
PART 1 - GENERAL

1.1 WORK OF THIS SECTION

- A. This section of the specifications details the components and work to be provided by the BMCS subcontractor related to the following:
 - 1. Automatic dampers (AD) which are not fire and/or smoke rated.
 - 2. Electric actuators for dampers.

PART 2 - PRODUCTS

2.1 DAMPERS - GENERAL

- A. Furnish automatic dampers (AD) as indicated on the Mechanical Drawings and Specifications and in the BMCS Field Termination Schedules section of these specifications for installation by the Mechanical subcontractor. Refer to the Mechanical Drawings and Specifications.
- B. Provide actuators for all automatic dampers. Provide all required actuator mountings, installation, drive arms, shaft extensions, linkages and damper position sensors and end switches.
- C. Multiple section two position dampers shall be controlled by one BMCS output unless indicated otherwise within the Field Termination Schedules or Sequences of Operation.
- D. Multiple section modulating dampers shall be controlled in sequence unless indicated otherwise within the Field Termination Schedules or Sequences of Operation.
- E. Individual sections shall not be larger than 18 square feet. Each section shall have a separate actuator. Jackshaft extensions shall not be used for controlling multiple sections.
- F. Actuators shall be mounted to allow complete access for maintenance and removal. Wherever possible provide damper actuators mounted on the exterior of the duct/damper section. The installation of actuators within air streams will be permitted only where damper configurations and site conditions require. Obtain approval for proposed installations of actuators within ductwork, plenums, airstreams, etc. Furnish access doors where required to allow access.
- G. Dampers and actuators shall be configured for normal and failure positions as indicated in the operating sequences and as indicated in the Mechanical Drawings and Specifications.
- H. Provide actuators sized in accordance with manufacturers recommendations and industry standards for accurate and stable control of airflow in each application.
- I. Provide damper and actuator installations to comply with the acoustical requirements for the project. Noise generated from dampers and actuators in air streams shall not be detectable in occupied building spaces.
- J. Furnish manufacturers' installation details to the Mechanical subcontractor. Provide details of all multiple section damper installations. Provide schematic diagrams for all multiple section damper installations indicating damper section dimensions, mounting configurations, linkages, actuator mounting locations, structural bracing/reinforcement, etc.
- K. Automatic Fire/Smoke Dampers (FSD), Smoke Dampers (SD), fusible link fire dampers, gravity dampers and volume/balancing dampers shall be provided by the Mechanical subcontractor.
- L. Submit damper schedules that include, at minimum, the following for each damper:
 - 1. Associated mechanical system.
 - 2. Damper manufacturer and model number.
 - 3. Actuator manufacturer and model number.
 - 4. Mechanical drawing reference.
 - 5. Damper size for each section.

6. Parallel or opposed blade configuration.
7. Ratio of anticipated air stream velocity to the manufacturer's maximum recommended velocity rating.

2.2 AUTOMATIC DAMPERS (AD)

- A. Furnish AD as detailed in the mechanical drawings.
- B. Modulating dampers shall be opposed blade type unless specified otherwise. Two position dampers shall be parallel or opposed blade type. Two position dampers for generator intake or discharge ventilation shall be opposed blade type.
- C. The maximum leakage rate for outside air isolation AD shall not exceed 8 cfm per square foot at 4 inches W.C. The maximum leakage rate for all other AD shall not exceed 10 cfm per square foot at 4 inches W.C. Provide dampers tested and certified for leakage performance in accordance with AMCA Standard 500.
- D. Provide integral damper position indicator switches as required by the operating sequences. Damper position switches shall be provided to indicate actual damper blade position. Damper position indication based on damper linkage position or damper drive shaft position is not acceptable.
- E. Frames:
 1. 16 gauge welded galvanized steel channel, or
 2. 3.2 mm (0.125 inch) thick formed aluminium channel.
 3. Corner bracing of frames of height or width larger than 1m. (3.28 ft.).
 4. Channel dimensions shall be a minimum of 125 mm by 25 mm (5 inch by 1 inch).
 5. Constructed for flanged duct work connection. Provide damper frames with flanges suitable for installation in interconnected duct work or plenums.
 6. Sized to match the duct dimension including lining materials.
- F. Blades:
 1. Material of construction shall be:
 - a. 21 gauge galvanized steel, with four (4) breaks, or
 - b. 22 gauge double galvanized sheets, with four (4) breaks in each sheet. Sheets shall be spot welded together, or
 - c. 14 gauge airfoil shaped double skin galvanized steel, or
 - d. 16 gauge airfoil shaped double skin extruded aluminum.
 2. 200 mm (8 inch) maximum width for galvanized steel.
 3. 150 mm (6 inch) maximum width for aluminum.
 4. 1.5 m (60 inch) maximum blade length.
 5. Replaceable edge seals made of one of the following:
 - a. Neoprene.
 - b. Vinyl.
 - c. Polyurethane.
 - d. Silicone rubber.
 - e. Synthetic elastomer.
 6. Side seals shall be one of the following:
 - a. Continuous spring stainless steel strip.
 - b. Synthetic elastomer.
 - c. Flexible aluminum compression type.
 7. Sections shall be installed such that blades are horizontal except where specifically noted otherwise. Vertically mounted damper blades shall have suitably rated thrust bearings.
- G. Axles:
 1. Materials of construction shall be:
 - a. 13 mm (0.5 inch) square zinc plated steel, or
 - b. 13 mm (0.5 inch) hexagonal zinc plated steel.
 2. Axles shall be fastened to the blades with bolts through the axle, rivets or welds.
 3. Bearings shall be one of the following:
 - a. Oil impregnated sintered bronze, or

- b. Stainless steel.
 - 4. Extend axle beyond the frame as necessary to match up with actuator.
 - H. Dampers shall be Ruskin CD-60 or approved equal.
 - I. Provide damper position sensors or end switches as required by the Field Termination Schedules and/or Sequence of Operation. Damper position shall meet, at minimum, the following:
 - 1. Position sensors shall be:
 - a. Direct mounting to blade of associated damper section.
 - b. 0-10 Vdc or 4-20mA output signal directly proportional to damper position between full open and full closed positions.
 - c. NEMA 1 potentiometer housing for mounting inside or outside the duct as appropriate for the location.
 - d. Suitable mounting brackets.
 - e. Sensor shall be Johnson controls PQ-1001 or approved equal.
 - 2. Position switches shall be:
 - a. Direct mounting to monitor blade full open position of associated damper section using whisker probe.
 - b. One N.O. and one N.C. contact.
 - c. 10 amp @ 24VAC, 5A @ 120VAC, 2.8A @ 24VDC contact rating.
 - d. NEMA rated contact housing.
 - e. Suitable mounting brackets.
 - f. Switch shall be ABB LS45M91B11 Whisker Switch or approved equal.

2.3 DAMPER ACTUATORS FOR AD

- A. Provide electric damper actuators for all AD. Electric actuators shall meet, at minimum, the following requirements:
 - 1. Stroke by the rotating motion of a reversible, overload-protected synchronous motor. Actuators shall be directly coupled to damper drive blades with no intermediate linkages or shall be rotary type actuators directly coupled to the damper drive shaft.
 - 2. Protected against overload by an integral magnetic clutch or stall protection by non-overloading impedance protected motor.
 - 3. 120 Vac + or - 10% 60 Hz or 24 Vac power supply.
 - 4. Provide one actuator for each damper section. Provide additional damper sections to ensure a single actuator can provide sufficient torque to meet the specified close off leakage and timing requirements. Damper actuators shall not be stacked.
 - 5. Actuators shall be motorized/driven in both the open and closed directions. Where required by the sequences of operation, actuators shall have a spring return to the de-energized position upon loss of power. Damper normal and failure positions shall be as identified within the sequences of operation.
 - 6. BMCS controlled actuators for modulating automatic dampers shall be controlled by a 0-10 Vdc, or 4-20mA signal. Provide actuators, which are fully compatible with the BMCS analog output subsystem. BMCS controlled actuators for two position dampers shall be controlled by 24Vac, 24Vdc or single-phase 120 Vac power switched by the BMCS.
 - 7. Floating actuators shall not be permitted.
 - 8. Complete with mounting brackets suitable for extended shaft mounting or direct damper drive shaft mounting.
 - 9. Stroke dampers from fully closed to fully open in accordance with the following:

<u>Service</u>	<u>Timing Requirement</u>
Two position normal service	75 seconds
Modulating normal service	120 seconds
Emergency service (stair pressurization, etc.)	30 seconds

- 10. Rated for operation at ambient temperatures of minus -40 Deg. F. to 122 Deg. F.
- 11. Complete with damper/actuator stroke position indicator.
- 12. Manual drive release mechanism and manual positioning mechanism.

- B. Actuators shall be quiet in operation such that noise from actuator operation is not detectable in any occupied spaces.
- C. Actuators shall be Belimo or approved equal.

PART 3 - EXECUTION

3.1 HARDWIRED INTERLOCKS

- A. Provide all required hardwired interlocks between fans, intake and discharge dampers, emergency generators, etc. and any motor actuated damper as identified within this specification or the Mechanical Drawings, whether or not furnished under this Section unless the fan is furnished with interlock by fan manufacturer.
- B. The BMCS Subcontractor shall provide all wiring as required for the control and interlocking of automatic dampers. The BMCS Subcontractor shall provide control signal and power supply wiring between any damper monitored and/or controlled by the BMCS regardless of whether the BMCS Subcontractor has furnished the damper/actuator assembly. The BMCS Subcontractor shall also provide power supply and control signal wiring between damper actuators and interlocked motor control circuits, thermostats, duct pressure limit switches, safeties, etc.
- C. Power for isolation dampers on fans and air handling units shall be obtained from the associated fan motor control circuit. Coordinate actuator power supply wiring and fire alarm system override control of dampers with Electrical.
- D. Where dampers are specified to be hard wire interlocked with electric fan motors the BMCS subcontractor shall provide the damper position switches and all required wiring and interconnection. Provide the damper end switch(s) hard wire interlocked to achieve the operational requirements as specified in the Field Termination Schedules and the sequences of operation in these specifications, and as indicated in the Mechanical Drawings and Specifications. Provide damper end switches hard wire interlocked to prevent fan motor operation in both the hand and auto position of hand/off/auto motor control circuit. The damper actuator shall be configured such that the damper is commanded open when the fan is in hand or commanded on in auto mode.
- E. Provide for each damper (AD, SD and/or SFD) that is controlled by both the BMCS and the FDACS, a terminal strip and associated control relays such as to allow control and monitoring as follows (as applicable):
 - 1. BMCS two position open-closed control with motor starter - contact closure of a BMCS relay, thermostat or interlocking device shall open the damper. Contact opening shall close the damper.
 - 2. BMCS two position open-closed control with variable speed drive - contact closure of a BMCS relay or FDACS command relay shall command the fan VSD to start, the programmable relay internal to the VSD shall command the interlocking damper open, and the end switch shall enable to VSD safety circuit to allow the fan to start. Contact opening of a BMCS relay or FDACS command relay shall close the damper and disable to fan VSD.
 - 2. BMCS modulating control - modulating signal from the BMCS of 0-10 VDC or 4-20 mA output to achieve the required sequence.
 - 3. Damper open/closed status - allow BMCS or FDACS monitoring or interlock of damper open and damper close status.
 - 4. Override open control - contact closure of a FDACS command relay or localized smoke detector shall override any BMCS modulating or open/closed control to open the damper.
 - 5. Override closed control - contact closure of a FDACS command relay or localized smoke detector shall override any BMCS modulating or open/closed control to close the damper.
 - 6. Provide cabling as follows:
 - a. Between all damper actuators and the associated damper terminal strip.
 - b. Between the BMCS and the damper terminal strip for any damper monitored and/or controlled by the BMCS.
 - c. Between the damper terminal strip and interlocked motors, thermostats, pressure

- switches, generators, pumps, etc.
7. Coordinate exact FDACS interface requirements and terminal strip locations with the Electrical subcontractor.

END OF SECTION