7
35NO-125D	125 VDC	3400	37	4.6	4.6
35NO-250D	250 VDC	14800	17	4.2	4.2
35NC-24A	24 VAC	36	310	7.4	3.5
35NC-120A	120 VAC	860	65	7.8	3.8
35NC-220A	220 VAC	3400	31	6.8	3.3
35NC-12D	12 VDC	36	333	4.0	4.0
35NC-24D	24 VDC	176	136	3.3	3.3
35NC-48D	48 VDC	580	86	4.1	4.1
35NC-125D	125 VDC	3400	37	4.6	4.6
60NO-24A	24 VAC	50	259	6.2	3.4
60NO-120A	120 VAC	1250	48	5.8	2.9
60NO-208A	208 VAC	3400	30	6.2	3.1
60NO-220A	220 VAC	4800	27	5.9	3.5
60NO-277A	277 VAC	7900	19	5.3	2.9
60NO-480A	480 VAC	20000	12	5.8	2.9
60NO-12D	12 VDC	36	333	4.0	4.0
60NO-24D	24 VDC	176	136	3.3	3.3
60NO-48D	48 VDC	636	75	3.6	3.8
60NO-125D	125 VDC	3400	37	4.6	4.6
60NO-240D	250 VDC	14800	17	4.3	4.3
60NC-24A	24 VAC	36	325	7.8	5.3
60NC-120A	120 VAC	860	69	8.3	4.1
60NC-220A	220 VAC	3400	34	7.5	3.9
60NC-277A	277 VAC	7900	26	7.3	5.5
60NC-12D	12 VDC	36	333	4.0	4.0
60NC-24D	24 VDC	140	171	4.1	4.1
60NC-48D	48 VDC	580	86	4.1	4.1
60NC-125D	125 VDC	3400	37	4.6	4.6
100NO-24A	24 VAC	16	646	15.5	6.7
100NO-120A	120 VAC	380	137	16.4	7.1
100NO-220A	220 VAC	1400	73	16.1	7.5
100NO-277A	277 VAC	2400	55	15.2	7.3
100NO-480A	480 VAC	6300	36	16.8	7.7
100NO-24D	24 VDC	65	369	8.9	8.9
100NO-48D	48 VDC	350	137	6.6	6.6
100NO-125D	125 VDC	2400	52	6.5	6.5
100NC-24A	24 VAC	16	515	12.4	4.2
100NC-120A	120 VAC	380	110	13.2	4.6
100NC-208A	220 VAC	1400	55	11.4	4.2
100NC-240A	240 VAC	1685	49	11.8	4.0
100NC-480A	480 VAC	6300	27	13.0	4.6
100NC-12D	12 VDC	28	433	5.2	5.2
100NC-24D	24 VDC	121	198	4.8	4.8
100NC-48D	48 VDC	380	126	6.1	6.1
100 NC-125D	125 VDC	2400	52	6.5	6.5

NOTES:
1. INRUSH CURRENT=1.5 TIMES THE STEADY STATE CURRENT. (NO INRUSH ON DC COILS).
2. MINIMUM OPERATING VOLTAGE 90% OF NOMINAL VOLTAGE.
3. ALL A.C. VOLTAGES ARE AT 50/60 Hz.
4. FOR OTHER COIL VOLTAGES CONTACT FACTORY.
5. RATINGS SHOWN ARE PER POLE (COILS ARE IN PARALLEL).

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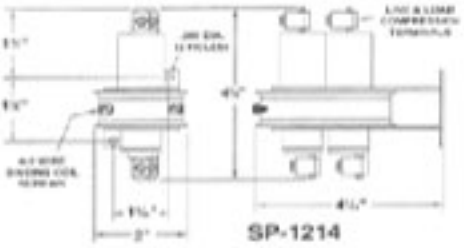
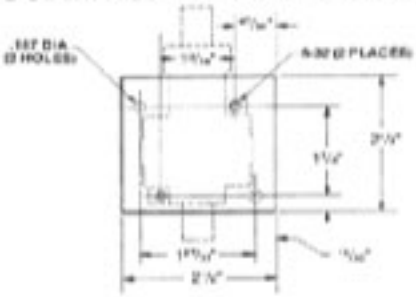
OPTIONAL TERMINATIONS AND MOUNTING PLATES

OPTIONAL 35 & 60-AMP CONTACTORS & TIMER MOUNTING PLATES

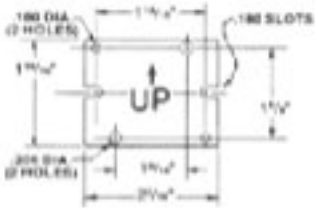


SP-1214

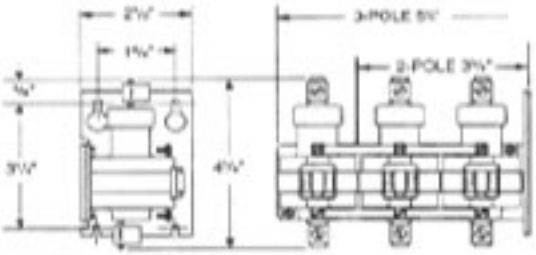
2" wide, narrow mount two pole 30 amp catalog number SP-1214 followed by the coil voltage, then "D" for DC.
Example: SP-1214-120A



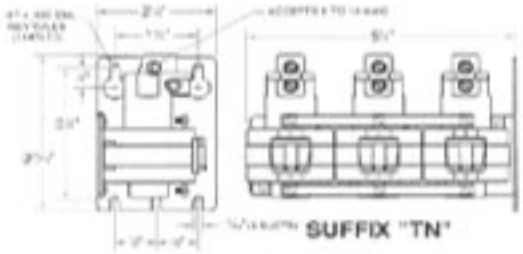
"P" PANEL MOUNT
For 35, 60-amp or standard timer, with standard mounting bracket. The standard mounting bracket attaches to the panel with two 8-32 screws. Material: 3/8" thick phenolic.



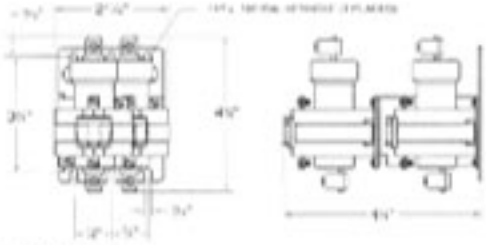
"U" UNIVERSAL BRACKET
For single pole, 35 and 60-amp units, and for timers. This is the standard bracket for hybrid timers. Material: 16-ga., zinc-plated steel.



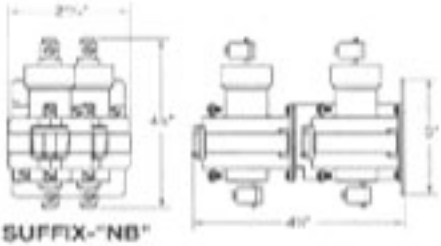
SUFFIX "N"
Narrow two or three pole 35 or 60 amp units only



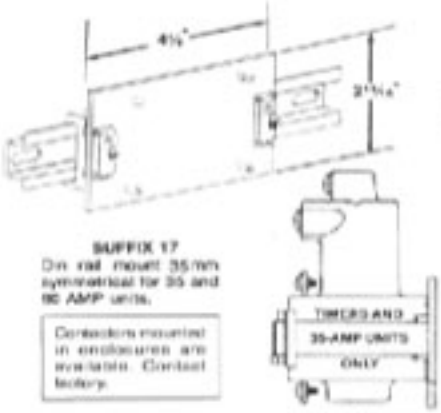
SUFFIX "TN"
Two or Three Pole 35 AMP Only.
Load terminals on top for shorter overall height.



SUFFIX-19
Two pole 35 or 60 amp narrow mounted, front facing, off set, for panel mounting.



SUFFIX-"NB"
Two pole 35 or 60 amp narrow mounted, front facing, off set, for snap track mounted



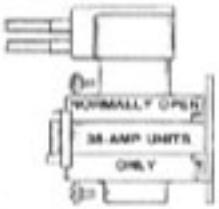
SUFFIX 17
On rail mount 35/60 symmetrical for 35 and 60 AMP units.

Contactors mounted in enclosures are available. Contact factory.

TIMERS AND 35-AMP UNITS ONLY

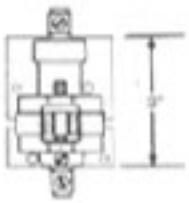
TB (Top Screws)
Designated by the letters "TB" in the catalog number suffix. For timers and 35-amp units. (Dimensions same as T Top)

TERMINATIONS



L-1 (Leaded)
Designated by the letters "L-1" in the catalog number suffix. For normally open 35-amp units. Height 3-3/16" other dimensions same as standard (page 6).

SNAP TRACK™ MOUNTING
Specify suffix "-B" for SNAP TRACK mount on single, two and three pole 35 and 60 amp series and single and two pole 30 amp series. SNAP TRACK mount is standard on three pole 30 amp without suffix.



"B" BRACKET
For single pole 35 and 60-amp units, and for timers. Mounts into standard 3" snap track. Material is 16 ga. plated steel

SNAP TRACK Mounting Channel™ Reed Devices Inc., a subsidiary of Aujet, Inc.

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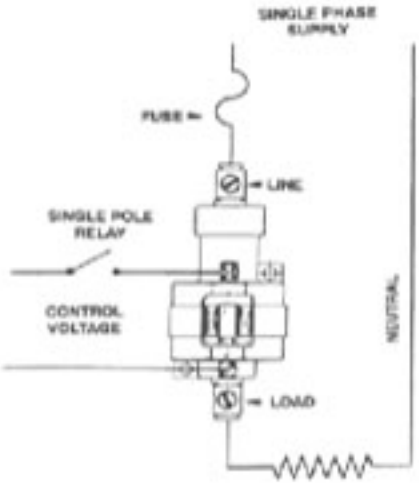
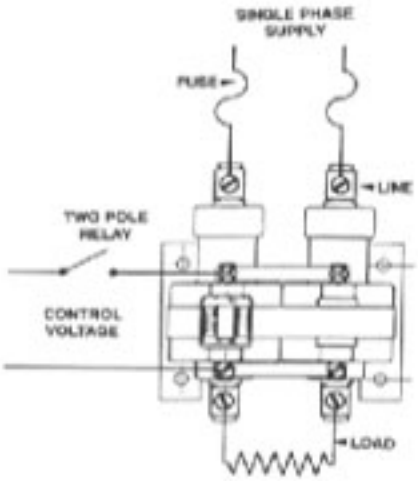
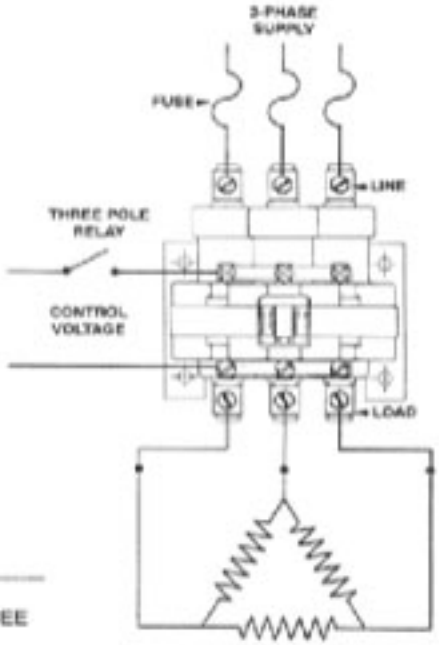
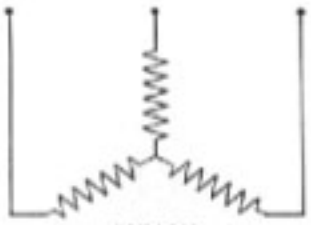
WIRING & FUSING
AC RESISTIVE LOADS







DELTA LOAD
OR



WYE LOAD

Proper Fusing is Required

1. While MDI's contactors handle high inrush, such as lamp loads, very well, mercury contactors are susceptible to damage by short circuit currents, and should be fused to minimize short circuit fault currents. Fast acting UL class RK-1 and class J fuses and semiconductor I^2t fuses more effectively protect relays than other fuses. These are low-peak fuses designed to limit short circuit currents. Regardless, when there is a short circuit, relay operations should be closely monitored afterward because of the possibility of concealed damage that could cause the relays to behave inconsistently.

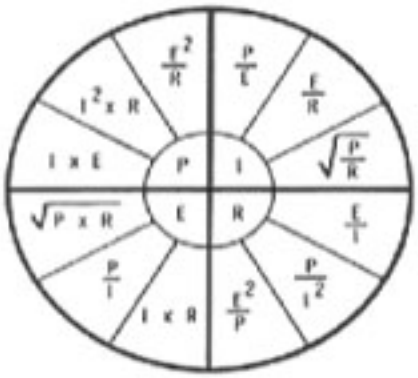
—RECOMMENDED—

250 VOLT	600 VOLT
KTN-R	KTS-R
JJN/AST	JJS
	JKS/A4J
	KTK-R

2. FOR SIZING OF RELAY SEE PAGE 10.
3. FOR DATA ON STANDARD COILS SEE PAGES 5, 10, & 11.
4. MERCURY DISPLACEMENT RELAYS MUST MOUNT VERTICALLY, ±10°.
5. CONTROL LINE CAN BE PROTECTED WITH METAL OXIDE VARISTORS (MOV). USE SUFFIX-11.
6. DISCONNECT POWER BEFORE INSTALLING OR SERVICING. OBSERVE ALL ELECTRICAL AND SAFETY CODES AND ORDINANCES SUCH AS NATIONAL ELECTRICAL CODE (NEC) AND THE OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA).

TORQUE SPECIFICATIONS

- FOR COILS 8 IN. LB. MAX.
- FOR LINE AND LOAD TERMINALS SEE RATING LABELS.



M.O.V

MOV CHART

FOR	SIEMANS	HARRIS	C.K.E.	M.D.I.
24 VOLTS	S14K30	V47ZA7	—	PM-567-5
120 VOLTS	S20K130	V150LA20B	Z150LA20B	PM-567-1
220 VOLTS	S20K275	V275LA40B	Z275LA40B	PM-567-2
277 VOLTS	S20K385	V320LA40B	Z320LA40B	PM-567-3

SIZING RELAY

TO FIND AMPS PER POLE
3 Ø BALANCED HEATER LOADS

$$\text{AMPS PER POLE} = \frac{\text{KW} \times 1{,}000}{\text{VOLTS} \times 1.732}$$

OR

MULTIPLY THE KILOWATTS TIMES THE APPROPRIATE FACTOR GIVEN BELOW

3 Ø AC	FACTOR
208 VOLTS	2.776
220 VOLTS	2.624
240 VOLTS	2.406
277 VOLTS	2.084
480 VOLTS	1.203
600 VOLTS	0.962

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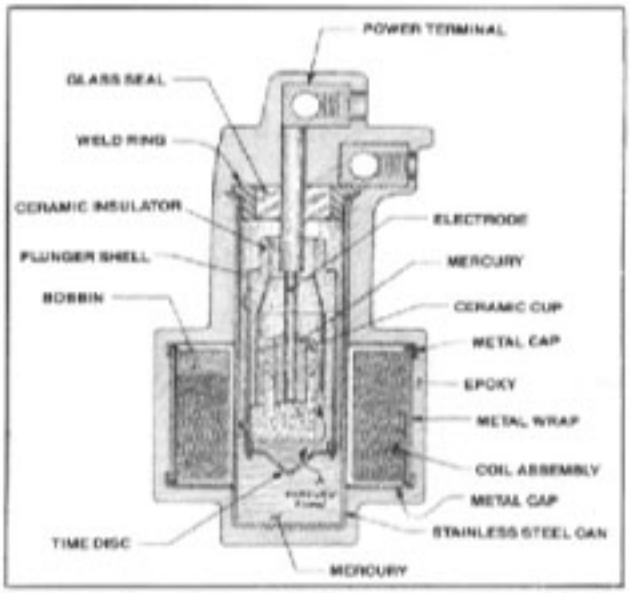
phone: 416.491.8436 toll free: 1.877.674.9744 fax: 416.491.2433
Toronto, Ontario Canada e-mail: sales@nphheaters.com website www.nphheaters.com

TIME DELAY RELAYS

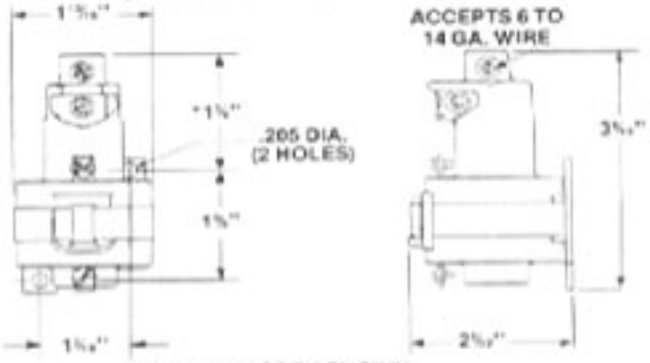
FOR HYBRID
TIMER-CONTACTORS
CONTACT THE FACTORY
OR GO TO
WWW.MDIUS.COM



DESCRIPTION: MERCURY TO MERCURY CONTACTOR: This unit operates the same as the mercury to metal device but the plunger assembly is different. Along with the ceramic insulated sleeve there is a ceramic cup and a disc on the bottom through which the mercury must pass. The cup is filled with mercury, and the electrode extends into the mercury in the cup. When the coil is powered, the plunger assembly moves into the large pool of mercury, forcing mercury up through the disc, over the cup edge to make contact with the mercury already in the cup.

A time delay function is accomplished in this unit by sizing a hole in the time disc that will control the rate of mercury flow. This controls the time it will take from the instant the coil is powered until the mercury pools make contact with each other, closing the circuit between the load terminals.

TIME DELAY RELAYS are available with delays of up to 15 seconds on normally open units, and 4 seconds on normally closed units. The timing limitation depends on the contact action required. Typical contact ratings 10-Amp. 120VAC. Pilot duty rating 720 VA. Common coil voltages are available. Standard load terminals are compression type. Coil terminals use #6 binding head screws. (For longer time delays, see page 14.)



NORMALLY OPEN SHOWN
*THIS DIMENSION IS 1 13/16" ON NORMALLY CLOSED UNITS.

MDI's time delay **CONTACT ACTION** is designated as follows:

DOO: Delay on operate, normally open
DORO: Delay on operate and release, normally open
DRO: Delay on release, normally open
DORC: Delay on operate and release, normally closed
DRC: Delay on release, normally closed

HOW TO ORDER

SPECIFY AS SHOWN BELOW

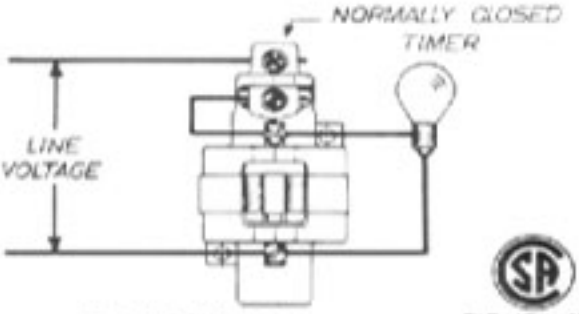
A = ALTERNATING CURRENT
D = DIRECT CURRENT

DOO—120AP—5 → TIME DELAY IN SECONDS

CONTACT ACTION

COIL VOLTAGE

MOUNTING
A = "A" BRACKET
U = UNIVERSAL BRACKET
P = PANEL MOUNT
} SEE PAGE 9 FOR DETAIL
THIS SPACE IS BLANK FOR STANDARD MOUNTING BRACKET



FLASHER

FILE # LR-41108 FILE # E-62767

UL LISTING: FILE #E62767 NORMALLY OPEN TIMERS (DOO, DORO AND DRO)
HAZARDOUS LOCATIONS UL FILE #E71867

National Plastic Heater Sensor & Control Co.
phone: 416.491.8436 **toll free: 1.877.674.9744** fax: 416.491.2433
Toronto, Ontario Canada e-mail: sales@nphheaters.com **website www.nphheaters.com**

National Plastic Heater

Call Toll Free 1.877.674.9744

LIQUID LEVEL CONTROL FLOATS

Features and Options Available

Switches
Mechanical or Mercury
Normally Open/Pump Down
Normally Closed/Pump Up
Double Throw/Mechanical Only
Rated Up to 2 H.P.
Sensor or Control Floats

Float Material
HIPS for Sump & Sewage (High Impact Polystyrene)
ABS for High Temperature
85 Deg. C/186 Deg. F (Acrylonitril Butadiene Styrene)
Various Colors

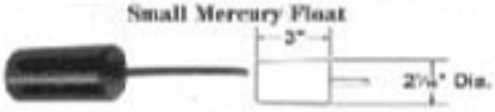
Construction
Outer Shell-Ultrasonically Welded
Cord is bonded with a Steel Ring and Epoxy potted for a Seal.
Axially non-position sensitive.
Ball & Switch Housing is precision molded for a consistent angle.

Cords
Flexible SJOW, in various lengths.
Molded Piggyback Plugs;
120 VAC NEMA 5-15 P&R
240 VAC NEMA 6-15 P&R, or Skived.
Cord Weights, or Weighted floats for tetherless operations.
Cord tie wraps available.

A Series
Narrow Angle Operation
1 Amp @ 120 VAC
1 Amp @ 28 VDC

B Series
90 Deg. Operating Angle
1 Amp @ 120 VAC
1 Amp @ 28 VDC

Small Mercury Float

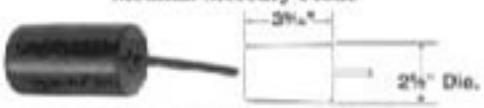


C SERIES
Narrow Angle Operation
13 Amp @ 120 VAC
6 Amp @ 240 VAC
with 16 GA. cord

D Series
90 Deg. Operating Angle
13 Amp @ 120 VAC
6 Amp @ 240 VAC
with 16 GA. cord

E Series
90 Deg. Operating Angle
13 Amp @ 120 VAC
6 Amp @ 240 VAC
with 16 GA. cord

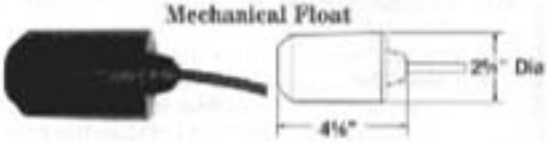
Medium Mercury Float



G Series
90 Deg. Operating Angle
1/2 H.P. @ 120/240 VAC
15 Amp @ 120/240 VAC with 14 GA. cord
13 Amp @ 120/240 VAC with 16 GA. cord
58.8 Amp overload

H Series
90 Deg. Operating Angle
1 H.P. @ 120 and 2 H.P. @ /240 VAC
15 Amp @ 120/240 VAC with 14 GA. cord
13 Amp @ 120/240 VAC with 16 GA. cord
96 Amp overload

Mechanical Float



K Series
Tetherless with Internal Weight
Narrow Angle Operation
10 Amp @ 120/240 VAC
1/4 H.P. @ 120/240 VAC
34.8 Amp overload

N Series
Narrow Angle Operation
10 Amp @ 120/240 VAC
1/4 H.P. @ 120/240 VAC
34.8 Amp overload

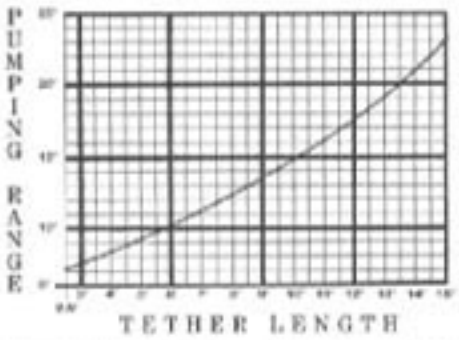
P Series
Narrow Angle Operation
1/2 H.P. @ 120/240 VAC
15 Amp @ 120/240 VAC with 14 GA. cord
13 Amp @ 120/240 VAC
with 16 GA. cord
58.8 Amp overload

R Series
Tetherless with Internal Weight
Narrow Angle Operation
1/2 H.P. @ 120/240 VAC
15 Amp @ 120/240 VAC with 14 GA. cord
13 Amp @ 120/240 VAC
with 16 GA cord
58.8 Amp overload

SEE ILLUSTRATIONS ON PAGE 5

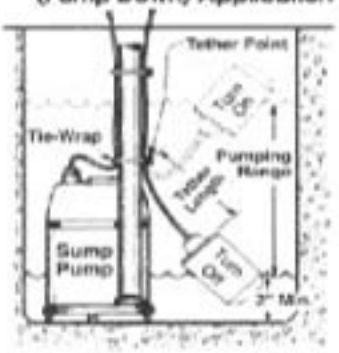
Tether Data

For neoprene jacketed cord
(16-2 SJOW-A/SJOW)



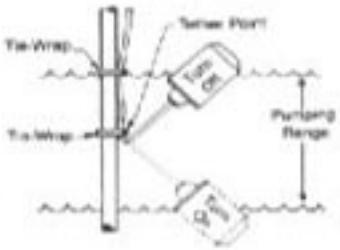
Installation Instructions

Typical Normally Open (Pump Down) Application



Tether Weights are Available. Contact the Factory.

Typical Normally Closed (Pump Up) Application



1. Attach cord, using a tie-wrap, to any convenient rigid surface as illustrated. This is known as the tether point. Do not tighten until both turn-on and turn-off levels are established.
2. To adjust for greater distance between turn-on and turn-off, increase cord length between tether point and float. For less distance between turn-on and turn-off, decrease cord length.
3. Make sure the float is at least 2 inches above pump base, in the lower position, before tightening tie-wrap at the tether point.
4. Plug piggy-back switch cord (current tap) into grounded outlet, then plug pump into piggy-back switch cord, and check for proper operation.

National Plastic Heater Sensor & Control Co.

phone: 416.491.8436 **toll free: 1.877.674.9744** fax: 416.491.2433
Toronto, Ontario Canada e-mail: sales@nphheaters.com **website www.nphheaters.com**

How to order Liquid Level Control Floats

BASIC SWITCH SERIES

MERCURY
- A-TS-1
- B-WATS-1
- C-TS-10
- D-NATS-20
- E-WATS-20

MECHANICALS
- G-½ H.P. 90 DEG.
- H-1 & 2 H.P. 90 DEG.
- K-10 AMP NARROW ANGLE TETHERLESS
- N-10 AMP NARROW ANGLE
- P-½ H.P. NARROW ANGLE
- R-½ H.P. NARROW ANGLE TETHERLESS

FLOAT SIZES & STANDARD COLOR CODE

NORMALLY OPEN	NORMALLY CLOSED	SERIES of BASIC SWITCH
S-SMALL MERCURY BLACK	S-SMALL MERCURY BLACK	A and B series
M-MEDIUM MERCURY BLACK	B-MEDIUM MERCURY YELLOW	C, D, and E series
F-MECHANICAL BLACK	YW-MECHANICAL YELLOW or WHITE	G, H, K, N, P, or R series
HIGH TEMPERATURE	HIGH TEMPERATURE	HIGH TEMPERATURE
R-MECHANICAL RED	B-MECHANICAL BLUE	G, H, K, N, P, or R series
G-GREEN for DOUBLE THROW Mechanical Switches		DOUBLE THROW G, H, K, N, P, or R series

GF10W1000-W

FLOAT MATERIAL
- 1-HIGH IMPACT POLYSTYRENE (HIPS)
- 2-ACRYLONITRILE BUTADIENE STYRENE Suitable for sewage & high temp. (ABS)

CONTACTS
- O-NORMALLY OPEN
- C-NORMALLY CLOSED
- D-DOUBLE THROW

CORD TYPE and MATERIAL
- Y-18 GAUGE-CPE JACKETED
- W-16 GAUGE-CPE JACKETED
- U-14 GAUGE-CPE JACKETED
- T-16 GAUGE-TEFLON JACKETED (For 105 Deg C, or 221 Deg F)

CORD LENGTH
From 01 to 50 feet. Lengths are in even foot increments.

OPTIONAL
- B-INDIVIDUALLY BOXED
- W-EXTERNALLY WEIGHTED
- BW-INDIVIDUALLY BOXED, and EXTERNALLY WEIGHTED

TERMINATION & LABEL DESIGNATION
- 00-NO TERMINATION, STANDARD SKIVE (FIG. 4) NO LABEL (COMPONENT RECOGNIZED)
- C1-115 VAC SERIES PLUG (6' MIN. SEE FIG. 1) LABEL ON CORD (LISTED)
- F1-115 VAC SERIES PLUG (6' MIN. SEE FIG. 1) LABEL ON FLOAT (LISTED)
- R1-115 VAC SERIES PLUG (6' MIN. SEE FIG. 1) NO LABEL (COMPONENT RECOGNIZED)
- C2-230 VAC SERIES PLUG (6' MIN. SEE FIG. 2) LABEL ON CORD (LISTED)
- F2-230 VAC SERIES PLUG (6' MIN. SEE FIG. 2) LABEL ON FLOAT (LISTED)
- R2-230 VAC SERIES PLUG (6' MIN. SEE FIG. 2) NO LABEL (COMPONENT RECOGNIZED)
- 03-3 PIN BARREL PLUG (FIG. 3) NO LABEL (COMPONENT RECOGNIZED)
- F0-LABEL ON FLOAT, NO TERMINATION, STANDARD SKIVE. (COMPONENT RECOGNIZED) (FIG. 4)

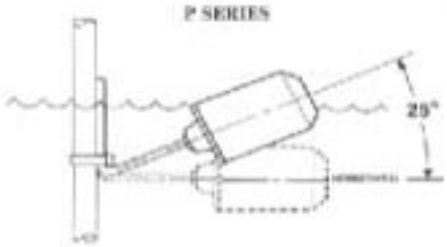
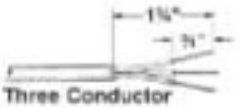


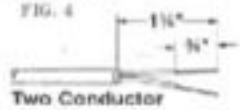
FIG. 1
120 VAC Series Plug

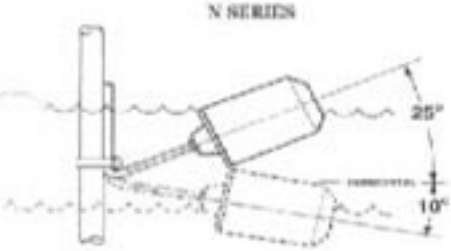
FIG. 2
220 VAC Series Plug

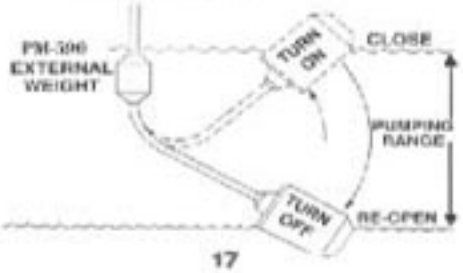
FIG. 3
3 Pin Barrel Plug



STANDARD SKIVE
FIG. 4







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TILT, TIP-OVER, DAMPER

Damper Arm Tilt Switch	Fig. #	RATINGS:
DATS-1-SPDT	1	1 Amp @ 120 VAC/1 Amp @ 28 VDC
DATS-1-SPST	1	1 Amp @ 120 VAC/1 Amp @ 28 VDC
Tilt Switches		
TS-1	2	1 Amp @ 120 VAC/1 Amp @ 28 VDC
TS-1-3	3	1 Amp @ 120 VAC/1 Amp @ 28 VDC
TS-1-6	4	1 Amp @ 120 VAC/1 Amp @ 28 VDC
TS-1C-L*	5	1 Amp @ 120 VAC/1 Amp @ 28 VDC
TS-10	6	10 Amp @ 120 VAC
TS-10C-L*	7	10 Amp @ 120 VAC
TS-20	6	20 Amp @ 240 VAC
TS-20C-L*	7	20 Amp @ 240 VAC
Tip Over Switch		
TOS-12-2	8	12 Amp @ 120 VAC
TOS-12C-8	9	12 Amp @ 120 VAC
TOS-12C-L*	10	12 Amp @ 120 VAC
Magnetic Switch (Proximity)		
MS-20	11	13 Amp @ 120 VAC/6 Amp @ 240 VAC
Narrow Angle Tilt Switch		
NATS-20	11	13 Amp @ 120 VAC/6 Amp @ 240 VAC
Wide Angle Tilt Switches		
WATS-1	12	1 Amp @ 120 VAC/1 Amp @ 28 VDC
WATS-1-3	3	1 Amp @ 120 VAC/1 Amp @ 28 VDC
WATS-1-6	4	1 Amp @ 120 VAC/1 Amp @ 28 VDC
WATS-1C-L*	5	1 Amp @ 120 VAC/1 Amp @ 28 VDC
WATS-20	11	13 Amp @ 120 VAC/6 Amp @ 240 VAC

For UL and CSA information, contact factory.

How to order

Specify as shown below

TILT SWITCH

TS · 1 · 3 ← TERMINATION

AMP RATING

MOUNTING CLIPS

PART NO.	FOR
PM-348-36	TS-1, TS-1-L1
PM-348-44	TS-10, TS-10-L1
PM-348-50	TS-1C-L1
PM-348-62	TS-10C-L1, TS-20C-L1

TERMINATION

TS · 1C · L1

"C" FOR CASED UNIT THIS SPACE IS BLANK FOR UNINSULATED UNITS.

ALL LEADED AND CASED TILT SWITCHES COME WITH SILICONE RUBBER MERCURY SWITCH LEAD WIRE, EXCEPT TOS-12

***TERMINATION WIRE LENGTHS**

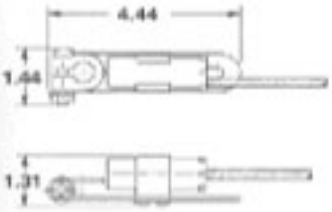
–L1= 6" Leads
–L2=12" Leads
–L3=18" Leads
–L4=24" Leads

FOR LEAD WIRE OR LENGTHS OTHER THAN THE ABOVE CONTACT THE FACTORY

National Plastic Heater Sensor & Control Co.
phone: 416.491.8436 **toll free: 1.877.674.9744** fax: 416.491.2433
Toronto, Ontario Canada e-mail: sales@nphheaters.com **website www.nphheaters.com**

& PROXIMITY SWITCHES

DATS-1



300V. PLENUM WIRE OR SJOW CORD

Fig. 1

TS-1-3/WATS-1-3

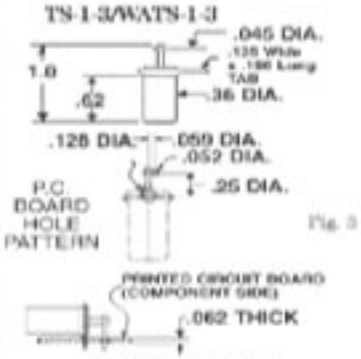


Fig. 3

PRINTED CIRCUIT MOUNTABLE TILT SWITCH

TS-1-6/WATS-1-6

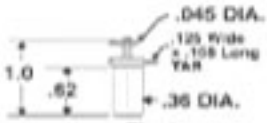


Fig. 4

TS-1

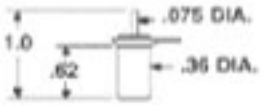


Fig. 2

TS-1C-L1/WATS-1C-L1

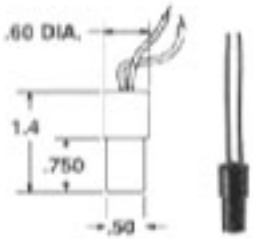


Fig. 5

TS-10 TS-20

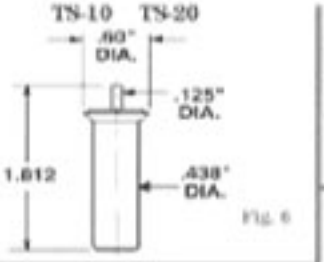
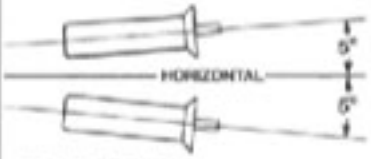


Fig. 6

TS-10C-L1 TS-20C-L1

Fig. 7

ILLUSTRATION



TS-1, TS-10, TS-20 RECOMMENDED OPERATING ANGLE FOR GOOD SWITCH OPEN AND CLOSURE CONDITIONS.

TOS-12-2

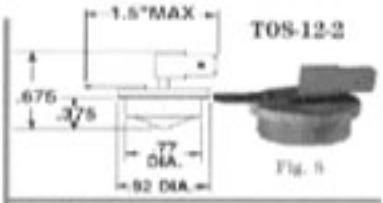


Fig. 8

TOS-12C .171 X .375 OBROUND

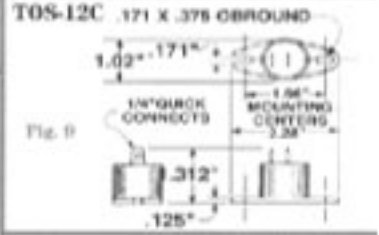
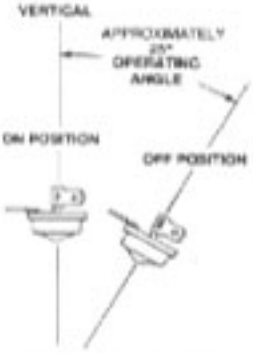


Fig. 9

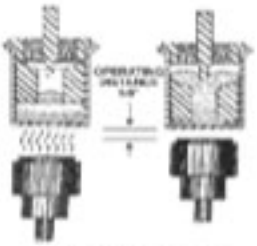
TOS-12C-L1

Fig. 10

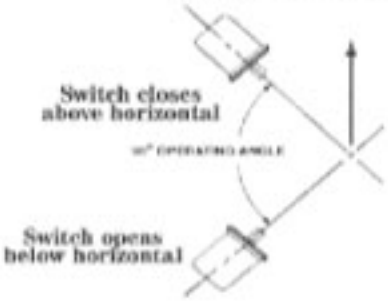
ILLUSTRATION



MS-20 ILLUSTRATION



WATS-20 ILLUSTRATION



WATS-1 ILLUSTRATION

WATS-20
MS-20
NATS-20

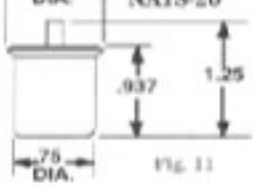
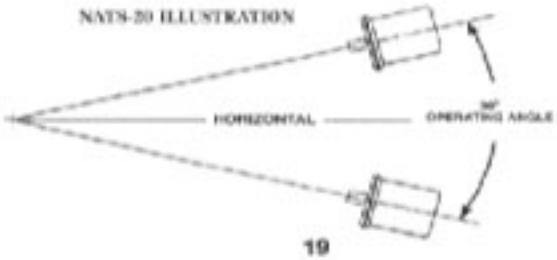


Fig. 11

NATS-20 ILLUSTRATION



WATS-1

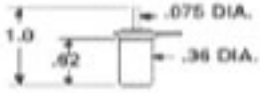


Fig. 12

National Plastic Heater Sensor & Control Co.
phone: 416.491.8436 **toll free: 1.877.674.9744** fax: 416.491.2433
Toronto, Ontario Canada e-mail: sales@nphheaters.com **website www.nphheaters.com**

National Plastic Heater

Call Toll Free 1.877.674.9744

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Dimmer Controls
Display Signs
Emergency Lighting
Flood Lights
High Intensity Lamps
Hospital Lighting
Lighting Test Panels
Mercury Vapor Lamps
Parking Lots
Photography Lighting
Railroad Signals
Scoreboards
Sodium Vapor Lamps
Stage Lighting
Street Lighting
Surgical Lighting Control
Tower Lights
Traffic Signal
Tungsten Lamps

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Alarm Systems
Automatic Door Closers
Battery Chargers
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Copiers
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Dusty, Oily Locations
Dry Cleaning Equipment
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Farm Incubators and Brooders
High Cycle Rate Applications
Low Voltage Switching
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Drying Ovens
Duct Heaters
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Glass Furnaces
Heat Lamps
Heat Sealing Machines
Induction Heater
Industrial Ovens
Infrared Heaters
Ink Drying
Ink Heating
Injection Molding Machines
Kilns
Lab Ovens
Packaging Equipment
Plastic Extruders
Pool Heaters
Quartz Heaters
Radiant Heaters
Roof Top Heating
Shrink Tunnels
Unit Heaters
Vacuum Forming

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Dishwashers
Electric Grills
Electric Ranges
Pizza Ovens
Steam Generators

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Mining Equipment
Phase Converters

WARRANTY

Mercury Displacement Industries, Inc., warrants its products to be free from defects in material or workmanship for one year, and will replace any units with such defects. Warranty is void if units are improperly applied. Mercury Displacement Industries, Inc. shall not be liable for special or consequential damages.

TO RECYCLE USED CONTACTORS, TILT SWITCHES & MERCURY FLOATS, RETURN TO MDI

National Plastic Heater Sensor & Control Co.

phone: 416.491.8436 **toll free: 1.877.674.9744** fax: 416.491.2433
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