Product Specifications for SUB series Motor Operators

1. General

a) This specification covers the design, manufacture, and shipment of motor operator mechanisms for the operation and control of substation style group-operated disconnect 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 and a manual operation mechanism.
c) Group operated switch, mounting structure, grounding materials, conduit and conduit hardware, mounting bolts or miscellaneous hardware will be provided by Others.
e) The motor mechanism is to be suitable for both local and remote 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, 20,000 or 30,000 inch/lbs
Rated Control and Motor Voltages	48 or 125 VDC
Rated Frequency	50 or 60 Hz
Operating Speed	0-2, 3-5, 6-8, 9-11 seconds over 180^{o}

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5. Motor Operator Design and Construction

a) Motor and Control Voltages
   i) Motor and control voltages will be 48 or 125 VDC and will utilize station service or other customer provided power source.

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.
   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.

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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.

ii) The enclosure will include a removable door with weather stripping, stainless steel pad lockable handle, screened louvre (vent) with fine mesh screen, removable conduit plate 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

f) Mounting Brackets

i) Mounting brackets are available as optional equipment when specified by the customer. If supplied, 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.

h) Fuses

i) Fuses for protection of the motor and heater shall be provided on 48 and 125 VDC units.

i) Temperature Control System

i) A system to regulate the interior temperature of the enclosure shall be provided. The system will include a 120 VAC, 100 watt heating element utilizing zero cross-over circuitry to prolong the operating life of the element.

j) Terminal Blocks and Disconnects

i) Screw type terminal blocks shall be provided for all external wire connections.

ii) Terminal blocks shall be uniformaly labeled and located (positioned) across all type SUB motor operator configurations.

iii) A visible open gap disconnect shall provided for both DC and AC.

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k) Auxiliary and Limit Switches
   i) Auxiliary switches and motor control limit switches are to be provided with adjustable setscrew type collars.
   ii) Two limit switches are provided and reserved for motor control. Eight auxiliary switches are provided as standard equipment for customer use. Eight additional auxiliary switches can be provided as optional equipment when specified by the customer.
   iii) Auxiliary and motor control limit switches shall be heavy-duty, industrial grade (long life) type contacts.
   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.
   v) An allen wrench for adjustment of the limit switches shall be supplied

l) Miscellaneous
   i) A convenience light utilizing zero cross-over circuitry to prolong the operating life of the bulb shall be provided as standard equipment.
   ii) A 15 amp convenience receptacle shall be provided as standard equipment

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 cardboard container with wooden pallet, properly sized and fabricated to protect the unit from normal wear and damage during transportation and subsequent storage.
b) Open pallet shipment without protective side and top rails is not acceptable.
c) 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
d) 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) Dessicant bag shall be provided to assist in keeping enclosure interior moisture-free

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