

**PART 1 GENERAL****1.1 RELATED DOCUMENTS**

- A. The requirements of the General Conditions, Supplementary Conditions and the following specification sections apply to all Work herein:
  - 1. Section 21 00 10 - General Requirements
  - 2. Section 21 00 20 - Scope of Work

**1.2 SUMMARY**

- A. Provide all Pre-functional Testing, Functional Testing and Integrated Systems Testing to demonstrate proper operation as required by these Specifications, the City of San Francisco, and the Authorities Having Jurisdiction of the Fire Suppression system, equipment and components as indicated on the Drawings and as specified herein. Tests shall include, but not be limited to the items specified in this section and in other Division 21 Specification sections.
- B. The Division 21 Subcontractor shall take the lead responsibility for inspecting, completing and documenting the Pre-Functional Testing for the Fire Suppression Systems to ensure the systems are fully operational and ready for Functional Testing.
- C. The Division 21 Subcontractor shall take the lead responsibility for demonstrating the operations of the Fire Suppression systems for the Functional Tests.
- D. Testing shall in no way relieve the Subcontractor of the warranty requirements.
- E. The Subcontractor shall furnish all fuel and water required in performing the testing, balancing and adjusting of fire suppression systems.

**1.3 REFERENCE STANDARDS**

- A. All testing shall be performed in accordance with the latest applicable industry standards, those standards referenced in the applicable Divisions 21 specifications, including the following:
  - 1. NFPA 3
  - 2. NFPA 13
  - 3. NFPA 14
  - 4. NFPA 20
  - 5. NFPA 25
  - 6. NEBB "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems"
  - 7. AABC National Standards
- B. All equipment and material to be furnished and installed on this Project shall be UL or ETL listed, in accordance with the requirements of the authorities having jurisdiction and suitable for its intended use on this Project.

**1.4 SUBMITTALS**

- A. The following submittal data shall be furnished according to the General Conditions, Section 21 00 10, and in accordance with the Subcontractor Scheduling Procedures in Section 21 00 20 titled "Fire Suppression Scope of Work" and shall include, but not be limited to:
  - 1. Proposed test procedures, recording forms, test equipment, and list of personnel and qualifications for all tests proposed. Refer to Section 26 08 13 titled "Testing" for additional requirements.
  - 2. Recording Forms.
    - a. Pre-Functional Test forms.
    - b. Functional Test forms.
    - c. Integrated Testing forms.
    - d. Sequence of Operation Test forms.
  - 3. Test Data and Results including the following:
    - a. Test performed.

- b. Test procedure.
- c. System and area tested.
- d. Date(s) and time(s) of test.
- e. Weather conditions.
- f. Test criteria.
- g. Test results.
- h. Additional pertinent data.
- i. Instruments including documentation that such instruments were properly calibrated at the time of the testing.
- j. Personnel printed name, title, company, and signature of persons who performed the test.

## **PART 2 PRODUCTS**

### **2.1 TESTING MATERIALS**

- A. Provide all materials and test equipment required for testing of specified fire suppression system components, including any retests required to obtain acceptable results.
- B. Testing materials that fail to provide acceptable test results shall be repaired or replaced with suitable materials as required to obtain acceptable test results.

## **PART 3 EXECUTION**

### **3.1 FACTORY TESTING**

- A. All factory testing shall be performed in accordance with the latest applicable industry standards, with the manufacturer's recommendations and as specified in the applicable Division 21 specification.

### **3.2 FIELD TESTING OF FIRE SUPPRESSION SYSTEMS**

- A. During the progress of the Work, tests shall be made as specified herein and as required by authorities having jurisdiction, including local inspectors, Owner, Owner's Insuring Agency, Architect or Engineer. Tests shall be conducted by the Fire Suppression Subcontractor as part of the Work of this Division and shall include all qualified personnel, equipment apparatus and services required to perform the tests. Comply with the procedures, methods, and documentation as outlined in NFPA 3 – Recommended Practice for Commissioning and Integrated Testing of Fire Protection and Life Safety Systems.
- B. In accordance with the Subcontractor Scheduling Procedures in Section 21 00 20 titled "Scope of Work", the Fire Suppression Subcontractor shall submit in writing proposed test procedures, recording forms, list of personnel and qualifications and test equipment for the Engineer's and Owner's review.
- C. Perform a demonstration and operating test of the entire Fire Suppression System as required by the Owner and the local authorities.
- D. Field vibration and alignment measurements shall be taken on every piece of the following listed equipment driven by a motor over 20 HP which appear in the judgment of the Engineer to have vibration, which exceeds the maximum vibration specified hereinafter. Readings shall include shaft alignment, equipment vibration, bearing housing vibration, foundation vibration, building structure vibration and other tests as directed by the Engineer. Readings will be made using portable IRD (or approved equal) equipment capable of filtering out various unwanted frequencies and standard reporting forms. Maximum vibration at any point listed above or specified shall not exceed 2 mils on pumps unless otherwise specified. Equipment manufacturers shall certify in writing that the field readings, which do not exceed the maximum specified, are acceptable to them. Vibration and alignment readings shall be taken by an independent testing agency. Submit qualifications of the independent testing agency to the Engineer for review.
- E. Fire protection system, sprinkler system and valve threads shall be tested in accordance with current NFPA 13, 14 and 20 Standards and as specified in Section 21 13 00 titled "Fire Protection Sprinkler Systems". Fire pumps shall be tested as specified in Section 21 30 00 titled "Fire Pumps and Controllers".

- F. Hydrostatic Pressure Testing: Before piping of various systems is insulated, furred in or otherwise covered, hydrostatic leak tests shall be conducted as specified below:
1. Vents shall be provided at all high points of the piping system in the position, in which the test is to be conducted to purge air pockets while the component or systems is filling. Venting during the filling of the system may be provided by the loosening of flanges having a minimum of four bolts or by the use of equipment vents.
  2. The test equipment shall be examined before pressure is applied to ensure that it is tightly connected. Pressure gauges shall be calibrated before the testing. Gauges shall read in not more than 2 psig increments. All low pressure filling lines and all other items not subject to the test pressure shall be disconnected or isolated by valves or other suitable means.
  3. The hydrostatic test pressure shall be 1-1/2 times the system working pressures listed in Section 21 05 07 titled "Design Conditions" except that the maximum test pressure shall not exceed 500 psig. Note: Equipment must be valved off or removed during the test if the pressure rating is lower than the test pressure. Equipment and piping shall be drained and protected anytime the ambient temperature is below freezing.
  4. The hydrostatic test pressure shall be continuously maintained for a minimum of eight (8) hours after which each joint, connection, etc., shall be visually examined to verify there is no evidence of weeping or leakage. The test may be witnessed by the Engineer if he so desires and pronounced satisfactory before pressure is removed or any water is drained off.
  5. The Subcontractor shall maintain a hydrostatic test log listing the system tested, portion tested, date of test, start time and pressure, finish time, pressure and test supervisor for each hydrostatic test. The hydrostatic test log shall be submitted to the Engineer and Owner for record prior to substantial completion of the Project.
- G. Pumps shall be tested to check impeller trim and operating characteristics. The following data shall be recorded and submitted to the Engineer for review. See Section 21 00 10 for requirements.
1. Flow at operating conditions where flow venturi or turbine type flow meters are installed in the system.
  2. Shutoff pressure required to check impeller trim.
  3. Discharge pressure at operating conditions.
  4. Suction pressure at operating conditions.
  5. Motor amperage and voltage on each phase at operating conditions.
  6. Record coupling alignment data, both face and radial, to verify alignment is within coupling tolerances.
- H. The Subcontractor shall demonstrate operating controls, control sequences and safety devices on the fire pump systems. The demonstration shall be conducted by a factory trained engineer from the manufacturer's plant.
- I. The Subcontractor shall prove the capacity and performance and/or demonstrate operating controls and safety devices of each piece of equipment by field tests as requested and/or specified in various sections of these Specifications. All equipment and instruments required for tests as well as additional thermowells or gauge connections shall be installed at no additional cost to the Owner. A qualified representative of the equipment manufacturer shall be present at the test. The Engineer may witness tests, if he so desires. The Subcontractor shall notify the Engineer and Owner in writing, at least three (3) weeks prior to the day of the test. See Section 21 00 10 for additional requirements.
- J. Refer to Division 25 BMCS specifications for testing requirements related to the communications interfaces with the Division 21 systems and equipment.
- K. Leaks, damage, or defects discovered or resulting from tests shall be repaired or replaced to a like new condition. Leaky pipe joints, etc., shall be removed and replaced with acceptable materials.
- L. All equipment and instruments required for tests as well as additional thermometer wells, gauge and instrument connections shall be installed at no additional cost to the Owner.
- M. All instruments used for testing and balancing must have been calibrated within a period of three (3) months prior to balancing. Instrument calibration shall be certified as specified in Section 21 00 10.
- N. Submit six (6) copies of each complete testing and balancing report to the Engineer for review and send two (2) copies of the report to the Owner. The Subcontractor shall submit individual testing and balance reports

for each individual floor air distribution system and each ventilation system in accordance with the Subcontractor Scheduling Procedures in Section 21 00 20 titled "Fire Suppression Scope of Work".

- O. The foregoing shall in no way relieve the Contractor of any warranty requirements.

**END OF SECTION**