

**SECTION 1 – GENERAL CONDITIONS****I. SCOPE:**

This specification outlines the requirements for a Carbon Dioxide (CO<sub>2</sub>) Fire Suppression System with a conventional detection and control system. The work described in this specification includes all engineering, labor, materials, equipment, fees and services necessary, and required, to complete and test the suppression and detection system.

**II. APPLICABLE STANDARDS AND PUBLICATIONS:**

The design, equipment, installation, testing and maintenance of the system shall be in compliance and accordance with the applicable requirements set forth in the latest edition of the following codes, standards, and third party approval agencies:

- 1) NFPA No. 12 - Carbon Dioxide Extinguishing Systems
- 2) NFPA No. 70 - National Electrical Code
- 3) NFPA No. 72 - National Fire Alarm Code
- 4) FM Approvals
- 5) Underwriters Laboratories
- 6) Requirements of the Authority Having Jurisdiction (AHJ)

The standards listed, as well as all other applicable codes and standards shall be used as "minimum" design standards. Also to be considered are the requirements of the "Authority Having Jurisdiction" (AHJ), and good engineering practices.

**III. REQUIREMENTS:**

The Carbon Dioxide Suppression System installation shall be made in accordance with the drawings, specifications and applicable standards. Should a conflict occur between the drawings and specifications, the specifications shall prevail.

**IV. EXCLUSIONS:**

The work listed below shall be provided by others, or under other sections of the specification:

- 1) 120 VAC or 240 VAC power supply to the Carbon Dioxide system control panel
- 2) Interlock wiring and conduit for shutdown of HVAC, dampers, and/or electric power supplies, relays or shunt trip breakers
- 3) Connection to local or remote fire alarm systems, or listed central alarm station(s)

**V. QUALITY ASSURANCE:****A) SUPPLIER:**

- 1) The supplier of the Fike Carbon Dioxide Suppression System hardware and detection components shall have a minimum of 10 years experience in the design and manufacture of similar types of suppression systems and who can refer to similar installations providing satisfactory service.
- 2) The name of the supplier, part numbers and serial numbers should appear on all major components.
- 3) All devices, components and equipment shall be the products of the same supplier.
- 4) All devices, components and equipment shall be new, standard products of the suppliers latest design, and suitable to perform the functions and tasks intended.
- 5) All devices and equipment shall be U.L listed and/or FM approved.

**B) INSTALLER:**

- 1) The installing contractor shall be trained by the Fike to design, install, test and maintain the Fike Carbon Dioxide Suppression Systems.
- 2) Whenever possible, the installing contractor shall employ a NICET certified special hazard designer, level 2 or above, who will be responsible for this project.
- 3) The installing contractor shall be an experienced firm regularly engaged in the installation of automatic Carbon Dioxide Clean Agent, or similar, fire suppression systems in strict accordance with all applicable standards.
- 4) The installing contractor must have a minimum of five (5) years experience in the design, installation and testing of Carbon Dioxide Clean Agent, or similar, fire suppression systems. A list of systems of a similar nature and scope shall be provided, on request.
- 5) The installing contractor shall show evidence that his company carries a minimum \$2,000,000.00 liability and completed operations insurance policy. These limits shall supersede limits required in the general terms and conditions of the specifications.
- 6) The installing contractor shall maintain, or have access to, a Carbon Dioxide Clean Agent recharging station. The installing contractor shall provide proof of his ability to recharge the largest Carbon Dioxide Clean Agent system within 24 hours after a discharge. Include the amount of Carbon Dioxide bulk agent storage available.
- 7) The installing contractor shall be an authorized stocking distributor of the Fike Carbon Dioxide Clean Agent system equipment so that immediate replacement parts are available from inventory.
- 8) The installing contractor shall show proof of emergency service available on a twenty-four hour, seven-day a week basis. Service personnel shall be available for emergency service response at all times.

**C) SUBMITTALS:**

- 1) The installing contractor shall submit the following design information and drawings for approval prior to starting work on this project:
  - a) Field installation layout drawings having a scale of not less than 1/8" = 1'-0", or 1:100m, detailing the location of all CO<sub>2</sub> cylinders, manifold arrangement, pipe runs including pipe sizes and lengths, control panel(s), detectors, manual pull stations, abort stations, audible and visual alarms, etc.
  - b) Layout drawings shall provide a piping isometric drawing detailing manifold and piping system hydraulic node points.
  - c) Auxiliary details and information such as maintenance panels, door holders, special sealing requirements and equipment shutdowns.
  - d) Separate drawings, shall be provided for each Carbon Dioxide design and/or hazard space, and for the mechanical and electrical work.
  - e) A separate layout, or drawing, shall show isometric details of agent storage containers, mounting, and anchoring details.
  - f) Electrical layout drawings shall show the location of all devices and include point-to-point conduit runs with the proposed number of wires to be contained in each so noted.
  - g) Provide an internal control panel wiring diagram which shall include power supply requirements and field wiring termination points.
  - h) Graphic Annunciator wiring schematics and dimensioned display panel illustration shall be provided. (Optional device)

- i) Complete hydraulic flow calculations shall be provided for all engineered systems utilizing the latest version of the equipment manufacturer's flow calculation program. The individual sections of pipe and each fitting to be used, as shown on the isometrics, must be identified and included in the calculation. Total agent discharge time must be shown and nozzle code numbers listed for final nozzle fabrication.
  - j) Provide calculations for the battery stand-by power supply, taking into consideration the power requirements of all alarms, initiating devices and auxiliary components under full load conditions.
  - k) A complete sequence of operation shall be submitted detailing all alarm devices, shutdown functions, remote signaling, damper operation, time delay and agent discharge for each zone or system.
- 2) Submit drawings, calculations and system component data sheets for approval to the local Fire Prevention Agency, owners Insurance Underwriter and all other Authorities Having Jurisdiction before starting installation. Submit approved plans to the Architect/Engineer for record.

## **SECTION 2 – SYSTEM REQUIREMENTS**

### **I. SYSTEM DESCRIPTION AND OPERATION:**

- A) The system shall be a Carbon Dioxide Clean Agent Fire Suppression System manufactured by the Fike and supplied through an authorized and trained sales outlet. Systems shall be designed in accordance with the manufacturer's guidelines.
- B) The Carbon Dioxide Suppression System provided shall conform to one of the following design criteria:
- 1) Total Flood / Surface Fire Minimum design concentration - 34%
  - 2) Total Flood / Deep Seated Fire Minimum design concentration - 50%
  - 3) Local Application - Rate-by-Area Minimum design - Based on nozzle flow rate
  - 4) Local Application - Rate-by-Volume Minimum design - 1 lb. / ft<sup>3</sup>/ min. (16kg/ m<sup>3</sup>/ min.)
  - 5) A combination of system designs from above

**NOTE:** It shall be the responsibility of the Fire Protection Engineer, or system designer, to select and apply the appropriate design criteria for the hazard(s) covered under this specification.

- C) The system shall be complete in all ways. It shall include all mechanical and electrical installation, all detection and control equipment, agent storage cylinders with agent, system actuation equipment, discharge nozzles, pipe and fittings, manual release and abort stations, audible and visual alarm devices, auxiliary devices and controls, shutdowns, alarm interface, caution/ advisory signs, functional checkout and testing, training and all other operations necessary for a functional U.L. Listed and/or F.M. Approved Carbon Dioxide Clean Agent Fire Suppression system.

The system design, for a specific hazard, shall conform to all applicable requirements of NFPA 12, latest edition, and the Fike "Carbon Dioxide System Design Manual", P/N C06-018, to provide the following:

- 1) Hazard Volume – ft<sup>3</sup> or m<sup>3</sup>
- 2) Agent quantity adjustment for:
  - a) Fuel conversion factor
  - b) High or low temperature adjustment
  - c) Ventilation – No shutdown capability
  - d) Uncloseable openings
- 3) Discharge duration
- 4) Minimum system flow rate
- 5) Nozzle quantity and flow rate in lbs. / kg per minute

- 6) Carbon Dioxide agent required
- 7) Number and size of Carbon Dioxide cylinders provided
- D) Provide two (2) inspections during the first year of service. Inspections shall be made at 6 month intervals commencing when the system is first placed into normal service.
- E) The general contractor shall be responsible for sealing and securing the protected spaces against agent loss or leakage during the required "hold" period (Total Flood applications only).
- F) The system(s) shall be actuated by ionization, photoelectric, or thermal detectors installed at spacings as detailed in NFPA 72 (latest edition), in both the room, underfloor and above ceiling (if required) protected spaces. Fike recommends detector spacing of 250 ft<sup>2</sup> (23.2 m<sup>2</sup>) per detector (Ion. or P/E) and 400 ft<sup>2</sup> (37 m<sup>2</sup>) for thermal detectors. These values may need to be reduced or adjusted for high airflow/velocity applications and/or ceiling height.
- G) Detectors shall be wired in Sequential detection method of operation, standard Cross-Zoned detection, or single detector release using either the Class "A" or Class "B" wiring arrangement. No other detection / wiring arrangements will be acceptable.
- H) Automatic operation of each protected area shall be as follows:
  - 1) Actuation of one (1) detector, within the system, shall:
    - a) Illuminate the "ALARM" LED on the control panel face.
    - b) Energize an alarm bell and an optional visual indicator.
    - c) Transfer sets of auxiliary contacts which can perform auxiliary system functions such as:
      - (1) Operate door holder / closures on access doors.
      - (2) Transmit a signal to a fire alarm system.
      - (3) Shutdown HVAC equipment.
    - d) Light an individual LED on a graphic annunciator panel (optional).
  - 2) Actuation of a 2nd detector, within the system, shall:
    - a) Illuminate the "PREDISCHARGE" LED on the control panel face.
    - b) Energize a "PREDISCHARGE" horn, bell, or horn/strobe device.
    - c) Shut down the HVAC system and/or close dampers.
    - d) Start time-delay sequence (Not to exceed 30 seconds).
    - e) Light an individual lamp on a graphic annunciator panel (optional).
  - 3) After completion of the time-delay sequence, the Carbon Dioxide Clean Agent system shall discharge and the following shall occur:
    - a) Illuminate a "RELEASE" LED on the control panel face.
    - b) Shutdown of all power to high-voltage equipment.
    - c) Energize a visual indicator outside the hazard in which the discharge occurred.
    - d) Energize a "SYSTEM RELEASE" audible device. (Optional)
  - 4) The system shall be capable of being actuated by electric/manual discharge devices located at each hazard exit. Operation of a manual device shall duplicate the detection sequence described above, except that the time delay function SHALL be bypassed. The manual discharge station shall be of the electrical actuation type and shall be supervised by the main control panel.

- 5) The system shall also be capable of being “Manually Actuated” at the cylinder location via the manual actuation provision provided with each “Master” cylinder actuation package, P/N C85-113 or C85-114. Providing a Pressure switch, P/N C70-202 (standard), or P/N CO2-1231 (explosion proof), wired into the manual actuation circuit of the control panel, will insure that all the system’s auxiliary functions operate as required should the system be actuated from the cylinder location. A connecting link assembly, P/N C70-228, must be provided on systems having two (2) “Master” valves, to link the valves together insuring the simultaneous actuation of both cylinders.

## **II. MATERIALS AND EQUIPMENT:**

### **A) General Requirements:**

The Fike Carbon Dioxide Clean Agent System materials and equipment shall be standard products of the supplier's latest design and suitable to perform the functions intended. When one or more pieces of equipment must perform the same functions, they shall be duplicates produced by one manufacturer.

- 1) All devices and equipment shall be U.L Listed and/or FM approved.

### **B) Carbon Dioxide Storage and Distribution:**

Each system shall have its own supply of agent or from a common agent supply protecting multiple enclosures with selector valves.

- 1) Each supply shall be located as near as possible to the hazard area to reduce the amount of pipe and fittings required to install the system.
- 2) The Carbon Dioxide agent shall be stored in FIKE P/N C70-XXX Series Agent Storage cylinders. Cylinders shall be of seamless steel construction, tested and marked in accordance with all Department of Transportation (DOT) specifications for 3AA steel cylinders.
- 3) Fike Carbon Dioxide cylinders shall have a red enamel or red epoxy finish. They are available in capacities of 50 lb. (22.7 kg), 75 lb. (34 kg), and 100 lb. (45.4 kg). Variable weight filling of Carbon Dioxide cylinders is “**NOT**” allowed.
- 4) Fike Carbon Dioxide Cylinders are equipped with a pressure differential valve machined from a brass forging with stainless steel trim and components and provided with a siphon tube to completely discharge the contents of the cylinder.
- 5) Each Fike Carbon Dioxide cylinder has a fill weight charged pressure of 850 psi @ 70° F. (5861 kPa @ 21°C).
- 6) Each cylinder valve shall have a pressure relief provision that automatically operates when the internal cylinder pressure reaches 2,650-3,000 psi (18,269-20,682 kPa) Fike Carbon Dioxide cylinders can be stored in an ambient temperature range of 32 to 130°F (0 to 54.4°C) for Local Application system designs and 0 to 130° F (-17.8 to 54.4°C) for Total Flood system designs.
- 7) Each cylinder shall have an identification label securely attached which contains the cylinder serial number, empty/full weights, cylinder part number, and listing information.
- 8) Each cylinder must be provided with a maintenance record card and safety/shipping cap.
- 9) Cylinder straps shall be supplied for all single cylinder systems as a minimum.
- 10) Cylinder racking shall be supplied for multiple cylinder systems. Racking shall be available in single row, double row and back-to-back arrangements. Provisions for weighing the cylinders in place shall be made available as an option for all racking configurations.
- 11) Check valves shall be provided on all systems utilizing a connected reserve supply. This prevents the reserve bank of cylinders from being activated when the main bank discharges. The check valve shall be constructed of [brass] [stainless steel] and capable of withstanding pressures of up to 5,000 psi. The check valve shall be of an “inline flow” design for minimal flow restriction during discharge.

- 12) Engineered Discharge Nozzle(s) shall be provided, within the manufacturer's guidelines, to distribute the agent throughout the protected spaces for Total Flood applications or to direct the agent on the hazard for Local Application applications. The nozzles shall be FIKE P/N C80-XXX-XXXX designed to provide proper agent quantity and distribution. Nozzles shall be available with ½" NPT threads. Orifice size to be determined by a computerized hydraulic calculation based on flow rate and the system design requirements. Nozzles to be constructed of natural brass or zinc plated aluminium for maximum corrosion resistance. Nozzles to be equipped with flange mounting kits and sealing discs where necessary.
- 13) Distribution Piping to meet the requirements of ASTM [A53] [A106] specifications. Distribution piping up to ¾ in. diameter shall be Schedule 40 seamless steel [black] [galvanized] pipe. Distribution piping larger than ¾ in. diameter shall be Schedule 80 seamless steel [black] [galvanized] pipe. For pipe sizes up to 2 in. diameter, Class 300 [malleable] [ductile] iron fittings shall be used. For pipe larger than 2 in. diameter, IPS and forged steel fittings shall be used.
- 14) Discharge Pressure Switch, P/N C70-202 or C02-1231 shall be installed in the piping network, before the Lock-out valve, to provide a positive pneumatic confirmation to the control / releasing panel that the CO<sub>2</sub> has been discharged manually, this switch provides to input to the control system needed to activate various audio/visual warning devices and auxiliary relays that would not be activated otherwise.
- 15) When a Carbon Dioxide system (Total Flood and/or Local Application) is installed where the discharge of the Carbon Dioxide agent will expose personnel to hazardous concentration of CO<sub>2</sub> the following items shall be provided:
  - a) Lock-out (Stop / Maintenance) Valve P/N C02-12XX is used to prevent discharge of CO<sub>2</sub> agent from the system while the system is "Locked out" for maintenance or other purposes. The system control panel shall supervise the valve's position providing a trouble signal when in the closed and locked position.
  - b) Pneumatic Time Delay P/N C70-23X is used pneumatically delay the discharge of CO<sub>2</sub> agent for a specific period of time (30 or 60 seconds). This delay is primarily intended to allow personnel time to leave the protected area; even if the system is discharged manually and also allows additional time for shutdown functions (ventilation, equipment etc.)
  - c) Pneumatic Pre-Discharge Alarm (Siren) P/N C02-1230 is used to warn personnel of a CO<sub>2</sub> system discharge before the CO<sub>2</sub> agent discharged, this device is installed in the piping / manifold before the Pneumatic Time Delay.
  - d) Olfactory Device P/N 02-9868 is used to give a distinctive odor to the discharging CO<sub>2</sub> agent which serves as an indication to personnel that CO<sub>2</sub> agent is present.

### **C) CONTROL PANEL**

- 1) The control panel shall be a SHP PRO® Control panel, P/N 10-063-1-C-P, manufactured by FIKE, Blue Springs, MO.
- 2) The SHP PRO Control System, and its components, shall be UL listed and FM approved for clean agent / inert gas releasing service and be suitable for Deluge and Pre-action sprinkler service.
- 3) The SHP PRO Control System shall perform all functions necessary to operate the system detection, actuation and auxiliary functions, as outlined.
- 4) The SHP PRO Control System shall be capable of providing 7 Ah to 40 Ah battery standby power.
- 5) The SHP PRO Control System shall be microprocessor based with hardware and software integration designed to guarantee reliability.
- 6) The SHP PRO Control System shall support Cross Zone, Sequential, Single Detector Release and Manual Release detection/actuation methods.

- 7) The SHP PRO Control System shall provide the following capabilities and functions:
- a) Three (3) Class B (Style Y), notification appliance circuits rated for 2.0 amps @ 24 VDC.
  - b) Up to two (2) Style B initiating device circuits capable of sequential alarm, cross-zone, or single detector release operation with an overall system capacity of 50 detectors maximum.
  - c) Three (3) Style B initiating device circuits capable of monitoring closed contact devices.
  - d) Optional Class A module that converts all five input circuits to Style D.
  - e) Optional Class A module that converts all five output circuits to Style Z (3 NAC, 2 Releasing)
  - f) Ten (10) Status LEDs plus alpha-numeric display for troubleshooting: AC normal; alarm; pre-discharge; release; supervisory; trouble; panel silenced; release disabled; and ground fault.
  - g) Programmable pre-discharge / discharge timers.
  - h) Resettable and continuous auxiliary output power.
  - i) Intelligent Transistor protection to prevent noise spikes and microprocessor failure from inadvertently activating release circuits.
  - j) A dedicated disarm switch for outputs.
  - k) Dedicated alarm, supervisory and trouble relay contacts.
  - l) Three (3) Form "C" relays, rated at 2 amps, are provided on the SHP PRO panel board. Installation of up to two (2) optional CRM4 Relay Module (P/N 10-2204) will provide up to eight (8) additional 2 amp relays.
  - m) Multiple input power source – 120 VAC or 240 VAC.
  - n) 4.0 amps @ 24 VDC power supply to operate high current draw horns and strobes.
  - o) Available in either Red or Gray finish.

**D) DETECTOR BASES:**

The detector bases shall be selected according to their operational characteristics and size of base.

- 1) 430 ohm bases are used to provide Sequential or Cross Zone detection on the SHP PRO initiating circuits. The bases shall be Fike P/N 67-1034 (6"/15cm) base, or P/N 67-1036 (4"/10cm) base.
- 2) 220 ohm bases are used to provide Cross Zone or Single Detector Release detection on the SHP PRO initiating circuits. The bases shall be Fike P/N 67-1035 (6"/15cm) base, or P/N 67-1037 (4"/10cm) base.
- 3) When using the SHP PRO in conjunction with a Graphic Annunciator panel, the following old style bases must be used.
  - a) Fike P/N 67-1027 (6"/15 cm) 430 ohm base.
  - b) Fike P/N 67-1028 (4"/10 cm) 430 ohm base.
  - c) Fike P/N 67-1010 (6"/15 cm) 220 ohm base.
  - d) Fike P/N 67-1017 (4"/10 cm) 220 ohm base.

**E) MANUAL RELEASE (Electric):**

The electric manual release switch shall be a dual action device which provides a means of manually discharging the ProInert system when used in conjunction with the FIKE SHP PRO Control System.

- 1) The Manual Release switch shall be a FIKE P/N 10-1638 or a Manual Pull station, P/N 02-3710.
- 2) The Manual Release switch or Manual Pull station shall be a dual action device requiring two distinct operations to initiate a system actuation.
- 3) Manual actuation shall bypass the time delay and abort functions, shall cause the system to discharge and shall cause all release and shutdown devices to operate in the same manner as if the system had operated automatically.
- 4) A Manual Release or Manual Pull switch shall be located at each exit from the protected hazard and shall have an advisory sign, FIKE P/N 02-10312, provided at each location.

**F) ABORT STATION (Switch):**

Abort Station (switch) shall be “NOT” used on a Carbon Dioxide system that must conform to NFPA 12.

**G) AUDIBLE and VISUAL ALARMS:**

Alarm audible and visual signal devices shall operate from the SHP PRO Control Panel.

- 1) The Alarm Bell, Alarm Horn and Horn/Strobe devices shall be FIKE P/N's 20-XXX, or equal in quality, performance and features. A label shall be attached to the strobe lens when required.
- 2) The visual alarm unit shall be a FIKE P/N 20-XXX Vertical Strobe device, or equal in quality, performance and features. A label shall be attached to the strobe lens when required.
- 3) A Strobe device shall be placed outside, and above, each exit door from the protected space. Provide an advisory sign, FIKE P/N 02-10313, at each light location.

**H) CAUTION and ADVISORY SIGNS:**

Provide signs, as required, to comply with NFPA 12 and the recommendations of the equipment supplier:

- 1) P/N C70-1032 - Warning Sign / Manual Actuation (Locate at cylinders)
- 2) P/N C70-1033 - Warning Sign / Operation of Manual Lever (Locate at cylinders)
- 3) P/N C70-1034 - Caution Sign / Vacate Immediately (Nearby space)
- 4) P/N C70-1035 - Warning Sign / Vacate Immediately (Inside room)
- 5) P/N C70-1081 - Warning Sign / Do Not Enter (Outside of Door(s) into Hazard Space)

**I) AUXILIARY PANELS: (Optional)**

- 1) A Graphic Annunciator panel will be mounted adjacent to the SHP Pro control panel. The graphic annunciator shall show a scale layout of the protected area(s) and have indicator LEDs to locate each system detector and/or other system components. The panel shall have a lamp test switch located on the panel face. Other panel options shall be available.  
Scale shall not be less than 1/8" = 1'-0" (1:100 m).

**J) SYSTEM and CONTROL WIRING:**

- 1) All system wiring shall be furnished and installed by the contractor.
- 2) All wiring shall be installed in electrical metallic tubing (EMT), or conduit, and must be installed and kept separate from all other building wiring.
- 3) All system components shall be securely supported independent of the wiring. Runs of conduit and wiring shall be straight, neatly arranged, properly supported, installed parallel and perpendicular to walls and partitions.



- 4) The sizes of the conductors shall be those specified by the manufacturer. Color coded wire shall be used. All wires shall be tagged at all junction points and shall be free from shorts, earth connections (unless so noted on the system drawings), and crosses between conductors. Final terminations between the Cheetah Xi control panel and the system field wiring shall be made under the direct supervision of a factory trained representative.
- 5) All wiring shall be installed by qualified individuals, in a neat and workmanlike manner, to conform to the National Electrical Code, Article 725, and Article 760, except as otherwise permitted for limited energy circuits, as described in NFPA 72 current edition. Wiring installation shall meet all local, state, province and/or country codes.
- 6) The complete system electrical installation, and all auxiliary components, shall be connected to earth ground in accordance with the National Electrical Code.

**K) SYSTEM INSPECTION and CHECKOUT:**

After the system installation has been completed, the entire system shall be checked out, inspected and functionally tested by qualified, trained personnel, in accordance with the manufacturer's recommended procedures and NFPA standards.

- 1) All cylinders and distribution piping shall be checked for proper mounting and installation.
- 2) All electrical wiring shall be tested for proper connection, continuity and resistance to earth.
- 3) The complete system shall be functionally tested, in the presence of the owner or his representative, and all functions, including system and equipment interlocks, must be operational at least five (5) days prior to the final acceptance tests.
  - a) Each detector shall be tested in accordance with the manufacturers recommended procedures, and test values recorded.
  - b) All system and equipment interlocks, such as door release devices, audible and visual devices, equipment shutdowns, local and remote alarms, etc. shall function as required and designed.
  - c) Each control panel circuit shall be tested for trouble by inducing a trouble condition into the system.

**L) TRAINING REQUIREMENTS:**

Prior to final acceptance, the installing contractor shall provide operational training to each shift of the owners personnel. Each training session shall include system operation (automatic and manual), trouble procedures, supervisory procedures, auxiliary functions and emergency procedures.

**M) OPERATION and MAINTENANCE:**

Prior to final acceptance, the installing contractor shall provide complete operation and maintenance instruction manuals, four (4) copies for each system, to the owner. All aspects of system operation and maintenance shall be detailed, including piping isometrics, wiring diagrams of all circuits, a written description of the system design, sequence of operation and drawing(s) illustrating control logic and equipment used in the system. Checklists and procedures for emergency situations, troubleshooting techniques, maintenance operations and procedures shall be included in the manual.

**N) AS-BUILT DRAWINGS:**

Upon completion of each system, the installing contractor shall provide four (4) copies of system "As-Built" drawings to the owner. The drawings shall show actual installation details including all equipment locations (i.e.: control panel(s), agent cylinder(s), detectors, alarms, manuals and aborts, etc.) as well as piping and conduit routing details. Show all room or facilities modifications, including door and/or damper installations completed. One (1) copy of reproducible engineering drawings shall be provided reflecting all actual installation details.

**O) ACCEPTANCE TESTS:**

- 1) At the time "As-Built" drawings and maintenance/operations manuals are submitted, the installing contractor shall submit a "Test Plan" describing procedures to be used to test the control system(s). The Test Plan shall include a step-by-step description of all tests to be performed and shall indicate the type and location of test apparatus to be employed. The tests shall demonstrate that the operational and installation requirements of this specification have been met. All tests shall be conducted in the presence of the owner and shall not be conducted until the Test Plan has been approved.
- 2) The tests shall demonstrate that the entire control system functions as designed and intended. All circuits shall be tested: automatic actuation, solenoid and manual actuation, HVAC and power shutdowns, audible and visual alarm devices and manual override of abort functions. Supervision of all panel circuits, including AC power and battery power supplies, shall be tested and qualified.
- 3) A room pressurization test shall be conducted, in each protected space, to determine the presence of openings, which would affect the agent system concentration levels. The test(s) shall be conducted using the Retro-Tec Corp. Door Fan system, or equivalent, with integrated computer program. All testing shall be in accordance with NFPA 2001, current edition.
- 4) If room pressurization testing indicates that openings exist which would result in leakage and/or loss of the extinguishing agent, the installing contractor shall be responsible for coordinating the proper sealing of the protected space(s) by the general contractor or his sub-contractor or agent. The general contractor shall be responsible for adequately sealing all protected space(s) against agent loss or leakage. The installing contractor shall inspect all work to ascertain that the protected space(s) have been adequately and properly sealed.

THE SUPPRESSION SYSTEM INSTALLING CONTRACTOR SHALL BE RESPONSIBLE FOR THE SUCCESS OF THE ROOM PRESSURIZATION TESTS.

- 5) If the first room pressurization test is not successful, in accordance with these specifications, the installing contractor shall direct the general contractor to determine, and correct, the cause of the test failure. The installing contractor shall conduct additional room pressurization tests, at no additional cost to the owner, until a successful test is obtained. Copies of successful test results shall be submitted to the owner for record.
- 6) Upon the successful completion of the room integrity testing, the installing contractor shall conduct a full discharge test of the Fike Carbon Dioxide Suppression System(s) installed, as outlined in NFPA 12, current edition.
- 7) When conducting a discharge test in a Total Flood application, a 3 point concentration test strip recorder should be used to provide a record of CO<sub>2</sub> concentration and hold times.
- 8) Upon acceptance by the owner, the completed system(s) shall be placed into service.

**P) SYSTEM INSPECTIONS:**

- 1) The installing contractor shall provide two (2) inspections of each system, installed under this contract, during the one-year warranty period. The first inspection shall be at the six month interval, and the second inspection at the 12 month interval, after system acceptance. Inspections shall be conducted in accordance with the manufacturer's guidelines, and the recommendations of NFPA 12.
- 2) Documents certifying satisfactory system(s) operation shall be submitted to the owner upon completion of each inspection.

**Q) WARRANTY:**

All Fike system components furnished, and installed under this contract, shall be guaranteed against defects in design, materials and workmanship for the full warranty period which is standard with the manufacturer, but in no case less than one (1) year from the date of system acceptance.