



## Product Specifications for MNM series Motor Operators

### 1. General

- a) This specification covers the design, manufacture, and shipment of motor operator mechanisms for the operation and control of group-operated disconnecting switches.
- b) The motor operator mechanism is to be provided with all equipment necessary to operate a group-operated switch, including gear mechanism and motor (drivetrain), auxiliary/limit switches, motor control, enclosure, mounting bracket, switch/motor coupling mechanism, manual operation mechanism, and optional integral power supply (batteries and charger), if requested.
- c) RTU's and communication devices (radio, modem, cell phone, etc.), if required, will be specified separately.
- d) Group operated switch, pole or mounting structure, grounding materials, conduit and conduit hardware, mounting through bolts, and miscellaneous pole or mounting structure hardware will be provided by Others.
- e) The motor mechanism is to be suitable for both local and supervisory operation, and, optionally, automatic operation.

### 2. Materials and Workmanship

- a) The equipment shall be new and of standard commercial, first-grade quality as to materials, workmanship, and design, in accordance with the best engineering practice, and shall be such as has been proven to be suitable for the intended purpose.

### 3. Environmental Conditions

- a) Temperature - Equipment supplied shall be adequate for an operating range of -40 degrees C to +85 degrees C
- b) Humidity - Equipment supplied shall be operated under humidity of up to 95% at a Temperature of 40 degrees C.
- c) Environment - Equipment supplied shall provide reliable performance in environments with high exposure to salt, minerals, chemicals, or wind-borne particulate

### 4. Ratings and Type

- a) Type – Motor operators shall be torsional drive mechanisms for the local and remote operation of group operated switches, with an electromechanical (non-hydraulic) drivetrain, maintenance-free design, and with all major components housed within a single enclosure. Operators shall be automation-ready with contacts for remote indication of switch and motor operator status and condition.
- b) Ratings – Motor operators shall meet or exceed the following ratings

Rated Output Torque	10,000, 15,000 or 20,000 inch/lbs
Rated Control and Motor Voltages	24, 48 or 125 VDC
Rated Frequency	50 or 60 Hz
Operating Speed	0-2, 3-5, 6-8, 9-11 seconds over 180°
Battery Supply	120 VAC or solar charging options on 24 VDC units



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### 5. Motor Operator Design and Construction

- a) Motor and Control Voltages
  - i) Motor and control voltages will be 24, 48 or 125 VDC.
  - ii) 48 and 125 VDC motor operator units will utilize station service or other customer provided power source.
  - iii) 24 VDC motor operator units will be supplied with an integral power supply, which includes batteries and a charger, and utilizes a 120 VAC customer supplied source voltage.
  - iv) If specified by customer, 24 VDC motor operator units can also be supplied with an integral solar charging package (batteries, solar panels, trickle charger, interwire kit) which is independent of (does not require) a customer supplied power source.
  - v) Alternatively, if specified by customer, 24 VDC motor operator units can be pigtailed off of a customer's existing 24 VDC power supply.
  
- b) Manual Switch Operation
  - i) For the safety of utility personnel, a manual operation swing handle is to be provided to operate the switch when the motor operator is de-coupled.
  - ii) The handle is to be stored within the enclosure; removal of the handle shall disable remote operation of the motor operator through the terminal blocks.
  - iii) A handle position status contact shall be provided that will remotely indicate that the swing handle has been removed (or replaced)
  - iv) The handle shall be expandable to 46 inches in length and will be painted bright yellow for easy identification.
  - v) A torque relief knob shall be provided to relieve pressure on the decoupling mechanism, allowing easy coupling and decoupling.
  
- c) Switch/ Motor Coupling
  - i) A locking mechanism is to be provided, which will utilize a single padlock to couple the switch operating pipe to the motor operator, and to lock the switch in the open or closed position when decoupled.
  - ii) An external coupling collar shall be provided, which will allow the switch operating pipe to be disengaged from the motor operator unit so that test operations of the switch, or motor, can be performed without disturbing the position of the other.
  - iii) The coupling shall be capable of being padlocked in either the coupled or decoupled positions.
  - iv) The coupling shall allow for tolerance of the vertical control pipe as a result of thermal expansion effects.
  - v) A means shall be provided for mechanical open and close position indication of the air break switch external to the cabinet, as an option.
  - vi) The external coupling collar shall be designed to insure that the switch and motor will always be re-coupled in the one true correct position, and absolutely preclude recoupling in any incorrect position.
  
- d) Drive Train
  - i) The gearbox is to be a double-reduction worm gear mechanism
  - ii) The gear mechanism will absolutely preclude the motor operator from being back-driven at the output shaft (switch creep) while in the stationary/ rest position.



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- iii) An electric dynamic brake shall be provided to stop the motor rotation immediately and precisely at the limit switch set points.
  - iv) Solenoid actuated brakes are not acceptable.
  - v) For operator safety and gear-train efficiency, the gearbox is to be totally enclosed and permanently sealed, with no exposed gearing.
  - vi) The gearbox is to be completely maintenance-free for the life of operator
  - vii) The motor will have a NEMA standard face mount (keyed connection) for easy field replacement. Use of gear pullers or heat to remove heat-shrunk couplings is not acceptable.
  - viii) Changing the direction of rotation of the motor operator shall be easily performed in the field without modifications to the motor operator wiring.
  - ix) Motor shall be high torque, starting and running, at minimum ANSI and NEMA voltages with full rated torque available at nominal voltages.
- e) Enclosure
- i) The standard enclosure is to be constructed of heavy gage aluminum. If specified by customer, a 304 stainless steel enclosure can be provided.
  - ii) The enclosure will include a removable door with weather stripping, stainless steel pad lockable handle, three point latching mechanism, screened louvre (vent) with removable dust filter, removable conduit plate, door hold back, and document (drawing) holder
  - iii) The interior of the enclosure will be organized in such a way as to provide easy physical access to all major components of the motor operator unit without the use of removable side-walls
  - iv) Enclosure dimensions will be adjusted to accommodate optional equipment (RTU, communication device, etc.) so that easy access to all major components is maintained
- f) Mounting Brackets
- i) Mounting brackets are to be provided as standard equipment. Mounting brackets are to be designed for each installation site as specified by the customer or to an approved customer standard.
- g) Motor and Operator Controls
- i) A four pole mechanically interlocked reversing contactor is to be used to control the motor operator rotation.
  - ii) For local operation of the motor operator unit, push buttons and switch position indicating lights are to be provided, and will be coded as green to open and red to close
  - iii) Operation counters are available as optional equipment, when specified by the customer.
  - iv) A local/remote operation selector switch shall be provided, which will disable the remote contacts when the selector switch is in the local position, and disable the local push buttons when the selector switch is in the remote position.
  - v) Remote indication of local/remote switch position status shall be provided.
  - vi) All devices inside the enclosure which are used for routine operation, such as the operator control panel, the manual swing handle, etc., will be colored bright yellow for easy identification by on-site utility personnel



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- h) Circuit Breakers
  - i) Circuit breakers for protection of the motor and heater shall be provided on 24 and 48 VDC units. Additional circuit breakers can be provided if specified. Fuses shall be used on 125 VDC operators.
  
- i) Temperature Control System
  - i) A system to regulate the interior temperature of the motor operator enclosure shall be provided. The system will include a 120 VAC, 350 watt heater, recirculating fan, microprocessor control, and communication interface.
  - ii) When the interior temperature exceeds the upper temperature set point, the recirculating fan will operate for a minimum predetermined length of time (hold time) or until the interior temperature falls within parameter. When the interior temperature falls below the lower temperature set point, both the fan and the heater will operate for the hold time or until the interior temperature is within parameter.
  - iii) The system will provide a means for utility personnel to specify or change initial set point values, such as upper and lower temperature range and the length of operating time (hold time) for the fan and heater
  - iv) The system will also maintain (data log) a rolling 30 day history of high and low temperatures.
  - v) Access to the control system shall be through the communication interface supplied and the customer's laptop. All control system features and menu options are to be accessible through Microsoft Windows Hyperterminal.
  - vi) When batteries are provided with the motor operator unit, the heater and fan shall be positioned so that both warm and cool air will be forced across the batteries to extend battery life.
  - vii) The heater and fan shall turn off while the cabinet door is open.
  
- j) Terminal Blocks and Knife switches
  - i) Heavy duty, screw type terminal blocks with white marking strips shall be provided for all external wire connections. Sliding link style terminal blocks shall be available as an option.
  - ii) A nickel-plated DC knife switch shall be provided. AC knife switches shall be provided as optional equipment when specified.
  - iii) A DC knife switch position indication status contact shall be provided as standard equipment. Changing the position from NO to NC (or reverse) shall be accomplished by changing jumper (shunt) position.
  - iv) Terminal blocks shall be uniformly labeled and located (positioned) across all type MNM motor operator configurations
  
- k) Auxiliary and Limit Switches
  - i) Auxiliary switches and motor control limit switches are to be provided with individually adjustable setscrew type collars. Adjustment of each collar is to be independent of any other collar, with no required sequence of adjustment.
  - ii) Two limit switches are provided and reserved for motor control. Eight auxiliary switches are provided for customer use. Additional auxiliary switches can be provided when specified by the customer.
  - iii) Auxiliary and motor control limit switches shall be heavy-duty, industrial grade (long life) type limit switches.
  - iv) Auxiliary and limit switches shall be form "c" contacts and shall be easily changed from NO to NC (or reverse) by changing jumper (shunt) position



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- v) Externally mounted auxiliary switches (barrel switches) can be supplied as optional equipment when specified by the customer. Auxiliary switches shall indicate the position of the group operated switch when decoupled from the motor operator. This mechanism shall also provide indication of the coupling status, i.e. coupled or decoupled.
- vi) An allen wrench for adjustment of the limit switches shall be supplied
- l) 120 VAC Power Supply Package
  - i) For motor operators not utilizing station power, a power supply package is to be provided which includes batteries, charger, and a battery test system with microprocessor control and com port.
  - ii) The charger shall utilize an AC source, with a range of 90 to 240 volts, and provide a constant 130 watt output power, and shall include the following features and functionality:
    - a) Three modes of charging: bulk charge, over charge, and float charge
    - b) Protection against: short circuit on outputs, voltage surges of the AC input, battery reverse polarity, and over temperature conditions
    - c) Float charge voltage to be regulated with respect to ambient temperature
    - d) LED status indicators
  - iii) Batteries shall be lead acid, gelled electrolyte style, 12 volt, 33 amp hour
  - iv) The battery test system shall provide the following features and functionality:
    - a) Loss of AC alarm (dry contact indication)
    - b) Low voltage DC alarm (dry contact indication)
    - c) Load test the batteries automatically on a preestablished time interval; a drop in voltage below 20 VDC will initiate a low voltage DC alarm.
    - d) If loss of AC voltage should occur, the load test shall be deferred until AC voltage is restored
    - e) The results of battery tests and/or the communication of alarms shall be for indication purposes only, and shall not prevent operation of the motor operator
    - f) The micro-processor control for the test system will provide a means for utility personnel to specify or change the time interval between battery tests, and to initiate battery tests locally upon command
    - g) Access to the control system shall be through the communication interface supplied and the customer's laptop. All control system features and menu options are to be accessible through Microsoft Windows Hyperterminal.
  - v) Batteries shall be insulated from the sides and bottom of the enclosure to help prolong battery life.
  - vi) Battery straps shall be provided to keep the batteries in place at the bottom of the enclosure.
- m) Solar Power Supply Package
  - i) When station service or a 120 VAC source is not available, a solar power supply package can be provided. The power supply package is to be complete in all respects and includes batteries, trickle charger, solar modules, interwire kit, and mounting brackets.
  - ii) The power supply is to be correctly sized and configured using the following parameters: the load requirements of the motor operator, the load requirements of the associated equipment package (i.e. radio/modem, RTU, etc.), and the geographical location and prevailing environmental conditions.



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- iii) Battery storage is to be sized for a 0% loss of load potential
  - iv) The charge controller and batteries shall be factory mounted and pre-wired inside the motor operator enclosure.
  - v) Solar panel angle is to be factory preset for installation latitude. Panels are to be pre-wired at the factory.
- n) Miscellaneous
- i) A convenience light with door operated on/off switch shall be provided as standard equipment on units with 120 VAC source
  - ii) A 15 amp GFI convenience receptacle shall be provided as standard equipment on units with 120 VAC source
  - iii) A door operated dry contact shall be provided to indicate remotely the door open/close status on units with 120 VAC source
  - iv) If specified by customer, an optional "auto-sectionalizing" feature to automatically initiate an open or close operation of the motor operator, upon loss or gain of potential (with or without time delay) shall be provided.
  - v) If specified by customer, an optional "switch maintenance indication" feature, which provides remote indication of possible mechanical damage or failure of the associated group operated switch, shall be provided.
    - a) Mechanical damage/failure of the switch is defined as operating effort (torque proxy) which exceeds an upper limit of acceptable operating effort for proper operation of the switch.
    - b) This feature determines the average operating effort to properly open or close the switch during initial motor operator installation and set-up; if actual subsequent open and close operations of the switch through the motor operator require operating effort outside the acceptable parameter, remote indication is provided through a dry contact alarm
    - c) This feature also maintains a history (data log) of torque for the last 30 operations, to facilitate trouble shooting and analysis

## 6. Nameplates

- a) All motor operator units shall be equipped with a non-corrosive nameplate in accordance with ANSI C37.30, permanently attached with rivets. The nameplate is to be located on the outside of the enclosure and below the door for easy customer access.
- b) Nameplates shall include the appropriate catalog number, product class (type), operating voltage, customer purchase order number, and manufacturer's serial number for proper and complete identification of the motor operator unit

## 7. Shipping

- a) Motor operator units will be shipped in a single wooden crate, properly sized and fabricated to protect the unit from damage during transportation and subsequent storage. When specified by customer, treated lumber will be used for longer term outdoor storage.
- b) Solar panel assemblies, when provided, will be shipped in a separate wooden crate.
- c) Open pallet shipment without protective side and top rails is not acceptable.
- d) All shipping units will carry a detailed packing slip with part number identification, associated drawing number and call out, and quantity count; packing slip will also provide the manufacturer's sales order number and customer purchase order number



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- e) All motor operator units will be shipped FOB factory, freight prepaid and add unless otherwise noted

### 8. Outdoor Storage

- a) Motor operator units shall be stored in an upright position
- b) If storage for greater than 90 days is anticipated, customer shall:
  - i) remove batteries from the enclosure and place them in a controlled environment under charge (120 VAC); batteries have a shelf life of approximately 4 months without charge
- c) If long term storage is anticipated by customer and advised at time of order, batteries will be shipped separately for easier handling and proper storage
- d) Dessicant bag shall be provided to assist in keeping enclosure interior moisture-free