Amendment No. 1
to
Contract No. NA170000070
for
Fire Hose Testing
between
Fire Catt L.L.C.
and the
City of Austin

1.0 The City hereby exercises the extension option for the above-referenced contract. Effective January 11, 2020, to January 10, 2021. One option remains.

2.0 The total contract amount is increased by $46,800.00 for the extension option period. The total Contract authorization is recapped below:

Term	Action Amount	Total Contract Amount
Basic Term: 01/11/2017 – 01/10/2020	$140,400.00	$140,400.00
Amendment No. 1: Option 1 01/11/2020 – 01/10/2021	$46,800.00	$187,200.00

3.0 MBE/WBE goals were established for this contract.

4.0 By signing this Amendment, the Contractor certifies that the Contractor and its principals are not currently suspended or debarred from doing business with the Federal Government, as indicated by the General Services Administration (GSA) List of Parties Excluded from Federal Procurement and Non-Procurement Programs, the State of Texas, or the City of Austin.

5.0 All other terms and conditions remain the same.

BY THE SIGNATURES affixed below, this Amendment is hereby incorporated into and made a part of the above-referenced contract.

Signature & Date: 11.20.19

Printed Name: MARC T. RADZICKY
Authorized Representative PRESIDENT

Signature & Date: 12-23-19

Cindy Reyes, Contract Management Specialist III
City of Austin
Purchasing Office

Fire Catt L.L.C.
3250 W. Big Beaver Rd, Suite 544
Troy, MI 48084

CONTRACT BETWEEN THE CITY OF AUSTIN
AND
Fire Catt L.L.C.
For
Fire Hose Testing
MA 8300 NA170000070

This Contract is made by and between the City of Austin ("City"), a home-rule municipality incorporated by the State of Texas, and Fire Catt L.L.C. ("Contractor"), having offices at 3250 W. Big Beaver Rd, Suite 544, Troy, MI 48084.

SECTION 1. GRANT OF AUTHORITY, SERVICES AND DUTIES

1.1 **Engagement of the Contractor.** Subject to the general supervision and control of the City and subject to the provisions of the Terms and Conditions contained herein, the Contractor is engaged to provide the services set forth in Section 2, Scope of Work.

1.2 **Responsibilities of the Contractor.** The Contractor shall provide all technical and professional expertise, knowledge, management, and other resources required for accomplishing all aspects of the tasks and associated activities identified in the Scope of Work. In the event that the need arises for the Contractor to perform services beyond those stated in the Scope of Work, the Contractor and the City shall negotiate mutually agreeable terms and compensation for completing the additional services.

1.3 **Responsibilities of the City.** The City's Contract Manager will be responsible for exercising general oversight of the Contractor's activities in completing the Scope of Work. Specifically, the Contract Manager will represent the City's interests in resolving day-to-day issues that may arise during the term of this Contract, shall participate regularly in conference calls or meetings for status reporting, shall promptly review any written reports submitted by the Contractor, and shall approve all invoices for payment, as appropriate. The City's Contract Manager shall give the Contractor timely feedback on the acceptability of progress and task reports.

1.4 **Designation of Key Personnel.** The Contractor's Contract Manager for this engagement shall be Marc Radecky, Phone: 248-318-3811, Email Address: mradecky@firecatt.com. The City's Contract Manager for the engagement shall be Karen Bitzer, Phone: (512) 974-4131, Email Address: Karen.Bitzer@austintexas.gov. The City and the Contractor resolve to keep the same key personnel assigned to this engagement throughout its term. In the event that it becomes necessary for the Contractor to replace any key personnel, the replacement will be an individual having equivalent experience and competence in executing projects such as the one described herein. Additionally, the Contractor will promptly notify the City Contract Manager and obtain approval for the replacement. Such approval shall not be unreasonably withheld.

SECTION 2. SCOPE OF WORK

2.1 **Contractor's Obligations.** The Contractor shall fully and timely provide all deliverables described herein and in the Contractor's Offer in strict accordance with the terms, covenants, and conditions of the Contract and all applicable Federal, State, and local laws, rules, and regulations.

2.2 **Tasks.** In order to accomplish the work described herein, the Contractor shall perform the tasks outlined in Exhibit C to this Contract.

SECTION 3. COMPENSATION

3.1 **Contract Amount.** The Contractor will be paid as indicated herein upon the successful completion of the Scope of Work. In consideration for the services to be performed under this Contract, the Contractor shall be paid an amount not-to-exceed $140,400 for the initial contract term and $46,800 for each extension option for all fees and expenses.

3.2 **Economic Price Adjustment.**

3.2.1. **Price Adjustments.** Prices shown in this Contract shall remain firm for the first twelve (12) month period of the Contract. After that, in recognition of the potential for fluctuation of the Contractor's cost, a price adjustment (increase or decrease) may be requested by either the City or the Contractor on the anniversary date of the Contract or as may otherwise be specified herein. The percentage change between

the contract price and the requested price shall not exceed the percentage change between the specified index in effect on the date the solicitation closed and the most recent, non-preliminary data at the time the price adjustment is requested. The requested price adjustment shall not exceed ten percent (10%) for any single line item and in no event shall the total amount of the contract be automatically adjusted as a result of the change in one or more line item made pursuant to this provision. Prices for product or services unaffected by verifiable cost trends shall not be subject to adjustment.

3.2.2 **Effective Date.** Approved price adjustments will go into effect on the first day of the upcoming renewal period or anniversary date of contract award and remain in effect until contract expiration unless changed by subsequent amendment.

3.2.3 **Adjustments.** A request for price adjustment must be made in writing and submitted to the other Party prior to the yearly anniversary date of the Contract; adjustments may only be considered at that time unless otherwise specified herein. Requested adjustments must be solely for the purpose of accommodating changes in the Contractor's direct costs. Contractor shall provide an updated price listing once agreed to adjustment(s) have been approved by the parties.

3.2.4 **Indexes.** In most cases an index from the Bureau of Labor Standards (BLS) will be utilized; however, if there is more appropriate, industry recognized standard then that index may be selected.

3.2.4.1 The following definitions apply:

3.2.4.1.1 **Base Period.** Month and year of the original contracted price (the solicitation close date).

3.2.4.1.2 **Base Price.** Initial price quoted, proposed and/or contracted per unit of measure.

3.2.4.1.3 **Adjusted Price.** Base Price after it has been adjusted in accordance with the applicable index change and instructions provided.

3.2.4.1.4 **Change Factor.** The multiplier utilized to adjust the Base Price to the Adjusted Price.

3.2.4.1.5 **Weight %.** The percent of the Base Price subject to adjustment based on an index change.

3.2.4.2 **Adjustment-Request Review.** Each adjustment-request received will be reviewed and compared to changes in the index(es) identified below. Where applicable:

3.2.4.2.1 Utilize final Compilation data instead of Preliminary data

3.2.4.2.2 If the referenced index is no longer available shift up to the next higher category index.

3.2.4.3 **Index Identification.** Complete table as they may apply.

Weight % of Base Price: 100%	
Database Name: Employment Cost Index	
Series ID: CIU2010000300000I (B)	
☒ Not Seasonally Adjusted	☐ Seasonally Adjusted
Geographical Area: United States	
Description of Series ID: Total compensation for Private industry workers in Service occupations	

3.2.5 **Calculation.** Price adjustment will be calculated as follows:

3.2.5.1 **Single Index.** Adjust the Base Price by the same factor calculated for the index change.

Index at time of calculation
Divided by index on solicitation close date

Equals Change Factor
Multiplied by the Base Rate
Equals the Adjusted Price

3.2.6 If the requested adjustment is not supported by the referenced index, the City, at its sole discretion, may consider approving an adjustment on fully documented market increases.

3.3 **Invoices.**

3.3.1 **Invoices shall contain a unique invoice number, the purchase order or delivery order number and the master agreement number if applicable, the Department's Name, and the name of the point of contact for the Department**. Invoices shall be itemized. The Contractor's name and, if applicable, the tax identification number on the invoice must exactly match the information in the Contractor's registration with the City. Unless otherwise instructed in writing, the City may rely on the remittance address specified on the Contractor's invoice. Invoices received without all required information cannot be processed and will be returned to the Contractor. Invoices shall be mailed to the below address:

	City of Austin
Department	Austin Fire Department
Attn:	Accounts Payable
Address	4201 Ed Bluestein Blvd
City, State, Zip Code	Austin, TX 78721

3.3.2 Invoices for labor shall include a copy of all time-sheets with trade labor rate and deliverables order number clearly identified. Invoices shall also include a tabulation of work-hours at the appropriate rates and grouped by work order number. Time billed for labor shall be limited to hours actually worked at the work site.

3.3.3 Unless otherwise expressly authorized in the Contract, the Contractor shall pass through all Subcontract and other authorized expenses at actual cost without markup.

3.3.4 Federal excise taxes, State taxes, or City sales taxes must not be included in the invoiced amount. The City will furnish a tax exemption certificate upon request.

3.4 **Payment.**

3.4.1 All proper invoices received by the City will be paid within thirty (30) calendar days of the City's receipt of the deliverables or of the invoice, whichever is later.

3.4.2 **If payment is not timely made, (per this paragraph), interest shall accrue on the unpaid balance at the lesser of the rate specified in Texas Government Code Section 2251.025 or the maximum lawful rate; except, if payment is not timely made for a reason for which the City may withhold payment hereunder, interest shall not accrue until ten (10) calendar days after the grounds for withholding payment have been resolved.**

3.4.3 The City may withhold or off set the entire payment or part of any payment otherwise due the Contractor to such extent as may be necessary on account of:

3.4.3.1 delivery of defective or non-conforming deliverables by the Contractor;

3.4.3.2 third party claims, which are not covered by the insurance which the Contractor is required to provide, are filed or reasonable evidence indicating probable filing of such claims;

3.4.3.3 failure of the Contractor to pay Subcontractors, or for labor, materials or equipment;

3.4.3.4 damage to the property of the City or the City's agents, employees or contractors, which is not covered by insurance required to be provided by the Contractor;

3.4.3.5 reasonable evidence that the Contractor's obligations will not be completed within the time specified in the Contract, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

3.4.3.6 failure of the Contractor to submit proper invoices with all required attachments and supporting documentation; or

3.4.3.7 failure of the Contractor to comply with any material provision of the Contract Documents.

3.4.4 Notice is hereby given of Article VIII, Section 1 of the Austin City Charter which prohibits the payment of any money to any person, firm or corporation who is in arrears to the City for taxes, and of §2-8-3 of the Austin City Code concerning the right of the City to offset indebtedness owed the City.

3.4.5 Payment will be made by check unless the parties mutually agree to payment by credit card or electronic transfer of funds. The Contractor agrees that there shall be no additional charges, surcharges, or penalties to the City for payments made by credit card or electronic transfer of funds.

3.5 **Non-Appropriation.** The awarding or continuation of this Contract is dependent upon the availability of funding. The City's payment obligations are payable only and solely from funds Appropriated and available for this Contract. The absence of Appropriated or other lawfully available funds shall render the Contract null and void to the extent funds are not Appropriated or available and any deliverables delivered but unpaid shall be returned to the Contractor. The City shall provide the Contractor written notice of the failure of the City to make an adequate Appropriation for any fiscal year to pay the amounts due under the Contract, or the reduction of any Appropriation to an amount insufficient to permit the City to pay its obligations under the Contract. In the event of non or inadequate appropriation of funds, there will be no penalty nor removal fees charged to the City.

3.6 **Reimbursable Expenses.** Reimbursable expenses are not allowable under this contract.

3.7 **Final Payment and Close-Out.**

3.7.1 The making and acceptance of final payment will constitute:

3.7.1.1 a waiver of all claims by the City against the Contractor, except claims (1) which have been previously asserted in writing and not yet settled, (2) arising from defective work appearing after final inspection, (3) arising from failure of the Contractor to comply with the Contract or the terms of any warranty specified herein, (4) arising from the Contractor's continuing obligations under the Contract, including but not limited to indemnity and warranty obligations, or (5) arising under the City's right to audit; and

3.7.1.2 a waiver of all claims by the Contractor against the City other than those previously asserted in writing and not yet settled.

SECTION 4. TERM AND TERMINATION

4.1 **Term of Contract.** The Contract shall be in effect for an initial term of thirty six (36) months and may be extended thereafter for up to two (2) additional twelve (12) month periods, subject to the approval of the Contractor and the City Purchasing Officer or his designee.

4.1.1 Upon expiration of the initial term or period of extension, the Contractor agrees to hold over under the terms and conditions of this Contract for such a period of time as is reasonably necessary to re-solicit and/or complete the project (not to exceed 120 calendar days unless mutually agreed on in writing).

4.1.2 This is a 36 month Contract. Prices are firm for the first twelve (12) months.

4.2 **Right To Assurance.** Whenever one party to the Contract in good faith has reason to question the other party's intent to perform, demand may be made to the other party for written assurance of the intent to perform. In the event that no assurance is given within the time specified after demand is made, the demanding party may treat this failure as an anticipatory repudiation of the Contract.

4.3 **Default.** The Contractor shall be in default under the Contract if the Contractor (a) fails to fully, timely and faithfully perform any of its material obligations under the Contract, (b) fails to provide adequate assurance of performance under the "Right to Assurance paragraph herein, (c) becomes insolvent or seeks relief under the

bankruptcy laws of the United States or (d) makes a material misrepresentation in Contractor's Offer, or in any report or deliverable required to be submitted by Contractor to the City.

4.4 **Termination For Cause.** In the event of a default by the Contractor, the City shall have the right to terminate the Contract for cause, by written notice effective ten (10) calendar days, unless otherwise specified, after the date of such notice, unless the Contractor, within such ten (10) day period, cures such default, or provides evidence sufficient to prove to the City's reasonable satisfaction that such default does not, in fact, exist. The City may place Contractor on probation for a specified period of time within which the Contractor must correct any non-compliance issues. Probation shall not normally be for a period of more than nine (9) months, however, it may be for a longer period, not to exceed one (1) year depending on the circumstances. If the City determines the Contractor has failed to perform satisfactorily during the probation period, the City may proceed with suspension. In the event of a default by the Contractor, the City may suspend or debar the Contractor in accordance with the "City of Austin Purchasing Office Probation, Suspension and Debarment Rules for Vendors" and remove the Contractor from the City's vendor list for up to five (5) years and any Offer submitted by the Contractor may be disqualified for up to five (5) years. In addition to any other remedy available under law or in equity, the City shall be entitled to recover all actual damages, costs, losses and expenses, incurred by the City as a result of the Contractor's default, including, without limitation, cost of cover, reasonable attorneys' fees, court costs, and prejudgment and post-judgment interest at the maximum lawful rate. All rights and remedies under the Contract are cumulative and are not exclusive of any other right or remedy provided by law.

4.5 **Termination Without Cause.** The City shall have the right to terminate the Contract, in whole or in part, without cause any time upon thirty (30) calendar days prior written notice. Upon receipt of a notice of termination, the Contractor shall promptly cease all further work pursuant to the Contract, with such exceptions, if any, specified in the notice of termination. The City shall pay the Contractor, to the extent of funds Appropriated or otherwise legally available for such purposes, for all goods delivered and services performed and obligations incurred prior to the date of termination in accordance with the terms hereof.

4.6 **Fraud.** Fraudulent statements by the Contractor on any Offer or in any report or deliverable required to be submitted by the Contractor to the City shall be grounds for the termination of the Contract for cause by the City and may result in legal action.

SECTION 5. OTHER DELIVERABLES

5.1 **Insurance**: The following insurance requirements apply.

5.1.1 **General Requirements.**

5.1.1.1 The Contractor shall at a minimum carry insurance in the types and amounts indicated herein for the duration of the Contract and during any warranty period.

5.1.1.2 The Contractor shall provide a Certificate of Insurance as verification of coverages required below to the City at the below address prior to Contract execution and within fourteen (14) calendar days after written request from the City.

5.1.1.3 The Contractor must also forward a Certificate of Insurance to the City whenever a previously identified policy period has expired, or an extension option or holdover period is exercised, as verification of continuing coverage.

5.1.1.4 The Contractor shall not commence work until the required insurance is obtained and has been reviewed by City. Approval of insurance by the City shall not relieve or decrease the liability of the Contractor hereunder and shall not be construed to be a limitation of liability on the part of the Contractor.

5.1.1.5 The City may request that the Contractor submit certificates of insurance to the City for all subcontractors prior to the subcontractors commencing work on the project.

5.1.1.6 The Contractor's and all subcontractors' insurance coverage shall be written by companies licensed to do business in the State of Texas at the time the policies are issued and shall be written by companies with A.M. Best ratings of B+VII or better.

5.1.1.7 All endorsements naming the City as additional insured, waivers, and notices of cancellation endorsements as well as the Certificate of Insurance shall be mailed to the following address:

City of Austin
Purchasing Office
P. O. Box 1088
Austin, Texas 78767

5.1.1.8 The "other" insurance clause shall not apply to the City where the City is an additional insured shown on any policy. It is intended that policies required in the Contract, covering both the City and the Contractor, shall be considered primary coverage as applicable.

5.1.1.9 If insurance policies are not written for amounts specified in Paragraph 5.1.2, Specific Coverage Requirements, the Contractor shall carry Umbrella or Excess Liability Insurance for any differences in amounts specified. If Excess Liability Insurance is provided, it shall follow the form of the primary coverage.

5.1.1.10 The City shall be entitled, upon request, at an agreed upon location, and without expense, to review certified copies of policies and endorsements thereto and may make any reasonable requests for deletion or revision or modification of particular policy terms, conditions, limitations, or exclusions except where policy provisions are established by law or regulations binding upon either of the parties hereto or the underwriter on any such policies.

5.1.1.11 The City reserves the right to review the insurance requirements set forth during the effective period of the Contract and to make reasonable adjustments to insurance coverage, limits, and exclusions when deemed necessary and prudent by the City based upon changes in statutory law, court decisions, the claims history of the industry or financial condition of the insurance company as well as the Contractor.

5.1.1.12 The Contractor shall not cause any insurance to be canceled nor permit any insurance to lapse during the term of the Contract or as required in the Contract.

5.1.1.13 The Contractor shall be responsible for premiums, deductibles and self-insured retentions, if any, stated in policies. All deductibles or self-insured retentions shall be disclosed on the Certificate of Insurance.

5.1.1.14 The Contractor shall endeavor to provide the City thirty (30) calendar days written notice of erosion of the aggregate limits below occurrence limits for all applicable coverages indicated within the Contract.

5.1.2 **Specific Coverage Requirements.** The Contractor shall at a minimum carry insurance in the types and amounts indicated below for the duration of the Contract, including extension options and hold over periods, and during any warranty period. These insurance coverages are required minimums and are not intended to limit the responsibility or liability of the Contractor.

5.1.2.1 **Commercial General Liability Insurance.** The minimum bodily injury and property damage per occurrence are $500,000 for coverages A (Bodily Injury and Property Damage) and B (Personal and Advertising Injuries). The policy shall contain the following provisions and endorsements.

5.1.2.1.1 Contractual liability coverage for liability assumed under the Contract and all other Contracts related to the project.

5.1.2.1.2 Contractor/Subcontracted Work.

5.1.2.1.3 Products/Completed Operations Liability for the duration of the warranty period.

5.1.2.1.4 Waiver of Subrogation, Endorsement CG 2404, or equivalent coverage.

5.1.2.1.5 Thirty (30) calendar days Notice of Cancellation, Endorsement CG 0205, or equivalent coverage.

5.1.2.1.6 The City of Austin listed as an additional insured, Endorsement CG 2010, or equivalent coverage.

5.1.2.2 **Business Automobile Liability Insurance.** The Contractor shall provide coverage for all owned, non-owned and hired vehicles with a minimum combined single limit of $500,000 per occurrence for bodily injury and property damage. Alternate acceptable limits are $250,000 bodily injury per person, $500,000 bodily injury per occurrence and at least $100,000 property damage liability per accident. The policy shall contain the following endorsements:

5.1.2.2.1 Waiver of Subrogation, Endorsement CA0444, or equivalent coverage.

5.1.2.2.2 Thirty (30) calendar days Notice of Cancellation, Endorsement CA0244, or equivalent coverage.

5.1.2.2.3 The City of Austin listed as an additional insured, Endorsement CA2048, or equivalent coverage.

5.1.2.3 **Worker's Compensation and Employers' Liability Insurance.** Coverage shall be consistent with statutory benefits outlined in the Texas Worker's Compensation Act (Section 401). The minimum policy limits for Employer's Liability are $100,000 bodily injury each accident, $500,000 bodily injury by disease policy limit and $100,000 bodily injury by disease each employee. The policy shall contain the following provisions and endorsements:

5.1.2.3.1 The Contractor's policy shall apply to the State of Texas.

5.1.2.3.2 Waiver of Subrogation, Form WC420304, or equivalent coverage.

5.1.2.3.3 Thirty (30) calendar days Notice of Cancellation, Form WC420601, or equivalent coverage.

5.1.2.5 **Endorsements.** The specific insurance coverage endorsements specified above, or their equivalents must be provided. In the event that endorsements, which are the equivalent of the required coverage, are proposed to be substituted for the required coverage, copies of the equivalent endorsements must be provided for the City's review and approval.

5.2 **Equal Opportunity.**

5.2.1 **Equal Employment Opportunity.** No Contractor, or Contractor's agent, shall engage in any discriminatory employment practice as defined in Chapter 5-4 of the City Code. No Offer submitted to the City shall be considered, nor any Purchase Order issued, or any Contract awarded by the City unless the Offeror has executed and filed with the City Purchasing Office a current Non-Discrimination Certification. Non-compliance with Chapter 5-4 of the City Code may result in sanctions, including termination of the contract and the Contractor's suspension or debarment from participation on future City contracts until deemed compliant with Chapter 5-4.

5.2.2 **Americans With Disabilities Act (ADA) Compliance.** No Contractor, or Contractor's agent, shall engage in any discriminatory practice against individuals with disabilities as defined in the ADA, including but not limited to: employment, accessibility to goods and services, reasonable accommodations, and effective communications.

5.3 **Acceptance of Incomplete or Non-Conforming Deliverables.** If, instead of requiring immediate correction or removal and replacement of defective or non-conforming deliverables, the City prefers to accept it, the City may do so. The Contractor shall pay all claims, costs, losses and damages attributable to the City's evaluation of and determination to accept such defective or non-conforming deliverables. If any such acceptance occurs prior to final payment, the City may deduct such amounts as are necessary to compensate the City for the diminished value of the defective or non-conforming deliverables. If the acceptance occurs after final payment, such amount will be refunded to the City by the Contractor.

5.4 **Delays.**

5.4.1 The City may delay scheduled delivery or other due dates by written notice to the Contractor if the City deems it is in its best interest. If such delay causes an increase in the cost of the work under the Contract, the City and the Contractor shall negotiate an equitable adjustment for costs incurred by the Contractor in the Contract price and execute an amendment to the Contract. The Contractor must assert its right to an adjustment within thirty (30) calendar days from the date of receipt of the notice of delay. Failure to agree on any adjusted price shall be handled under the Dispute Resolution process specified herein. However, nothing in this provision shall excuse the Contractor from delaying the delivery as notified.

5.4.2 Neither party shall be liable for any default or delay in the performance of its obligations under this Contract if, while and to the extent such default or delay is caused by acts of God, fire, riots, civil commotion, labor disruptions, sabotage, sovereign conduct, or any other cause beyond the reasonable control of such Party. In the event of default or delay in Contract performance due to any of the foregoing causes, then the time for completion of the services will be extended; provided, however, in such an event, a conference will be held within three (3) business days to establish a mutually agreeable period of time reasonably necessary to overcome the effect of such failure to perform.

SECTION 6. WARRANTIES

6.1 **Warranty – Price.**

6.1.1 The Contractor warrants the prices quoted in the Offer are no higher than the Contractor's current prices on orders by others for like deliverables under similar terms of purchase.

6.1.2 The Contractor certifies that the prices in the Offer have been arrived at independently without consultation, communication, or agreement for the purpose of restricting competition, as to any matter relating to such fees with any other firm or with any competitor.

6.1.3 In addition to any other remedy available, the City may deduct from any amounts owed to the Contractor, or otherwise recover, any amounts paid for items in excess of the Contractor's current prices on orders by others for like deliverables under similar terms of purchase.

6.2 **Warranty – Services.** The Contractor warrants and represents that all services to be provided to the City under the Contract will be fully and timely performed in a good and workmanlike manner in accordance with generally accepted industry standards and practices, the terms, conditions, and covenants of the Contract, and all applicable Federal, State and local laws, rules or regulations.

6.2.1 The Contractor may not limit, exclude or disclaim the foregoing warranty or any warranty implied by law, and any attempt to do so shall be without force or effect.

6.2.2 Unless otherwise specified in the Contract, the warranty period shall be at least one year from the acceptance date. If during the warranty period, one or more of the warranties are breached, the Contractor shall promptly upon receipt of demand perform the services again in accordance with above standard at

no additional cost to the City. All costs incidental to such additional performance shall be borne by the Contractor. The City shall endeavor to give the Contractor written notice of the breach of warranty within thirty (30) calendar days of discovery of the breach of warranty, but failure to give timely notice shall not impair the City's rights under this section.

6.2.3 If the Contractor is unable or unwilling to perform its services in accordance with the above standard as required by the City, then in addition to any other available remedy, the City may reduce the amount of services it may be required to purchase under the Contract from the Contractor, and purchase conforming services from other sources. In such event, the Contractor shall pay to the City upon demand the increased cost, if any, incurred by the City to procure such services from another source.

SECTION 7. MISCELLANEOUS

7.1 **Place and Condition of Work.** The City shall provide the Contractor access to the sites where the Contractor is to perform the services as required in order for the Contractor to perform the services in a timely and efficient manner in accordance with and subject to the applicable security laws, rules, and regulations. The Contractor acknowledges that it has satisfied itself as to the nature of the City's service requirements and specifications, the location and essential characteristics of the work sites, the quality and quantity of materials, equipment, labor and facilities necessary to perform the services, and any other condition or state of fact which could in any way affect performance of the Contractor's obligations under the Contract. The Contractor hereby releases and holds the City harmless from and against any liability or claim for damages of any kind or nature if the actual site or service conditions differ from expected conditions.

7.2 **Workforce.**

7.2.1 The Contractor shall employ only orderly and competent workers, skilled in the performance of the services which they will perform under the Contract.

7.2.2 The Contractor, its employees, subcontractors, and subcontractor's employees may not while engaged in participating or responding to a solicitation or while in the course and scope of delivering goods or services under a City of Austin contract or on the City's property:

7.2.2.1 use or possess a firearm, including a concealed handgun that is licensed under state law, except as required by the terms of the Contract; and

7.2.2.2 use or possess alcoholic or other intoxicating beverages, illegal drugs or controlled substances, nor may such workers be intoxicated, or under the influence of alcohol or drugs, on the job.

7.2.3 If the City or the City's representative notifies the Contractor that any worker is incompetent, disorderly or disobedient, has knowingly or repeatedly violated safety regulations, has possessed any firearms, or has possessed or was under the influence of alcohol or drugs on the job, the Contractor shall immediately remove such worker from Contract services, and may not employ such worker again on Contract services without the City's prior written consent.

7.3 **Compliance with Health, Safety, and Environmental Regulations.** The Contractor, its Subcontractors, and their respective employees, shall comply fully with all applicable federal, state, and local health, safety, and environmental laws, ordinances, rules and regulations in the performance of the services, including but not limited to those promulgated by the City and by the Occupational Safety and Health Administration (OSHA). In case of conflict, the most stringent safety requirement shall govern. The Contractor shall indemnify and hold the City harmless from and against all claims, demands, suits, actions, judgments, fines, penalties and liability of every kind arising from the breach of the Contractor's obligations under this paragraph.

7.4 **Significant Event.** The Contractor shall immediately notify the City's Contract Manager of any current or prospective "significant event" on an ongoing basis. All notifications shall be submitted in writing to the Contract Manager. As used in this provision, a "significant event" is any occurrence or anticipated occurrence which might

reasonably be expected to have a material effect upon the Contractor's ability to meet its contractual obligations. Significant events may include but not be limited to the following:

7.4.1 disposal of major assets;

7.4.2 any major computer software conversion, enhancement or modification to the operating systems, security systems, and application software, used in the performance of this Contract;

7.4.3 any significant termination or addition of provider contracts;

7.4.4 the Contractor's insolvency or the imposition of, or notice of the intent to impose, a receivership, conservatorship or special regulatory monitoring, or any bankruptcy proceedings, voluntary or involuntary, or reorganization proceedings;

7.4.5 strikes, slow-downs or substantial impairment of the Contractor's facilities or of other facilities used by the Contractor in the performance of this Contract;

7.4.6 reorganization, reduction and/or relocation in key personnel;

7.4.7 known or anticipated sale, merger, or acquisition;

7.4.8 known, planned or anticipated stock sales;

7.4.9 any litigation against the Contractor; or

7.4.10 significant change in market share or product focus.

7.5 **Audits and Records.**

7.5.1 The Contractor agrees that the representatives of the Office of the City Auditor or other authorized representatives of the City shall have access to, and the right to audit, examine, or reproduce, any and all records of the Contractor related to the performance under this Contract. The Contractor shall retain all such records for a period of three (3) years after final payment on this Contract or until all audit and litigation matters that the City has brought to the attention of the Contractor are resolved, whichever is longer. The Contractor agrees to refund to the City any overpayments disclosed by any such audit.

7.5.2 Records Retention:

7.5.2.1 Contractor is subject to City Code chapter 2-11 (Records Management), and as it may subsequently be amended. For purposes of this subsection, a Record means all books, accounts, reports, files, and other data recorded or created by a Contractor in fulfillment of the Contract whether in digital or physical format, except a record specifically relating to the Contactor's internal administration.

7.5.2.2 All Records are the property of the City. The Contractor may not dispose of or destroy a Record without City authorization and shall deliver the Records, in all requested formats and media, along with all finding aids and metadata, to the City at no cost when requested by the City.

7.5.3 The Contractor shall include sections 7.5.1 and 7.5.2 above in all subcontractor agreements entered into in connection with this Contract.

7.6 **Stop Work Notice.** The City may issue an immediate Stop Work Notice in the event the Contractor is observed performing in a manner that is in violation of Federal, State, or local guidelines, or in a manner that is determined by the City to be unsafe to either life or property. Upon notification, the Contractor will cease all work until notified by the City that the violation or unsafe condition has been corrected. The Contractor shall be liable for all costs incurred by the City as a result of the issuance of such Stop Work Notice.

7.7 **Indemnity.**

7.7.1 Definitions:

7.7.1.1 "Indemnified Claims" shall include any and all claims, demands, suits, causes of action, judgments and liability of every character, type or description, including all reasonable costs and expenses of litigation, mediation or other alternate dispute resolution mechanism, including attorney and other professional fees for:

7.7.1.1.1 damage to or loss of the property of any person (including, but not limited to the City, the Contractor, their respective agents, officers, employees and subcontractors; the officers, agents, and employees of such subcontractors; and third parties); and/or;

7.7.1.1.2 death, bodily injury, illness, disease, worker's compensation, loss of services, or loss of income or wages to any person (including but not limited to the agents, officers and employees of the City, the Contractor, the Contractor's subcontractors, and third parties),

7.7.1.2 "Fault" shall include the sale of defective or non-conforming deliverables, negligence, willful misconduct, or a breach of any legally imposed strict liability standard.

7.7.2 **THE CONTRACTOR SHALL DEFEND (AT THE OPTION OF THE CITY), INDEMNIFY, AND HOLD THE CITY, ITS SUCCESSORS, ASSIGNS, OFFICERS, EMPLOYEES AND ELECTED OFFICIALS HARMLESS FROM AND AGAINST ALL INDEMNIFIED CLAIMS DIRECTLY ARISING OUT OF, INCIDENT TO, CONCERNING OR RESULTING FROM THE FAULT OF THE CONTRACTOR, OR THE CONTRACTOR'S AGENTS, EMPLOYEES OR SUBCONTRACTORS, IN THE PERFORMANCE OF THE CONTRACTOR'S OBLIGATIONS UNDER THE CONTRACT. NOTHING HEREIN SHALL BE DEEMED TO LIMIT THE RIGHTS OF THE CITY OR THE CONTRACTOR (INCLUDING, BUT NOT LIMITED TO, THE RIGHT TO SEEK CONTRIBUTION) AGAINST ANY THIRD PARTY WHO MAY BE LIABLE FOR AN INDEMNIFIED CLAIM.**

7.8 **Claims.** If any claim, demand, suit, or other action is asserted against the Contractor which arises under or concerns the Contract, or which could have a material adverse affect on the Contractor's ability to perform thereunder, the Contractor shall give written notice thereof to the City within ten (10) calendar days after receipt of notice by the Contractor. Such notice to the City shall state the date of notification of any such claim, demand, suit, or other action; the names and addresses of the claimant(s); the basis thereof; and the name of each person against whom such claim is being asserted. Such notice shall be delivered personally or by mail and shall be sent to the City and to the Austin City Attorney. Personal delivery to the City Attorney shall be to City Hall, 301 West 2nd Street, 4th Floor, Austin, Texas 78701, and mail delivery shall be to P.O. Box 1088, Austin, Texas 78767.

7.9 **Notices.** Unless otherwise specified, all notices, requests, or other communications required or appropriate to be given under the Contract shall be in writing and shall be deemed delivered three (3) business days after postmarked if sent by U.S. Postal Service Certified or Registered Mail, Return Receipt Requested. Notices delivered by other means shall be deemed delivered upon receipt by the addressee. Routine communications may be made by first class mail, telefax, or other commercially accepted means. Notices to the City and the Contractor shall be addressed as follows:

To the City:	To the Contractor:
City of Austin, Purchasing Office	Fire Catt L.L.C.
ATTN: Erin D'Vincent	ATTN: Marc Radecky
P O Box 1088	3250 W. Big Beaver Rd., Suite 544
Austin, TX 78767	Troy, MI 48084

7.10 **Confidentiality.** In order to provide the deliverables to the City, Contractor may require access to certain of the City's and/or its licensors' confidential information (including inventions, employee information, trade secrets, confidential know-how, confidential business information, and other information which the City or its

licensors consider confidential) (collectively, "Confidential Information"). Contractor acknowledges and agrees that the Confidential Information is the valuable property of the City and/or its licensors and any unauthorized use, disclosure, dissemination, or other release of the Confidential Information will substantially injure the City and/or its licensors. The Contractor (including its employees, subcontractors, agents, or representatives) agrees that it will maintain the Confidential Information in strict confidence and shall not disclose, disseminate, copy, divulge, recreate, or otherwise use the Confidential Information without the prior written consent of the City or in a manner not expressly permitted under this Contract, unless the Confidential Information is required to be disclosed by law or an order of any court or other governmental authority with proper jurisdiction, provided the Contractor promptly notifies the City before disclosing such information so as to permit the City reasonable time to seek an appropriate protective order. The Contractor agrees to use protective measures no less stringent than the Contractor uses within its own business to protect its own most valuable information, which protective measures shall under all circumstances be at least reasonable measures to ensure the continued confidentiality of the Confidential Information.

7.11 **Advertising.** The Contractor shall not advertise or publish, without the City's prior consent, the fact that the City has entered into the Contract, except to the extent required by law.

7.12 **No Contingent Fees.** The Contractor warrants that no person or selling agency has been employed or retained to solicit or secure the Contract upon any agreement or understanding for commission, percentage, brokerage, or contingent fee, excepting bona fide employees of bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business. For breach or violation of this warranty, the City shall have the right, in addition to any other remedy available, to cancel the Contract without liability and to deduct from any amounts owed to the Contractor, or otherwise recover, the full amount of such commission, percentage, brokerage or contingent fee.

7.13 **Gratuities.** The City may, by written notice to the Contractor, cancel the Contract without liability if it is determined by the City that gratuities were offered or given by the Contractor or any agent or representative of the Contractor to any officer or employee of the City with a view toward securing the Contract or securing favorable treatment with respect to the awarding or amending or the making of any determinations with respect to the performing of such contract. In the event the Contract is canceled by the City pursuant to this provision, the City shall be entitled, in addition to any other rights and remedies, to recover or withhold the amount of the cost incurred by the Contractor in providing such gratuities.

7.14 **Prohibition Against Personal Interest in Contracts.** No officer, employee, independent consultant, or elected official of the City who is involved in the development, evaluation, or decision-making process of the performance of any solicitation shall have a financial interest, direct or indirect, in the Contract resulting from that solicitation. Any willful violation of this section shall constitute impropriety in office, and any officer or employee guilty thereof shall be subject to disciplinary action up to and including dismissal. Any violation of this provision, with the knowledge, expressed or implied, of the Contractor shall render the Contract voidable by the City.

7.15 **Independent Contractor.** The Contract shall not be construed as creating an employer/employee relationship, a partnership, or a joint venture. The Contractor's services shall be those of an independent contractor. The Contractor agrees and understands that the Contract does not grant any rights or privileges established for employees of the City.

7.16 **Assignment-Delegation.** The Contract shall be binding upon and enure to the benefit of the City and the Contractor and their respective successors and assigns, provided however, that no right or interest in the Contract shall be assigned and no obligation shall be delegated by the Contractor without the prior written consent of the City. Any attempted assignment or delegation by the Contractor shall be void unless made in conformity with this paragraph. The Contract is not intended to confer rights or benefits on any person, firm or entity not a party hereto; it being the intention of the parties that there be no third party beneficiaries to the Contract.

7.17 **Waiver.** No claim or right arising out of a breach of the Contract can be discharged in whole or in part by a waiver or renunciation of the claim or right unless the waiver or renunciation is supported by consideration and is in writing signed by the aggrieved party. No waiver by either the Contractor or the City of any one or more events of default by the other party shall operate as, or be construed to be, a permanent waiver of any rights or obligations

under the Contract, or an express or implied acceptance of any other existing or future default or defaults, whether of a similar or different character.

7.18 **Modifications.** The Contract can be modified or amended only in writing signed by both parties. No pre-printed or similar terms on any Contractor invoice, order or other document shall have any force or effect to change the terms, covenants, and conditions of the Contract.

7.19 **Interpretation.** The Contract is intended by the parties as a final, complete and exclusive statement of the terms of their agreement. No course of prior dealing between the parties or course of performance or usage of the trade shall be relevant to supplement or explain any term used in the Contract. Although the Contract may have been substantially drafted by one party, it is the intent of the parties that all provisions be construed in a manner to be fair to both parties, reading no provisions more strictly against one party or the other. Whenever a term defined by the Uniform Commercial Code, as enacted by the State of Texas, is used in the Contract, the UCC definition shall control, unless otherwise defined in the Contract.

7.20 **Dispute Resolution.**

7.20.1 If a dispute arises out of or relates to the Contract, or the breach thereof, the parties agree to negotiate prior to prosecuting a suit for damages. However, this section does not prohibit the filing of a lawsuit to toll the running of a statute of limitations or to seek injunctive relief. Either party may make a written request for a meeting between representatives of each party within fourteen (14) calendar days after receipt of the request or such later period as agreed by the parties. Each party shall include, at a minimum, one (1) senior level individual with decision-making authority regarding the dispute. The purpose of this and any subsequent meeting is to attempt in good faith to negotiate a resolution of the dispute. If, within thirty (30) calendar days after such meeting, the parties have not succeeded in negotiating a resolution of the dispute, they will proceed directly to mediation as described below. Negotiation may be waived by a written agreement signed by both parties, in which event the parties may proceed directly to mediation as described below.

7.20.2 If the efforts to resolve the dispute through negotiation fail, or the parties waive the negotiation process, the parties may select, within thirty (30) calendar days, a mediator trained in mediation skills to assist with resolution of the dispute. Should they choose this option, the City and the Contractor agree to act in good faith in the selection of the mediator and to give consideration to qualified individuals nominated to act as mediator. Nothing in the Contract prevents the parties from relying on the skills of a person who is trained in the subject matter of the dispute or a contract interpretation expert. If the parties fail to agree on a mediator within thirty (30) calendar days of initiation of the mediation process, the mediator shall be selected by the Travis County Dispute Resolution Center (DRC). The parties agree to participate in mediation in good faith for up to thirty (30) calendar days from the date of the first mediation session. The City and the Contractor will share the mediator's fees equally and the parties will bear their own costs of participation such as fees for any consultants or attorneys they may utilize to represent them or otherwise assist them in the mediation.

7.21 **Minority And Women Owned Business Enterprise (MBE/WBE) Procurement Program.**

7.21.1 All City procurements are subject to the City's Minority-Owned and Women-Owned Business Enterprise Procurement Program found at Chapters 2-9A, 2-9B, 2-9C and 2-9D of the City Code. The Program provides Minority-Owned and Women-Owned Business Enterprises (MBEs/WBEs) full opportunity to participate in all City contracts.

7.21.2 The City of Austin has determined that no goals are appropriate for this Contract. **Even though no goals have been established for this Contract, the Contractor is required to comply with the City's MBE/WBE Procurement Program, Chapters 2-9A, 2-9B, 2-9C and 2-9D, of the City Code, as applicable, if areas of subcontracting are identified.**

7.21.3 If any service is needed to perform the Contract and the Contractor does not perform the service with its own workforce or if supplies or materials are required and the Contractor does not have the supplies or materials in its inventory, the Contractor shall contact the Department of Small and Minority Business

Resources (DSMBR) at (512) 974-7600 to obtain a list of MBE and WBE firms available to perform the service or provide the supplies or materials. The Contractor must also make a Good Faith Effort to use available MBE and WBE firms. Good Faith Efforts include but are not limited to contacting the listed MBE and WBE firms to solicit their interest in performing on the Contract; using MBE and WBE firms that have shown an interest, meet qualifications, and are competitive in the market; and documenting the results of the contacts.

7.22 **Subcontractors.**

7.22.1 If the Contractor identified Subcontractors in an MBE/WBE Program Compliance Plan or a No Goals Utilization Plan, the Contractor shall comply with the provisions of Chapters 2-9A, 2-9B, 2-9C, and 2-9D, as applicable, of the Austin City Code and the terms of the Compliance Plan or Utilization Plan as approved by the City (the "Plan"). The Contractor shall not initially employ any Subcontractor except as provided in the Contractor's Plan. The Contractor shall not substitute any Subcontractor identified in the Plan, unless the substitute has been accepted by the City in writing in accordance with the provisions of Chapters 2-9A, 2-9B, 2-9C and 2-9D, as applicable. No acceptance by the City of any Subcontractor shall constitute a waiver of any rights or remedies of the City with respect to defective deliverables provided by a Subcontractor. If a Plan has been approved, the Contractor is additionally required to submit a monthly Subcontract Awards and Expenditures Report to the Contract Manager and the Purchasing Office Contract Compliance Manager no later than the tenth calendar day of each month.

7.22.2 Work performed for the Contractor by a Subcontractor shall be pursuant to a written contract between the Contractor and Subcontractor. The terms of the subcontract may not conflict with the terms of the Contract, and shall contain provisions that:

7.22.2.1 require that all deliverables to be provided by the Subcontractor be provided in strict accordance with the provisions, specifications and terms of the Contract.

7.22.2.2 prohibit the Subcontractor from further subcontracting any portion of the Contract without the prior written consent of the City and the Contractor. The City may require, as a condition to such further subcontracting, that the Subcontractor post a payment bond in form, substance and amount acceptable to the City;

7.22.2.3 require Subcontractors to submit all invoices and applications for payments, including any claims for additional payments, damages or otherwise, to the Contractor in sufficient time to enable the Contractor to include same with its invoice or application for payment to the City in accordance with the terms of the Contract;

7.22.2.4 require that all Subcontractors obtain and maintain, throughout the term of their contract, insurance in the type and amounts specified for the Contractor, with the City being a named insured as its interest shall appear; and

7.22.2.5 require that the Subcontractor indemnify and hold the City harmless to the same extent as the Contractor is required to indemnify the City.

7.22.3 The Contractor shall be fully responsible to the City for all acts and omissions of the Subcontractors just as the Contractor is responsible for the Contractor's own acts and omissions. Nothing in the Contract shall create for the benefit of any such Subcontractor any contractual relationship between the City and any such Subcontractor, nor shall it create any obligation on the part of the City to pay or to see to the payment of any moneys due any such Subcontractor except as may otherwise be required by law.

7.22.4 The Contractor shall pay each Subcontractor its appropriate share of payments made to the Contractor not later than ten (10) calendar days after receipt of payment from the City.

7.23 **Living Wages.**

7.23.1 The minimum wage required for any Contractor employee directly assigned to this City Contract is $13.50 per hour, unless Published Wage Rates are included in the solicitation. In addition, the City may stipulate higher wage rates in certain contracts in order to assure quality and continuity of service.

7.23.2 The City requires Contractors to provide a signed certification certifying that all employees directly assigned to this Contract will be paid a minimum living wage equal to or greater than $13.50 per hour (see Exhibit C, Living Wages Contractor Certification). The certification shall include a list of all employees directly assigned to providing services under the Contract including their name and job title. The list shall be updated and provided to the City as necessary throughout the term of the Contract.

7.23.3 The Contractor shall maintain throughout the term of the Contract basic employment and wage information for each employee as required by the Fair Labor Standards Act (FLSA).

7.23.4 The Contractor shall provide to the Department's Contract Manager with the first invoice, individual Employee Certifications for all employees directly assigned to the Contract. The City reserves the right to request individual Employee Certifications at any time during the Contract term. Employee Certifications shall be signed by each employee directly assigned to the Contract. The Employee Certification form is available on-line at:
https://assets.austintexas.gov/purchase/living_wages_employee_certification.pdf

7.23.5 Contractor shall submit employee certifications annually on the anniversary date of Contract award with the respective invoice to verify that employees are paid the Living Wage throughout the term of the Contract. The Employee Certification Forms shall be submitted for employees added to the Contract and/or to report employee changes as they occur.

7.23.6 The City's Contract Manager will periodically review the employee data submitted by the Contractor to verify compliance with this Living Wage provision. The City retains the right to review employee records identified above in paragraph 7.23.3 above to verify compliance with this provision.

7.24 **Jurisdiction And Venue.** The Contract is made under and shall be governed by the laws of the State of Texas, including, when applicable, the Uniform Commercial Code as adopted in Texas, V.T.C.A., Bus. & Comm. Code, Chapter 1, excluding any rule or principle that would refer to and apply the substantive law of another state or jurisdiction. All issues arising from this Contract shall be resolved in the courts of Travis County, Texas and the parties agree to submit to the exclusive personal jurisdiction of such courts. The foregoing, however, shall not be construed or interpreted to limit or restrict the right or ability of the City to seek and secure injunctive relief from any competent authority as contemplated herein.

7.25 **Invalidity.** The invalidity, illegality, or unenforceability of any provision of the Contract shall in no way affect the validity or enforceability of any other portion or provision of the Contract. Any void provision shall be deemed severed from the Contract and the balance of the Contract shall be construed and enforced as if the Contract did not contain the particular portion or provision held to be void. The parties further agree to reform the Contract to replace any stricken provision with a valid provision that comes as close as possible to the intent of the stricken provision. The provisions of this section shall not prevent this entire Contract from being void should a provision which is the essence of the Contract be determined to be void.

7.26 **Holidays.** The following holidays are observed by the City:

Holiday	Date Observed
New Year's Day	January 1
Martin Luther King, Jr.'s Birthday	Third Monday in January
President's Day	Third Monday in February
Memorial Day	Last Monday in May
Independence Day	July 4

Labor Day	First Monday in September
Veteran's Day	November 11
Thanksgiving Day	Fourth Thursday in November
Friday after Thanksgiving	Friday after Thanksgiving
Christmas Eve	December 24
Christmas Day	December 25

If a Legal Holiday falls on Saturday, it will be observed on the preceding Friday. If a Legal Holiday falls on Sunday, it will be observed on the following Monday.

7.27 **Survivability of Obligations.** All provisions of the Contract that impose continuing obligations on the parties, including but not limited to the warranty, indemnity, and confidentiality obligations of the parties, shall survive the expiration or termination of the Contract.

7.28 **Non-Suspension or Debarment Certification.** The City of Austin is prohibited from contracting with or making prime or sub-awards to parties that are suspended or debarred or whose principals are suspended or debarred from Federal, State, or City of Austin Contracts. By accepting a Contract with the City, the Vendor certifies that its firm and its principals are not currently suspended or debarred from doing business with the Federal Government, as indicated by the General Services Administration List of Parties Excluded from Federal Procurement and Non-Procurement Programs, the State of Texas, or the City of Austin.

7.29 **Incorporation of Documents. Section 0100, Standard Purchase Definitions**, is hereby incorporated into this Contract by reference, with the same force and effect as if they were incorporated in full text. The full text versions of this Section are available, on the Internet at the following online address:
https://assets.austintexas.gov/purchase/downloads/standard_purchase_definitions.pdf

In witness whereof, the parties have caused duly authorized representatives to execute this Contract on the dates set forth below.

FIRE CATT L.L.C.

By: _____
Signature

Name: MARC T. RADECKY
Printed Name

Title: PRESIDENT

Date: 1-9-17

CITY OF AUSTIN

By: _____
Signature

Name: Erin D'Vincent

Title: Senior Buyer Specialist

Date: 1-10-17

List of Exhibits

Exhibit A	Non Discrimination Certification, Section 0800
Exhibit B	Living Wages Contractor Certification, Section 0815
Exhibit C	Contractor's Scope of Work and Quote

EXHIBIT A
City of Austin, Texas
Section 0800
NON-DISCRIMINATION AND NON-RETALIATION CERTIFICATION

City of Austin, Texas

Equal Employment/Fair Housing Office

To: City of Austin, Texas,

I hereby certify that our firm complies with the Code of the City of Austin, Section 5-4-2 as reiterated below, and agrees:

(1) Not to engage in any discriminatory employment practice defined in this chapter.

(2) To take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without discrimination being practiced against them as defined in this chapter, including affirmative action relative to employment, promotion, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rate of pay or other forms of compensation, and selection for training or any other terms, conditions or privileges of employment.

(3) To post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Equal Employment/Fair Housing Office setting forth the provisions of this chapter.

(4) To state in all solicitations or advertisements for employees placed by or on behalf of the Contractor, that all qualified applicants will receive consideration for employment without regard to race, creed, color, religion, national origin, sexual orientation, gender identity, disability, sex or age.

(5) To obtain a written statement from any labor union or labor organization furnishing labor or service to Contractors in which said union or organization has agreed not to engage in any discriminatory employment practices as defined in this chapter and to take affirmative action to implement policies and provisions of this chapter.

(6) To cooperate fully with City and the Equal Employment/Fair Housing Office in connection with any investigation or conciliation effort of the Equal Employment/Fair Housing Office to ensure that the purpose of the provisions against discriminatory employment practices are being carried out.

(7) To require of all subcontractors having 15 or more employees who hold any subcontract providing for the expenditure of $2,000 or more in connection with any contract with the City subject to the terms of this chapter that they do not engage in any discriminatory employment practice as defined in this chapter

For the purposes of this Offer and any resulting Contract, Contractor adopts the provisions of the City's Minimum Standard Non-Discrimination and Non-Retaliation Policy set forth below.

City of Austin
Minimum Standard Non-Discrimination and Non-Retaliation in Employment Policy

As an Equal Employment Opportunity (EEO) employer, the Contractor will conduct its personnel activities in accordance with established federal, state and local EEO laws and regulations.

The Contractor will not discriminate against any applicant or employee based on race, creed, color, national origin, sex, age, religion, veteran status, gender identity, disability, or sexual orientation. This policy covers all aspects of employment, including hiring, placement, upgrading, transfer, demotion, recruitment, recruitment advertising, selection for training and apprenticeship, rates of pay or other forms of compensation, and layoff or termination.

The Contractor agrees to prohibit retaliation, discharge or otherwise discrimination against any employee or applicant for employment who has inquired about, discussed or disclosed their compensation.

Further, employees who experience discrimination, sexual harassment, or another form of harassment should immediately report it to their supervisor. If this is not a suitable avenue for addressing their compliant, employees are advised to contact another member of management or their human resources representative. No employee shall be discriminated against, harassed, intimidated, nor suffer any reprisal as a result of reporting a violation of this policy. Furthermore, any employee, supervisor, or manager who becomes aware of any such discrimination or harassment should immediately report it to executive management or the human resources office to ensure that such conduct does not continue.

Contractor agrees that to the extent of any inconsistency, omission, or conflict with its current non-discrimination and non-retaliation employment policy, the Contractor has expressly adopted the provisions of the City's Minimum Non-Discrimination Policy contained in Section 5-4-2 of the City Code and set forth above, as the Contractor's Non-Discrimination Policy or as an amendment to such Policy and such provisions are intended to not only supplement the Contractor's policy, but will also supersede the Contractor's policy to the extent of any conflict.

UPON CONTRACT AWARD, THE CONTRACTOR SHALL PROVIDE THE CITY A COPY OF THE CONTRACTOR'S NON-DISCRIMINATION AND NON-RETALIATION POLICIES ON COMPANY LETTERHEAD, WHICH CONFORMS IN FORM, SCOPE, AND CONTENT TO THE CITY'S MINIMUM NON-DISCRIMINATION AND NON-RETALIATION POLICIES, AS SET FORTH HEREIN, **OR** THIS NON-DISCRIMINATION AND NON-RETALIATION POLICY, WHICH HAS BEEN ADOPTED BY THE CONTRACTOR FOR ALL PURPOSES WILL BE CONSIDERED THE CONTRACTOR'S NON-DISCRIMINATION AND NON-RETALIATION POLICY WITHOUT THE REQUIREMENT OF A SEPARATE SUBMITTAL.

Sanctions:

Our firm understands that non-compliance with Chapter 5-4 and the City's Non-Retaliation Policy may result in sanctions, including termination of the contract and suspension or debarment from participation in future City contracts until deemed compliant with the requirements of Chapter 5-4 and the Non-Retaliation Policy.

Term:

The Contractor agrees that this Section 0800 Non-Discrimination and Non-Retaliation Certificate of the Contractor's separate conforming policy, which the Contractor has executed and filed with the City, will remain in force and effect for one year from the date of filling. The Contractor further agrees that, in consideration of the receipt of continued Contract payment, the Contractor's Non-Discrimination and Non-Retaliation Policy will automatically renew from year-to-year for the term of the underlying Contract.

Dated this 9TH day of JANUARY, 2017

CONTRACTOR FIRE CATT, L.L.C

Authorized Signature

Title PRESIDENT

EXHIBIT B
CITY OF AUSTIN, TEXAS
LIVING WAGES CONTRACTOR CERTIFICATION

Pursuant to the Living Wages provision (reference Section 0400, Supplemental Purchase Provisions) the Contractor is required to pay to all employees directly assigned to this City contract a minimum Living Wage equal to or greater than $13.50 per hour.

(1) The below listed employees of the Contractor who are directly assigned to this contract are compensated at wage rates equal to or greater than $13.50 per hour:

Employee Name	Employee Job Title
TBD	

(2) all future employees assigned to this Contract will be paid a minimum Living Wage equal to or greater than $13.50 per hour.

(3) Our firm will not retaliate against any employee claiming non-compliance with the Living Wage provision.

A Contractor who violates this Living Wage provision shall pay each affected employee the amount of the deficiency for each day the violation continues. Willful or repeated violations of the provision or fraudulent statements made on this certification may result in termination of this Contract for Cause, subject the firm to possible suspension or debarment, or result in legal action.

I hereby certify that all the listed employees of the Contractor who are directly assigned to this contract are paid a minimum Living Wage equal to or greater than $13.50 per hour.

Contractor's Name: FIRE CATT, L.L.C.

Signature of Officer or Authorized Representative:

Date: 1-9-2017

Printed Name: MARC T. RADZICKI

Title: PRESIDENT

EXHIBIT C
CONTRACTOR'S SCOPE OF WORK AND QUOTE

See next page

Electronic submission

November 3, 2016

Calvin Poole
Battalion Chief
Austin Fire Department
Operations Support
2011 E. 51st St., Austin, TX 78723

Chief Poole:

Per your request, we are pleased to submit this proposal for your annual fire hose testing.

Background:

FireCatt is proud to have revolutionized the fire hose testing industry with a patented method using a software program designed to meet every NFPA standard on every test integrating the first and only computer controlled testing system designed for precise accuracy.

FireCatt is now testing over 6 million feet of fire hose per year in 36 States. We have been testing fire hose for more than 9 years and our customers include fire departments, oil refineries, nuclear power plants and industrial operations.

We trust you will take the time to understand the value FireCatt creates by using the best technology, people and processes available to provide your critical annual services testing. FireCatt will save you manpower time, reduce liability and injuries, and create repeatable, valid test results with advanced technology.

Testing Scope:

FireCatt will provide annual service pressure testing per the **NFPA 1962, 2013 Edition Standard** for Hose and **NFPA 1932 Standard for Ladders** using patented technology test equipment designed for safety, accuracy and efficiency.

Sole Source FireCatt Specifications:

- Electronic and computer controlled pressure transducers are used to monitor and regulate pressures.
- Electronic and Computer controlled pressure transducers are used to acquire all Hydro Static pressure data (PSI)
- Air actuated and computer controlled valves are used to eliminate manual control of all valves at high pressure and provide emergency automated shut-off/shut-down

capability. The use of manual valves that are less than 100% repeatable and that may expose personnel to unnecessary risk will not be permitted.

- □ Pressure release at the end of each test will be accomplished through air actuated and computer controlled valves operated remotely. This will eliminate the need to release pressure at the end of each hose and eliminate the risk associated with exposing personnel to potential catastrophic failure while any hose is fully pressurized.
- □ Hydrant pressure will be monitored through the use of electronic and computer controlled pressure transducers. Hydrant pressure will be regulated to meet the NFPA requirement of 45 PSI at the beginning of each test.
- □ A computer controlled amber warning beacon will be illuminated at all times when a hose is pressurizing or at high pressure.
- □ Ten manifolds will be used, each with its own computer controlled pressure transducer and valve so that ten separate pressures can be tested simultaneously.
- □ Air relief valves will be used at the end of each hose lay, and at the elbow at mobile test lab.
- □ Computer controlled digital pressure readouts will be used in order to eliminate subjective “needle bounce” of analog gauges.
- □ Computer controlled timing of tests will be used to eliminate subjective timing devices such as manual stop watches which are prone to operator error.
- □ Heavy Duty Bar Code labels will be used on each hose for ease of Identification and Inventory Control.

NFPA Fire Hose Testing Standards:

1. Each length of hose will be assigned an Identification Number using a barcode label on each coupling. That I.D. number shall also be recorded on the hose jacket at each end of the hose using a permanent ink marker.
2. Each length of hose will be inspected both the outer jacket and inner liner.
3. All couplings and threads will be inspected.
4. All gaskets will be inspected; defective gaskets will be replaced at no extra cost.
5. FireCatt will supply hose manufacturer approved 100% silicone lubricant for coupling lubrication.
6. All defective hose will be tagged and removed from service and the defect location on the hose will be marked using permanent marker. The tag will be distinctive and state the reason for removal from service, date, and hose I.D. number. This information will also be contained within the test report
7. FireCatt will supply “Never Seize” lubricant for lubricating all apparatus connection points so as to reduce galvanic reaction associated with dissimilar metal contact
8. FireCatt will accurately record all data that will be contained in the final report which will include, Department I.D., Station or Apparatus I.D., FireCatt hose I.D., Fire Department hose I.D., Manufacturer, Date of Manufacture, Date in Service, Size, Length, Pressure, Pass/Fail, Reason for Failure, and Tread Type.
9. FireCatt will provide a hard copy of the Test Report within 1 week of test completion. The Hose Test Report is documented on a per Department basis. If you require your hose documentation broken down per apparatus or station, this service is available for an additional charge and must be pre-arranged.

10. FireCatt will provide internet web access to your electronic test record and protect this information using a unique login and password within 1 week of test completion. Access to the test records will be for a minimum of 7 years from date of the most recent test.
11. FireCatt will be licensed and insured to meet the State, City and Department requirements.

Pricing:

Service	Estimated Feet to Test	Price per foot	Estimated Annual Cost
Option 1: Fire Hose Testing- Fire Department provides labor to **reload apparatus only**	240,000	**$0.195**	**$46,800.00**

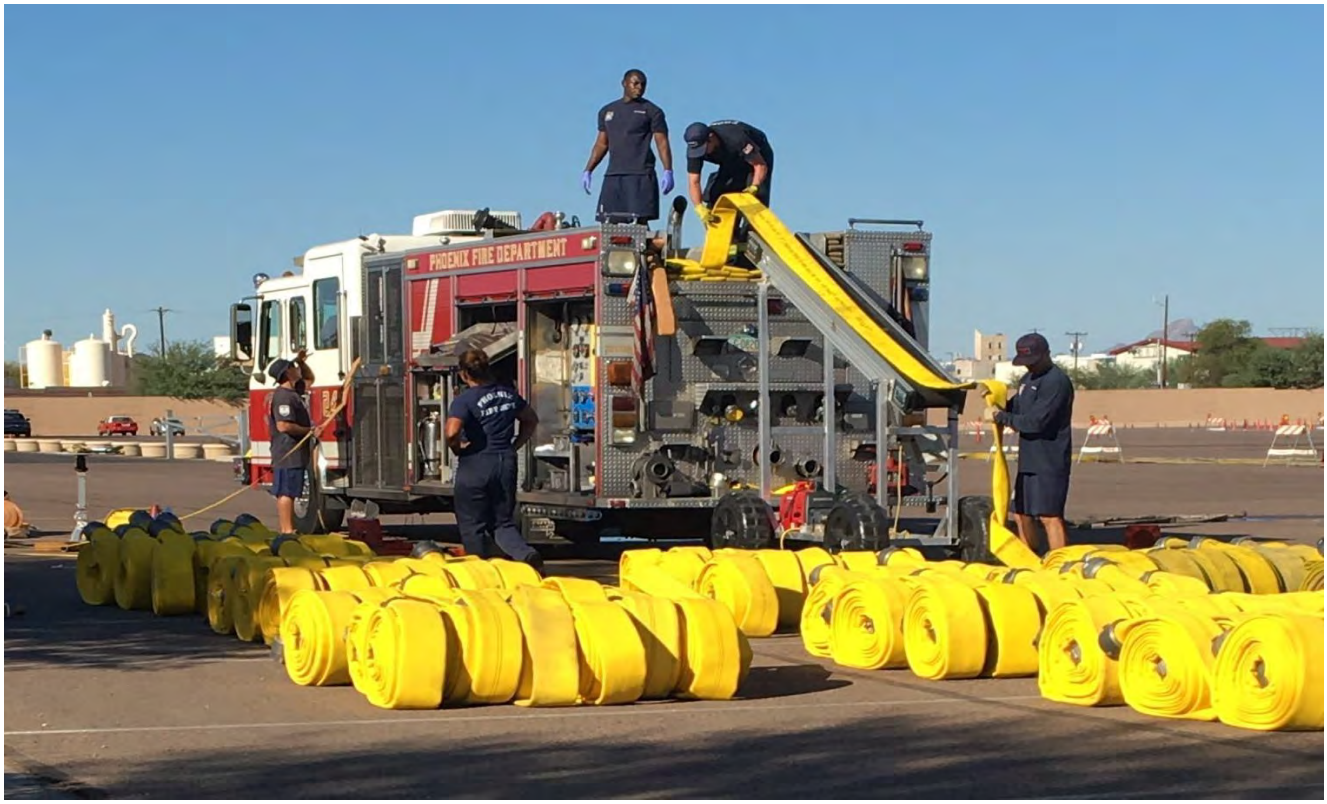
Note: Hard suction hose, if utilized, is vacuum tested at the same price per foot as supply and attack hose.

FireCatt is the only fire hose testing company in the nation using computer controlled testing units programmed to meet NFPA1962 to insure accuracy, reduce human error, and increase safety.

Term:

3 year initial term (estimated total annual cost year 1-$46,800.00, year 2-$46,800.00, year 3- $46,800.00) with two 1 year extension's at the City's discretion.

Option 1: FireCatt will assist the Fire Department in unloading apparatus, and provide labor to lay out test, couple/uncouple, and roll hose. The Fire Department will provide labor to reload apparatus. We suggest utilizing two Fire Department crews/companies to reload. The crew who's apparatus is being reloaded and the crew who's apparatus is next to be unloaded. FireCatt will provide equipment to assist the Fire Department, such as LDH conveyor and cross lay turntables to make loading the most efficient and reduce the risk of injury to your firefighters. (See photos below)



Logistics:

Prior to testing FireCatt will work with your Department to formulate and tailor a logistics plan that will work best for you. The following is an example of a typical logistics plan:

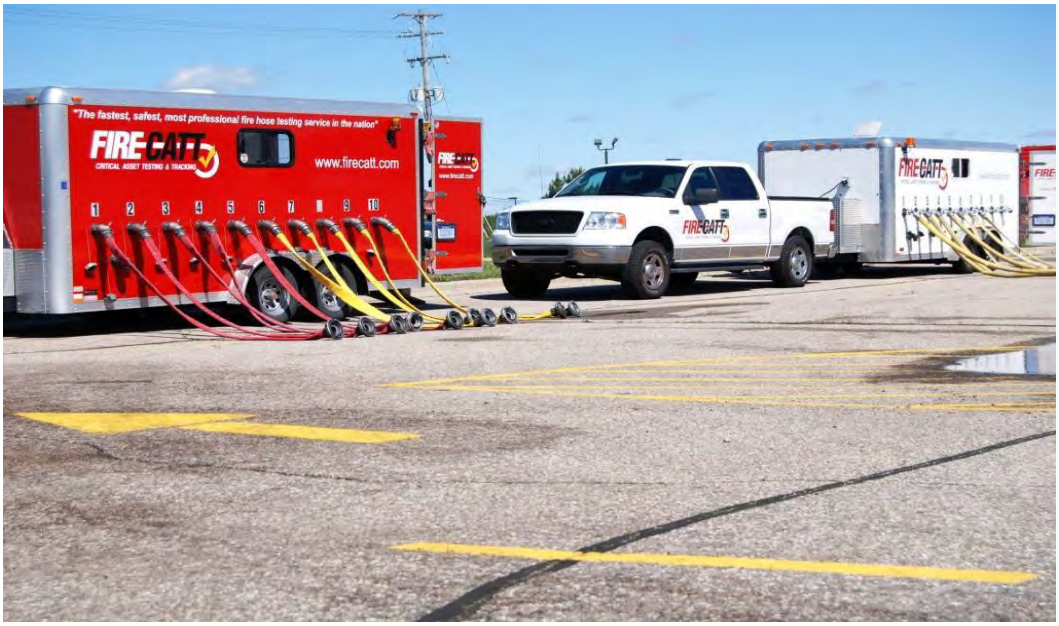
When FireCatt begins testing we will start with your *rack/auxiliary* hose then your *reserve* apparatus(s). Your tested *rack/auxiliary* hose will be ready to replace any failed hose from your apparatus(s). Once the *reserve apparatus(s)* are tested your company can take the tested reserve to replace a front-line apparatus prior to testing. Thus, we eliminate any down time in your Department for hose testing and we keep your companies in district. That way the public that you serve will not see an increase in response time during hose testing.

The Department will be responsible to provide a suitable test a location 300’ in length x 100’ wide, a water supply via Fire Hydrant (preferably), stand pipe, or tender, a driver to move your apparatus and a single point of contact.

Completion:

FireCatt can provide up to 2 of our mobile test labs to conduct testing. With 2 mobile test labs testing will take approximately 10 days cycling 8 engines per day. If you elect 1 mobile test lab, testing will take approximately 20 days cycling 4 engines per day. (weather, total feet, & test site dependent).

FireCatt typically tests 10,000'-12,000' of hose per day and/or 4 Engine/Pumpers per day using 1 mobile test lab. 2 test labs will double this production rate. (See photo below)



Summary of Benefits Received from Choosing FireCatt

- Use the best technology the industry has to offer and fully trained technicians.
- Longer life of hose due to ensuring NFPA 1962 is followed every test cycle.
- Assurance hose is tested to prescribed pressures, if not, either false positives results or premature stress and loss of hose life are the results (especially the unnecessary cost of replacing LDH – Supply Lines)
- Workers compensation injuries resulting from testing accidents, either immediate or develops after, such as back / knee strain from re-loading hose (conveyor system and turntables)
- Reduction of any overtime hours used for testing and or training, freeing up man-hours from faster re-loading and the use of two mobile test labs.
- Proven Professional Operation - experience in testing large departments.

I believe that you would agree that the issues of safety, time, technology and tracking are the most important to you and your department. Our patented method, and the unique features listed above allow for the NFPA 1962 Standards to be met in the most “objective” manner possible. In comparison, other testing companies will provide you with “subjective” test results. We have designed our testing and reporting technology to meet the requirements and future needs of the industry.

Our issued and pending patents are strong evidence of the exclusive nature of our solutions. In short, we believe that no other company in the nation can match or exceed the accuracy or safety of the fire hose testing services that FireCatt can provide to your department. We have yet to encounter another hose testing company in the nation deploying a similar state-of-the-art computerized testing technology.

We are pleased to offer our services to your department and believe the investment in FireCatt generates the peace of mind for everyone that we are all creating the safest environment for the firefighter and citizens of your community.

We look forward to creating a mutually beneficial and successful long term relationship, and believe in 100% customer satisfaction. If you have any questions or comments, feel free to contact us at any time.

Respectfully Submitted,

Marc T. Radecky

Marc T. Radecky
President
248-318-3811 mobile/direct

FOR FIREHOSE TESTING

City of Austin FSD Purchasing Office

Certificate of Exemption

DATE: 11/01/2016 DEPT: Fire

TO: Purchasing Officer or Designee FROM: Karen Bitzer

BUYER: Erin D/Vincent PHONE: (512) 974-4131

Chapter 252 of the Local Government Code requires that municipalities comply with the procedures established for competitive sealed bids or proposals before entering into a contract requiring an expenditure of $50,000 or more, unless the expenditure falls within an exemption listed in Section 252.022.

Senate Bill 7 amended Chapter 252 of the Local Government Code to exempt from the requirements of such Chapter expenditures made by a municipally owned electric utility for any purchases made by the municipally owned electric utility in accordance with procurement procedures adopted by a resolution of its governing body that sets out the public purpose to be achieved by those procedures. The Austin City Council has adopted Resolution No. 040610-02 to establish circumstances which could give rise to a finding of critical business need for Austin Energy.

This Certification of Exemption is executed and filed with the Purchasing Office as follows:

1. The undersigned is authorized to submit this certification.
2. The undersigned certifies that the following exemption is applicable to this purchase. (Please check which exemption you are certifying)

- ○ a procurement made because of a public calamity that requires the immediate appropriation of money to relieve the necessity of the municipality's residents or to preserve the property of the municipality
- ○ a procurement necessary to preserve or protect the public health or safety of municipality's residents
- ○ a procurement necessary because of unforeseen damage to public machinery, equipment, or other property
- ○ a procurement for personal, professional, or planning services
- ○ a procurement for work that is performed and paid for by the day as the work progresses
- ○ a purchase of land or right-of- way
- ⊙ a procurement of items available from only one source, including: items that are available from only one source because of patents, copyrights, secret processes, or natural monopolies; films, manuscripts, or books; gas, water, and other utility services; captive replacement parts or components for equipment; books, papers, and other library materials for a public library that are available only from the persons holding exclusive distribution rights to the materials; and management services provided by a nonprofit organization to a municipal museum, park, zoo, or other facility to which the organization has provided significant financial or other benefits
- ○ a purchase of rare books, papers, and other library materials for a public library
- ○ paving, drainage, street widening and other public improvements, or related matters, if at least one- third of the cost is to be paid by or through special assessments levied on property that will benefit from the improvements
- ○ a public improvement project, already in progress, authorized by voters of the municipality, for which there is a deficiency of funds for completing the project in accordance with the plans and purposes as authorized by the voters

- ○ a payment under a contract by which a developer participates in the construction of a public improvement as provided by Subchapter C, Chapter 212
- ○ personal property sold: at an auction by a state licensed auctioneer; at a going out of business sale held in compliance with Subchapter F, Chapter 17, Business & Commerce Code; by a political subdivision of this state, a state agency of this state, or an entity of the federal government; or under an interlocal contract for cooperative purchasing administered by a regional planning commission established under Chapter 391
- ○ services performed by blind or severely disabled persons
- ○ goods purchased by a municipality for subsequent retail sale by the municipality
- ○ electricity
- ○ advertising, other than legal notices
- ○ Critical Business Need (Austin Energy Only)

3. The following facts as detailed below support an exemption according to Section 252.022 of the Local Government Code for this purchase. Please verify the steps taken to confirm these facts. If you are citing the following exemptions, please provide the additional information requested below. A more detailed explanation of these exemptions is attached.

   - **Preserve and Protect the Public Health and Safety** – Describe how this purchase will preserve and protect the public safety of residents.
   - **Sole Source** – Describe what patents, copyrights, secret processes, or natural monopolies exist. Attach a letter from vendor supporting the sole source. The letter must be on company letterhead and be signed by an authorized person in company management.
   - **Personal Services** – Describe those services to be performed personally by the individual contracted to perform them.
   - **Professional Services** – Describe what mainly mental or intellectual rather than physical or manual and/or disciplines requiring special knowledge or attainment and a high order of learning, skill, and intelligence are required to perform this service.
   - **Planning Services** – Describe the services primarily intended to guide governmental policy to ensure the orderly and coordinated development of the state or of municipal, county, metropolitan, or regional land areas.
   - **Critical Business Need** – Describe the procurement necessary to protect the competitive interests or position of Austin Energy.

   According to NFPA 1962 Section 4.1.2, "Hose that is in service shall be service tested as specified in Section 4.8 at least annually."
   The Austin Fire Department has approximately 200,000 feet of hose that needs to be service tested annually. Currently, the hose is tested by the Austin Fire Department through an internal process.
   FireCatt, Inc. has a patented method to test 10 hoses at multiple pressures at one time and generate reports with all of the test data following the requirements as described in NFPA 1962 (US Patent: 8,554,497). Patent is attached.

4. Please attach any documentation that supports this exemption.

5. Please provide any evaluation conducted to support the recommendation. Include the efforts taken to ensure the selected vendor is responsible and will provide the best value to the City (Ex: evaluation of other firms, knowledge of market, etc).

There is no other vendor that has the same testing method because of the patent.
FireCatt provides these services to several other comparable departments across the country.

Austin Fire wishes to engage in a ~~six~~ five KLB year contract: A three year initial term with ~~three~~ two KLB 1-year renewal terms. Each term is expected to be $46,800.
$140,400 for the initial term, $46,800 each additional term for a contract total of ~~$280,800.~~ $234,000 KLB

6. Because the above facts and documentation support the requested exemption, the City of Austin intends to contract with FireCatt. Inc.
which will cost approximately $ 280,800.00 (Provide estimate and/or breakdown of cost).

Recommended Certification — Originator: Karen Butzer — Date: 11/8/16

Approved Certification — Department Director or designee — Date: 11/10/16

Assistant City Manager / General Manager or designee (if applicable) — Date: 11/16/16

Purchasing Review (if applicable) — Buyer — Date: 12-21-16 — Manager Initials

Exemption Authorized (if applicable) — Purchasing Officer or designee — Date: 12/21/16

02/26/2013

United States Patent **8,554,497**

Hamilton , et al. **October 8, 2013**

****Please see images for: (Certificate of Correction) ****

Fire hose testing apparatus and method

Abstract

A method for testing a plurality of fire hoses having respective service test pressures and the test apparatus therefor wherein each hose is required to maintain a test pressure for a specified duration to pass the test. The test pressure is proportional to the service test pressure. Each hose is coupled to a respective hose fitting of a respective branch test conduit. Each branch test conduit includes an isolation valve, a pressure transducer, and a hose fitting downstream of the isolation valve. A variable frequency-variable speed controls a motor which drives a positive displacement water pump supplying water to and pressurizing a water header conduit and a plurality of branch test conduits interconnected therewith. An algorithm applied to the error signal for a respective hose line generates a pump speed command limited by the controller to regulate the rate of increase of pump output pressure.

Inventors: **Hamilton; David** (Erie, PA)**, Zeiber; Dennis** (Erie, PA)

Applicant:

Name	City	State	Country	Type
Hamilton; David	Erie	PA	US	
Zeiber; Dennis	Erie	PA	US	

Assignee: **Fire Catt LLC** (Troy, MI)

Family ID: **41118420**

Appl. No.: **12/057,342**

Filed: **March 27, 2008**

Prior Publication Data

Document Identifier	Publication Date
US 20090248324 A1	Oct 1, 2009

Current U.S. Class:	**702/47**; 702/50; 702/51; 702/82; 73/37; 73/40; 73/40.5R
Current CPC Class:	A62C 37/50 (20130101); G01M 3/2815 (20130101); G01M 3/2846 (20130101)
Current International Class:	G01F 1/00 (20060101)
Field of Search:	;702/47,51,50,82 ;73/37,40,40.5R

References Cited [Referenced By]

U.S. Patent Documents

4167868	September 1979	Bobo
4599890	July 1986	Girone et al.
5297736	March 1994	Vickery
5339677	August 1994	Haug
6783328	August 2004	Lucke et al.
6934644	August 2005	Rogers et al.
2003/0078751	April 2003	Juhasz
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2008/0059082	March 2008	Morrison
2009/0087319	April 2009	Russold et al.

Foreign Patent Documents

1369679	Dec 2003	EP

Other References

Pump school tutorial, "When to use a positive displacement pump," 2007. cited by examiner .
eCircuit Center tutorial, "PID controller," 2002. cited by examiner .
Bormann, EP 1369679 A2--English translated version (Machine translated). cited by examiner .
Parker, "Positive displacement pumps-performance and application," Proceedings of 11th International Pump Users Symposium (1994). cited by examiner .
eCircuit Center, "PID controller" (2002). cited by examiner .
NFPA 1962, "Standard for the care, use and service testing of fire hose including couplings and nozzles," (1992). cited by examiner .
Elastic potential energy (1999). cited by examiner.

Primary Examiner: Kundu; Sujoy
Assistant Examiner: Park; Hyun
Attorney, Agent or Firm: Woodling, Krost and Rust

Claims

The invention claimed is:

1. A method for testing a plurality of fire hoses, each of said hoses required to maintain a test pressure for a specified duration, said test pressure proportional to a service test pressure, comprising the steps of: affixing a plurality of hoses to branch test conduits, each of said branch test conduits includes a manifold valve, said branch test conduits communicating with a water header conduit; interconnecting said water header conduit with a water pressure source; opening a main valve in said water header conduit; opening said manifold valves in each of said branch test conduits; pressurizing, using a pressure reducing valve, said water header conduit, said branch test conduits and said hoses to 45 psig plus or minus 5 psig; checking for hose or coupling water leaks; if a hose or coupling water leak occurs: close said main valve and said manifold valves followed by opening a drain valve interconnected with said water header conduit followed by opening said manifold valves; repairing said hose or coupling and closing said drain valve followed by opening said main valve and pressurizing, using a pressure reducing valve, said water header conduit, said branch test conduits and said hoses to 45 psig plus or minus 5 psig followed by checking for hose or coupling leaks and repeating this step if a hose or coupling leak occurs; if a hose or coupling leak is not found, then bleed air from the bleed nipple at the end of each hose line and mark said hose at the coupling end; starting and running a variable frequency variable speed drive and a positive displacement pump; monitoring and measuring an actual hose pressure of each of said hoses and taking the derivative of said actual hose pressure with respect to time to ensure that said derivative is greater than or equal to a predetermined negative value; if said derivative of said actual hose pressure with respect to time is not greater than or equal to said predetermined negative value, then close said manifold valves and inspect said hoses and hose couplings for leaks, discontinue operation of said variable frequency variable speed drive and said positive displacement pump; if leaks in said hoses or hose couplings are found, repeat said steps of: if a hose or coupling water leak occurs and all the subsequent steps; if said derivative of said actual hose pressure with respect to time is greater than or equal to said predetermined negative value, then compare specified pressures of each hose with said actual hose pressures forming pressure differences; entering said pressure differences into said controller, said controller operating on said differences according to an algorithm, said controller outputting a pump speed command; rate limiting said pump speed command; outputting said rate limited pump speed command to a pump motor speed control; outputting a pressure from said positive displacement pump; closing said manifold valves at actual hose pressures greater than or equal to said specified pressures for each said hose; stopping said variable frequency variable speed drive and said positive displacement pump; stabilizing said actual hose pressures for a stabilizing period of time allowing said hoses to expand; monitoring and comparing said actual hose pressures to said service test pressures at the end of said stabilizing period; if said actual hose pressures are not greater than or equal to said service test pressures, then restart said variable frequency variable speed drive and said positive displacement pump to boost pressure and repeat said steps of: monitoring and measuring said actual pressure of each of said hoses and taking the derivative of said pressure with respect to time to ensure that said derivative is greater than or equal to a predetermined negative value and all subsequent steps; if said actual hose pressures are greater than or equal to said service test pressures then monitor said actual hose pressures for a period of time to ensure that said actual hose pressures remain above a predetermined percentage of said service test pressures; if said actual hose pressures remain above said predetermined percentage of said service test pressures for said period of time, then said hose or hoses pass said test; and, if said actual hose pressures do not remain above said predetermined percentage of said service test pressure for said period of time, then said hose or hoses fail said test.

2. A method for testing a plurality of fire hoses, each of said hoses required to maintain a test pressure for a specified duration, said test pressure proportional to a service test pressure, comprising the steps of: affixing a plurality of hoses to branch test conduits, each of said branch test conduits includes a manifold valve, said branch test conduits communicating with a water header conduit; interconnecting said water header conduit

with a water pressure source; opening a main valve in said water header conduit; opening said manifold valves in each of said branch test conduits; pressurizing, using a pressure reducing valve, said water header conduit, said branch test conduits and said hoses to a predefined pressure plus or minus 5 psig; checking for hose or coupling water leaks; if a hose or coupling water leak occurs: close said main valve and said manifold valves followed by opening a drain valve interconnected with said water header conduit followed by opening said manifold valves; repairing said hose or coupling and closing said drain valve followed by opening said main valve and pressurizing, using a pressure reducing valve, said water header conduit, said branch test conduits and said hoses to a predefined pressure plus or minus 5 psig followed by checking for hose or coupling leaks and repeating this step if a hose or coupling leak occurs; if a hose or coupling leak is not found, then bleed air from the bleed nipple at the end of each hose line and mark said hose at the coupling end; starting and running a variable frequency variable speed drive and a positive displacement pump; monitoring and measuring an actual hose pressure of each of said hoses and taking the derivative of said actual hose pressure with respect to time to ensure that said derivative is greater than or equal to a predetermined negative value; if said derivative of said actual hose pressure with respect to time is not greater than or equal to said predetermined negative value, then close said manifold valves and inspect said hoses and hose couplings for leaks, discontinue operation of said variable frequency variable speed drive and said positive displacement pump; if leaks in said hoses or hose couplings are found, repeat said steps of: if a hose or coupling water leak occurs and all the subsequent steps; if said derivative of said actual hose pressure with respect to time is greater than or equal to said predetermined negative value, then compare specified pressures of each hose with said actual hose pressures forming pressure differences; entering said pressure differences into said controller, said controller operating on said difference according to an algorithm, said controller outputting a pump speed command; rate limiting said pump speed command; outputting said rate limited pump speed command to a pump motor speed control; outputting a pressure from said positive displacement pump; closing said manifold valves at actual hose pressures greater than or equal to said specified pressures for each said hose; stopping said variable frequency variable speed drive and said positive displacement pump; stabilizing said actual hose pressures for a stabilizing period of time allowing said hoses to expand; monitoring and comparing said actual hose pressures to said service test pressures at the end of said stabilizing period; if said actual hose pressures are not greater than or equal to said service test pressures, then restart said variable frequency variable speed drive and said positive displacement pump to boost pressure and repeat said steps of: monitoring and measuring said actual pressure of each of said hoses and taking the derivative of said pressure with respect to time to ensure that said derivative is greater than or equal to a predetermined negative value and all subsequent steps; if said actual hose pressures are greater than or equal to said service test pressures then monitor said actual hose pressures for a period of time to ensure that said actual hose pressures remain above a predetermined percentage of said service test pressures; if said actual hose pressures remain above said predetermined percentage of said service test pressures for said period of time, then said hose or hoses pass said test; and, if said actual hose pressures do not remain above said predetermined percentage of said service test pressure for said period of time, then said hose or hoses fail said test.

Description

FIELD OF THE INVENTION

The invention is in the field of fire hose testing apparatuses and methods.

BACKGROUND OF THE INVENTION

The National Fire Protection Association (NFPA) promulgated NFPA 1962 entitled Standard for the Inspection, Care, and Use of Fire Hose, Couplings and Nozzles and the Service Testing of Fire Hose sets forth testing requirements for fire hose and couplings as the title of the document implies. It is necessary that fire departments employ fire hoses which are reliable and suitable for immediate use. Periodic testing of fire hose is necessary and a system for documenting historical testing of the fire hose is desirable.

U.S. Pat. No. 4,599,890 to Girone et al. discloses in the abstract thereof: "a hydrostatic test apparatus for pressure testing fire hoses, pressure vessels such as fire extinguishers, or the like, including a small, portable unit having an inlet line for connection to a hose from an ordinary water tap." "A pump, a first bypass line between the inlet lines for filling the item being tested, a control valve in the first bypass line which is closed during testing to prevent backflow of test pressure into the water supply, a pressure gauge in the outlet line for reading test pressure, and an adjustable relief valve in a second bypass line between the inlet and outlet lines for setting a predetermined test pressure" are also disclosed. "Air vents or bleeds allow the apparatus to be completely bled of air before testing to assure accuracy of the test pressure readings. The apparatus operates on very low water volume for safety". In col. 5, lns. 27 et seq. of U.S. Pat. No. 4,599,890 it is stated that "several lines could be tested simultaneously simply by mounting a manifold (not shown) on threaded outlet 32 and then connecting 300 foot sections of hose to be tested to the outlet ports of the manifold." No indication is given in U.S. Pat. No. 4,599,890 to Girone et al. about testing hoses at different pressures. Nor is there any structure allowing specific lines to be isolated or shut down if a hose leak or burst should occur.

It is desirable, therefore, to efficiently, accurately and cost-effectively test fire hose at low pressure and at the higher service test pressure and to record and maintain the results of the tests.

SUMMARY OF THE INVENTION

A fire hose testing apparatus for testing a plurality of fire hoses is disclosed wherein each of the hoses is required to maintain a specified pressure for a specified duration of time. Fire hoses may be linked together if they have the same service pressure. There are two tests performed on the fire hose. First, there is a low pressure test where the fire hose is pressurized to 45 psig+/-5 psi and observations are then made about leakage and fitting or coupling slippage. If a leak or coupling slippage is observed, then corrective action must be performed. Second, there is a service pressure test where the fire hose is pressurized to a pressure of at least its service test pressure for a three minute period of time.

The term "specified pressure" referred to herein is 5% greater than the service test pressure. Those skilled in the art will recognize that other specified pressures may be used. For instance, the specified pressure may be 2%, 8%, or 10% greater than the service test pressure. In the service pressure test, pressure in the hose is raised to at least 5% more than the service test pressure and then the hose is allowed to stabilize. The term "service test pressure" means the pressure at which a fire hose must be tested to remain in service. The term "test pressure" means a pressure proportional to the "service test pressure" and it is a percentage of the service test pressure. Preferably, the "test pressure" is 90% of the service test pressure. Other test pressures expressed as a percentage of the service test pressure may be used. In the service pressure test, the "actual line pressure" as measured in the branch test conduit must be greater than the "test pressure" for a period of time.

Stabilization allows the hose to expand. Fire hoses are known to expand due to variations in temperature, construction type of hose, age of the hose and pressure applied. Additionally, since the hoses may be linked together provided they do not extend past three hundred feet in length, any one of the individual hose lengths

or the coupling may leak.

In the low pressure test, the hose fittings are first marked with a bar code or other identifying indicia. The hoses are checked for leaks at 45 psig+/-5 psi. The hoses are coupled to a respective hose fitting of a respective branch test conduit. Each of the branch test conduits includes an isolation valve, a pressure transducer downstream of the isolation valve, and a hose fitting downstream of the isolation valve. Pressure testing is performed on the hoses with the isolation valves open during the low pressure test and closed during the service pressure test once the specified pressure is achieved.

The branch test conduit and hose fittings are preferably made of metal which can be stainless or some other grade of steel. The isolation valve is preferably a ball valve with a pneumatic operator, for example, air is required to open the valve and a spring closes the valve. The valve does not modulate, it is either fully open or fully closed. Water is supplied to a pressure reducing valve to regulate pressure at 45 psig+/-5 psi. The pressure reducing valve communicates with a water header conduit which supplies water to and pressurizes the plurality of branch test conduits. The branch test conduits are interconnected with the water header conduit and the hoses receive water from the branch test conduits and the water header conduit.

During the low pressure test, pressure in each of the branch test conduits and the hoses is measured and the isolation valve of each of the branch test conduits is open. If and when the pressure transducer measures a sufficient pressure loss with respect to time in any of the branch test conduits and hoses during pressurization and/or when a leak is visually observed in the hose and/or a coupling of the hose, the isolation valve (manifold valve) is closed.

The invention uses a variable frequency-variable speed drive to control the pump motor to drive a positive displacement pump which supplies water to and pressurizes the water header conduit.

A pressure reducing valve is arranged in series with the positive displacement pump if the pump is running. If the pump is not running, the pressure reducing valve supplies water to a pump bypass conduit. The apparatus may reside in a vehicle trailer enabling the trailer to service fire stations regionally on an annual or semi-annual testing schedule. In the service pressure test a plurality of fire hoses are simultaneously tested at different pressures and sizes resulting in cost, time and accuracy advantages.

In the performance of testing to meet regulatory standards of the NFPA, a Service Test Pressure Glossary is helpful. "Service Test Pressure" is the pressure at which the hose is tested. A set point (specified pressure) is an actuating criterion used herein and by definition herein is calculated to be 1.05 times the "service test pressure". The "actual line pressure" (ALP) is the pressure measured in the hose line as inferred by a pressure transducer in the branch test conduit leading to the hose. The "test pressure" is a proportion (i.e. a percentage less than 100 percent) of the "service test pressure". A partial glossary of terms is summarized as follows.

Service test pressure=nominal pressure at which a hose is tested, the value which is inserted by the operator into the controller which is then scaled to a higher value known as the set point (specified pressure).

Test pressure=90% of service test pressure, the actual pressure must be greater than or equal to the test pressure to pass the test. Alternatively, an acceptable predetermined limit below the service test pressure other than 90% may be used.

Specified pressure=set point=service test pressure times a scaling factor such as 1.05.

Actual line pressure (ALP)=pressure measured in the branch test conduits.

A controller (an Allen Bradley programmable logic controller) regulates the variable frequency-variable speed drive which controls the pump motor and limits the rate of pressure rise or fall in each of the branch test conduits. The controller positions the isolation valve of each of the branch conduits depending on the state of the process. For instance, the controller closes the isolation valve as necessary to repair the hose when the low pressure service test is performed at 45 psig+/-5 psi.

Prior to any water entering the hose, while the isolation valve is open, the hose is coupled to the fitting outside the trailer. When the hose is filled with water at low pressure (45 psig+/-5 psig) and is observed by test personnel for leaks, bulges (bubbles) and for rotation of the hose material with respect to its fittings/couplings. Before the low pressure test is commenced the hose is marked where it meets the hose fitting with a magic marker, bar code, or some other type of chalk or with paint. After the hose has been pressurized at low pressure (45 psig+/-5 psi) according to NFPA 1962 (the National Fire Protection Association standard 1962) the hose and fittings are observed for leaks, and bulges (bubbles). If a leak is observed, then the isolation valve for the branch test conduit is closed and the pressure is relieved from the hose and the hose and/or the fitting is repaired or removed.

Operation of the isolation valve is performed by a test operator inside the trailer at the Panel View controller interface. The Panel View interface is a touch screen interface to and with an Allen Bradley programmable logic controller. The 45 psig+/-5 psi low pressure test is controlled by an in-line pressure reducing valve which regulates incoming water pressure to 45 psig+/-5 psi. Usually, water from a fire hydrant (fire plug) is used to supply the test apparatus and is regulated to 45 psig+/-5 psi where it is then fed into a water header conduit for distribution into branch test conduits. The branch test conduits each include an in-line isolation valve, a pressure transducer downstream of the isolation valve and a pressure transducer downstream of the pressure isolation valve. Usually, the preferred isolation valve is a ball valve with an air to open, spring to close actuator controlled by the controller. A solenoid controlled actuator is controlled by the controller. Different valve types may be used and different operators may be used. The spring to close operator has been found to provide rapid closure time so as to prevent the hose coupled to the branch conduit test fitting from whipping and causing damage to nearby equipment and personnel. Each of the branch test conduits terminates in a fitting to which the hose is coupled.

The controller compares the specified pressure (set point) of each of the hoses to the actual line pressure in each of the hoses as measured by the pressure sensor of each of the branch test conduits generating an error signal. The controller generates an output signal (pump speed command) which is based on a proportional plus integral plus derivative algorithm or based on some other algorithm. The proportional plus integral plus derivative algorithm is the sum of: a first proportional constant times the error signal plus a second proportional constant times the integral of the error signal plus a third proportional constant times the derivative of the error signal. The rate of change of the pump speed command is limited by the controller such that the pressure output of the pump and hence the actual line pressure of each hoses being tested does not exceed 15 psi/second. In effect the derivative of the actual line pressure (ALP) is less than or equal to 15 psi/second, dALP(t)/dt.ltoreq.15 psi/second.

A method for testing a plurality of fire hoses is disclosed and each of the hoses is required to maintain a test pressure for a specified duration. The steps of the process include coupling each of the hoses to a respective hose fitting of a respective branch test conduit. As previously indicated each of the branch test conduits includes an isolation valve, a pressure transducer downstream of the isolation valve, and a hose fitting downstream of the isolation valve. First, a variable frequency-variable speed drive controls the positive

displacement water pump and supplies water to and pressurizes a water header conduit. The plurality of branch test conduits are interconnected with the water header conduit, the hoses receiving water from the branch test conduit and the water header conduit. Actual line pressure sensed from each of the pressure transducers downstream of the respective isolation valve of each of the branch test conduits is inputted into a controller. Specified pressures (set points, 1.05 times the service test pressures) are inputted into the controller for each of the hoses to be tested prior to pressurization for the low pressure test. The procedure for inputting the specified pressures into the controller is to use the touch screen interface whereby the service test pressure is input for each hose line to be tested. The controller includes a scaling factor of 1.05 times the service test pressure which is denoted herein as the set point or the specified pressure. The operator at the touch screen interface will input the service test pressure into the controller. The actual line pressures are then subtracted from the respective specified pressures (set points, 1.05 times the service test pressure) generating pressure error signals. Using the controller, an algorithm is then applied to the individual error signals and a respective pump speed command beginning with the branch test conduit having the lowest specified pressure (1.05 times service test pressure) is generated and outputted. The algorithm is preferably a proportional plus integral plus derivative algorithm, for example, the pump speed command is in the form of: motor speed/pump pressure inferred=K.DELTA.P(t)+K.sub.1.intg..DELTA.P(t)+K.sub.2d/dt .DELTA.P(t) with appropriate scaling factors and integration constants (biases). The rate of change of the pump speed and hence, the rate of change of the actual line pressure is then limited by the controller. The respective isolation valve of the branch test conduit for the lowest specified pressure (1.05 times service test pressure) is closed when the branch test conduit pressure and the hose pressure (actual line pressure) is greater than the specified pressure. In this way the pressure in the branch test conduit and hence in the hose under test is elevated by a certain amount typically 5% greater than the service test pressure which the hose must meet to satisfy regulatory and safety standards. Simply put, the specified pressure or set point pressure is equal to 1.05 times the service test pressure.

After the first branch test conduit and hose has reached the specified pressure (i.e., the set point) for testing, the controller then outputs a respective pump speed command for the branch test conduit having the next lowest specified pressure. The controller does this by applying the exact same algorithm and process steps used to generate sufficient actual line pressure for the first line (i.e., the line having the lowest set point pressure). The controller is processing the algorithm for the second hose line in parallel with the algorithm for the first hose line. In identical fashion the controller is applying the same algorithm and the same process steps in parallel for the remaining 3-10 hose lines or more generally stated for 1-n hose lines. The rate of change of the pump speed and hence the rate of change of the pressure in the water header conduit and the branch test conduit is controlled according to industry and safety standards. Specifically, the allowable rate of change of pressure is 15 psi per second so that an increase of pressure, for example, of 60 psi is achieved in 4 seconds. Once the respective branch test conduit and the hose have achieved an actual line pressure greater than or equal to the specified pressure (set point), the respective isolation valve of the branch test conduit is closed. Next, the stabilization period begins on a line by line basis.

The steps of: outputting a respective pump speed command with respect to the branch test conduit having a specified pressure, limiting the rate of change of the pump speed, closing the respective isolation valve of the branch test conduit for the specified pressure (1.05 times service test pressure) when the actual line pressure is greater than or equal to the specified pressure (set point) are performed repeatedly and successively for each branch test conduit from the lowest specified pressure (1.05 times service test pressure) to the highest specified pressure. In other words, the process can be thought of as a seamless step-wise service test. Specifically, for example, if 10 hoses are being tested and each hose tested has a different service test pressure, for example, 100 psig, 125 psig, 150 psig, 175, psig, 200 psig, 225, psig, 250 psig, 275 psig, 300 psig, and 325 psig, the test apparatus and process will first satisfy the 100 psig conduit test branch by raising

the pressure from a starting point near 45 psig (when the pump is first activated) at a controlled rate to 105 psig (1.05 times the service test pressure of 100 psig). At this time the isolation valves for all the test branches are open. When 105 psig (5% greater than the specified pressure, i.e., 1.05 times the service test pressure) is reached the isolation valve in the branch test conduit will close while the isolation valves for the other branch test conduits remain open communicating fluid to the other hoses being tested. Next, the controller seamlessly (and simultaneously) in parallel commands a speed output to the motor to increase the speed to obtain the required specified pressure (set point) for the next hose to be tested, namely, approximately 131.25 psig 1.05 times service test pressure of 125 psig). The process is repeated until the specified pressures (set points) are satisfied in all of the hose lines.

Due to expansion of the hoses under pressure the volume of the hoses will increase and the pressure will be reduced. If the reduction in actual line pressure goes below the service test pressure of the hose then the actual line pressure must be increased (i.e. boosted) to the specified pressure (i.e. set point pressure, 1.05 times the service test pressure. Temperature, pressure, type of fire hose and age of the fire hose are all factors which determine its expansion. Once the specified pressure (1.05 times service test pressure) at which the fire hose is to be tested is achieved, the hose under test is stabilized for a period of up to three minutes depending on the hose length under test. During the stabilization period, the pressure may decrease as just described. If the actual line pressure goes below the service test pressure then the pressure must be increased or boosted. The step of opening the respective isolation valves and boosting the actual line pressures, if necessary, of one or more of the respective branch test conduits and the hoses coupled thereto is performed if the actual line pressure is less than or equal to the service test pressure. One boost cycle is preferred; however, additional boost cycles can be added to the process if desired. If the hose does not maintain its pressure above the service test pressure after being once boosted, then the fire hose is taken out of service.

Boosting the pressure is accomplished by starting the pump motor and following the process steps stated above. Once the specified pressure (1.05 times service test pressure) for a given hose is again achieved, the respective isolation valve of that branch test conduit is closed. If, for example, the set points of the first seven lines have been achieved and the controller is in the process of bring the eighth line up to its set point pressure (specified pressure) and at this time the third hose line under test falls below its service test pressure, the controller finishes pressurizing the 8.sup.th, 9.sup.th and 10.sup.th lines to their set points before boosting the pressure in the 3.sup.rd line to its set point.

During pressurization by the pump for the service pressure test or during pressurization using a fire hydrant as the source of the water for the low pressure test, the isolation valves of the branch test conduit immediately close when the respective pressure transducers sense a sufficiently reduced pressure with respect to time. In other words should a hose burst during a test or develop a significant leak, the pressure of that hose and the pressure in the branch test conduit will be reduced dramatically and will exceed a preset limit. Thus an indication of a leak or a hose failure can be determined by the controller as it monitors the actual line pressure in each branch test conduit and hose as a function of time. When the slope of the actual line pressure as a function of time is less than or equal to some permissibly negative rate then a leak or burst of the hose may be assumed and the isolation valve for the effected hose under test must be quickly closed. This is accomplished by the controller determining the derivative (slope) of the actual line pressure with respect to time and comparing that value to a preset value, for example, -J. The preset value of -J is determined so as to accommodate expansion of the hose during the stabilization process where some decrease in pressure with respect to time is permissible.

The test method, said another way, includes stabilizing each of the branch test conduits and the hoses coupled thereto if the actual line pressure in each hose is greater than or equal to the specified pressure. If the hose

loses too much actual line pressure and falls below the service test pressure, then, the pressure is boosted above the specified pressure and the hose line proceeds into the test period. If the actual line pressure is greater than or equal to the test pressure (preferably 90% of service test pressure) for a specified duration (usually at least 3 minutes for 300 feet of hose), then the hose passes the test and the controller displays the result on the graphical user interface. The stabilization and test periods are one minute per 100 feet of hose. Therefore if the hose lengths are shorter then the stabilization periods are shorter. If the actual line pressure is not greater than or equal to the test pressure then the hose fails the test and the controller displays the results on the graphical user interface.

Before the testing of the hose begins and during the setup of the test each hose is identified using a bar code system. Other identifying indicia may be used as well. The bar code and/or other identifying indicia may be used to track the performance of the hose from one annual test to another thus developing historical data in regard to the hose. The bar code is applied to the hose coupling/fitting. This data may be stored in the controller or it may be stored in a portable device interconnectable with the controller. Pass fail data and other test data may be recorded and stored in a spreadsheet and the spreadsheet may be uploaded to a website accessible by fire departments in the region serviced by a given mobile fire hose testing trailer.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a vehicle trailer wherein hose fittings and elbows protrude from a side of the trailer.

FIG. 1A is an enlarged portion of two of the hose fittings and elbows protruding from the side of the trailer along with the strobe annunciators.

FIG. 1B is a schematic of a trailer with the hoses laid out before pressurization thereof.

FIG. 1C is an enlargement of a portion of a hose in its depressurized state illustrating the coupling and an end portion of one of the hoses with an identifying bar code placed on the coupling.

FIG. 1D is an enlargement of a portion of a hose in its pressurized state illustrating the coupling and an end portion of one of the hoses with an identifying bar code placed on the coupling.

FIG. 1E is a cross-sectional view taken along the lines 1E-1E of FIG. 1B illustrating a weighted clamp to tie the hose to the surface.

FIG. 1F is a schematic of a trailer with ten hoses laid out after pressurization thereof.

FIG. 1G is a side view of smaller diameter hoses laid out in the pressurized state.

FIG. 1H is an enlarged portion of FIG. 1F illustrating a section of hose.

FIG. 1I is a side view of one of the hose lines illustrating an adapter hose and hoses of different diameter interconnected together.

FIG. 2 is a schematic of the process and instrument diagram illustrating the valving arrangement, pressure reducing valve, pressure sensors (transducers), controller and pump.

FIG. 2A is a perspective view of the interior of the trailer illustrating the valving arrangement, pressure reducing valve, sensors and pump.

FIG. 2B is an enlargement of a portion of FIG. 2A illustrating two isolation valves (manifold valves) and pressure sensors.

FIGS. 3, 3A, 3B and 3C illustrate a diagrammatic process flow chart.

FIG. 4, prior art, illustrates pump curves for various operating pressures.

A better understanding of the drawings will be had when reference is made to the description of the invention and the claims which follow.

DESCRIPTION OF THE INVENTION

A fire hose testing apparatus for testing a plurality of fire hoses is disclosed wherein each of the hoses is required to maintain a specified pressure (1.05 times service test pressure) for a specified duration of time. The terms "specified pressure" and "set point" mean a pressure 1.05 times the service test pressure. The "actual line pressure" is the measured pressure in the hose.

There are two tests performed on the fire hose. The fire hoses may be linked together as illustrated in FIGS. 1B and 1F if they have the same service test pressure.

First, there is a low pressure test where the fire hose is pressurized to 45 psig+/-5 psi and observations are then made about leakage. If a leak is observed, then corrective action must be performed.

Second, there is a service pressure test where the fire hose is pressurized to a pressure greater than its service test pressure for a period of time of at least three minutes (for three hundred feet of hose). The set point pressure is sometimes referred to herein as the specified pressure (1.05 times service test pressure) and this pressure is typically 5% greater than the service test pressure of the hose. The service test pressure is inputted to the controller by a test operator using the touch screen interface to the controller. In the service pressure test the hose is raised to the set point pressure of 1.05 times the service test pressure and then the hose is allowed to stabilize.

Stabilization allows the hose to expand. Fire hoses are known to expand due to variations in ambient temperature, water temperature, construction type of the hose, age of the hose, and pressure applied. Additionally, since a plurality of hoses may be linked together provided they do not extend past three hundred feet in total length, any one of the individual hose lengths, fittings or couplings may leak. During stabilization the actual pressure in the hose is permissibly reduced below the set point pressure (specified pressure) due to expansion of the hose provided the actual line pressure does not fall below the service test pressure of the hose. If actual line pressure falls below the service test pressure during stabilization one boost cycle is performed. It then enters the service pressure test where the pressure is allowed to fall below the service test pressure and still meet the test criterion, passing the service pressure test if the actual line pressure is at least 90% of the service test pressure after sufficient time lapse. If the actual line pressure is not at least 90% of the service test pressure after a sufficient time lapse then the hose fails the service pressure test.

FIG. 1 is a perspective view 100 of a vehicle trailer 120 wherein hose fittings and elbows 101, 102, 103, 104, 105, 106, 107, 108, 109, 110 protrude from a side of the trailer. Truck 121 tows trailer 120 to different testing

locations. FIG. 1A is an enlarged portion 100A of two of the hose fittings and elbows 109, 110 protruding from the side of the trailer. FIG. 1A also illustrates strobe annunciators 101A, 102A, 103A, 104A, 105A, 106A, 107A, 108A, 109A and 110A which illuminate when the service pressure test is performed.

Still referring to FIGS. 1 and 1A, hose fittings and elbows are arranged at an angle with respect to the side of the trailer 120 and point downwardly toward the surface 180 of the parking lot or roadway. Surface 180 is used to lay out the hose test and should be clean and flat. FIG. 1 also illustrates the drain fitting and elbow 111.

FIG. 1B is a schematic 100B of a trailer with the hose layout illustrating ten hose lines before pressurization thereof. Specifically, FIG. 1B illustrates hose sections lying flat on surface 180 in the depressurized state. The number of hose lines which may be tested is variable and may range preferably from 1 to 10. More or fewer than 10 lines may be utilized with design changes specifically contemplated within the scope of this disclosure.

Still referring to FIG. 1B, adapter hoses 199 which lead from the fittings which protrude from the side of the trailer are illustrated. Adapter hoses 199 are used if the diameter of the hose to be tested is greater than or equal to 3.5 inches in diameter. An adapter hose 199 is used to interconnect hoses 135, 137, and 136. It will be noticed that hose 137 is slightly narrower in diameter than hoses 135 and 136. However, if the first hose in line (135, 136, and 137) in the line is at least 3.5 inches in diameter, then an adapter hose must be used. FIG. 1I is a side view 1001 of one of the hose lines illustrating an adapter hose 199 and hoses 135, 136 of different diameter interconnected together.

Hoses smaller than 3.5 inches in diameter do not require adapter hoses 199 as they are connected directly to the fittings as indicated by the first hose line 131, 132, 133. The hoses may be interconnected through couplings or joints 172, 172A with hoses having different diameters but having the same service test pressure. See FIG. 1C. The total length of interconnected hose shall not exceed 300 feet.

Still referring to FIG. 1B, the first hose lines indicates three hoses 131, 132, and 133 joined together. An end cap fitting 134 best viewed in FIGS. 1G and 1I enables bleeding of air from the end of the hose. Preferably, air is bled from the hose after it has been initially filled. Water from a fire hydrant is communicated to an inlet line 201 which in turn communicates with an in-line water filter 294 which in turn communicates with pipe section 202 and then proceeds to pressure reducing valve 204 where the pressure is reduced to 45 psig+/-5 psi. FIG. 2 is a schematic 200 of the process and instrument diagram illustrating the valving arrangement, pressure reducing valve, pressure sensors (transducers), controller and pump.

Referring to FIG. 2, the water is then communicated to pipe section 205 and then to water header conduit 213. Water header conduit 213 communicates with and out to branch test conduits 214, 215, 216, 217, 218, 219, 220, 221, 222, 223 through the isolation valves 224, 225, 226, 227, 228, 229, 230, 231, 232, 233 and then to the respective fire hoses. The branch test conduits are interconnected with the water header conduit 213 using pipe unions known as pipe tees. As water flows into and through each of the respective fire hoses, a valve included in fitting 134 at the end of the last hose in the hose line is closed. Once filled, the hose is elevated to a height at least as high as the fitting and elbows 101-110 on the trailer and the valve 134 is opened to bleed the air off. The fittings and elbows 101-110 on the trailer are located a convenient height above the test surface (parking lot, unused roadway, etc.) so that test personnel may easily interconnect the hose fitting to the fitting on the end of the branch test conduit. Additionally, the test fittings and elbows 101-110 include air bleed ports such as those bleed ports 109B, 110B illustrated in FIG. 1A. Caps on the bleed ports may be temporarily removed to ensure that air is removed from the hose. Once air from the hose

is completely eliminated the valve in the end cap fitting 134 is closed.

Still referring to FIG. 1B, the hoses 131, 132, 133 have a diameter less than 3.5 inches. Once the hoses have been filled with water and any entrapped air is removed therefrom, the hoses are then secured by weighted clamps 181 as illustrated in FIGS. 1B and 1E. Hose 173 is illustrated within the weighted clamp 181 in FIG. 1E. FIG. 1E is a cross-sectional view 100E taken along the lines 1E-E of FIG. 1B. Weighted clamps 181 are not illustrated on each of the lines in FIGS. 1B and 1F for the sake of drawing clarity. However, the weighted clamps or other securement is applied to the ends of all of the hoses to prevent whipping of the hoses upon performance of the service pressure test. For instance, as an alternative, all of the hoses can be interconnected in a single weighted rack.

FIG. 1C is an enlargement 100C of a portion of hoses 132, 133 illustrating the coupling 172, 172A and an end portion of one of the hoses with an identifying bar code 171 placed on the coupling. In proximity to the coupling 172, 172A the hoses being joined are shown as being of somewhat lesser diameter as compared to the portion thereof which lies flat somewhat rightwardly and leftwardly of the coupling. FIG. 1D is an enlargement 100D of a portion of a hose 132 in its pressurized state illustrating the coupling 172, 172A and an end portion of one of the hoses 132 with an identifying bar code 171 placed on the coupling. FIG. 1F is a schematic 100F of the trailer 120 substantially similar to FIG. 1B with the hose layout illustrating the ten hose lines after pressurization thereof. The diameters of the hose in FIG. 1F appear more uniform between the fittings as the hose lines are pressurized. Hose fittings may be threaded or they may be of the Storz type.

FIG. 1G is a side view 100G of a smaller diameter hose (less than 3.5 inches in diameter) in the pressurized state. It will be noticed that the diameter of all of the hoses illustrated in FIG. 1G are less than 3.5 inches in diameter and that no adapter hose is required. It will be further noticed that the lengths of the hoses are not the same according to the diagrammatic depiction of FIG. 1C. It will be further noticed that a slight gap 174 exists between hose 132 and the surface 180 of the parking lot as illustrated in FIGS. 1G and 1H. FIG. 1H is an enlarged portion 100H of FIG. 1G.

FIG. 2 is the process and instrument diagram 200 illustrating the valving arrangement, pressure reducing valve 204, pressure sensors (transducers) 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 290, 291, 292 controller 285 and pump 210. The controller 285 is preferably an Allen Bradley AB Logix programmable logic controller utilizing an Allen Bradley Panel View Plus 1000 2711P-T4C4A1 touch screen interface. Controller 285 is not shown in FIGS. 2A and 2B. Controller 285 controls the service pressure test as set forth below in an automatic mode. In manual mode the operator utilizes the touch screen interface to enter service test pressures to control operation of all of the valves and the variable frequency-variable speed drive to control the motor. An operator may toggle back and forth between automatic and manual modes. The controller 285 dictates the position of the isolation valves 224-233, main valve 203, and drain valve 298. Controller 285 actuates the solenoid controlled pneumatic operators which control the position of the isolation valves 224-233, main valve 203 and drain valve 298. All of the isolation valves (sometimes referred to herein as manifold valves) fail safe in the closed position upon loss of control air from the air compressor 243A or electrical power to the solenoids. The solenoids are part of the operators 224A-233A, 203A and 298A. The operators are sometimes referred to as actuators and are air to open, spring to close actuators. Under loss of electrical power or control air pressure, all of the isolation valves, the main valve and the drain valve fail safe in the closed position. Reference numeral 257 schematically denotes electrical power distribution to and from the identified components. Reference numeral 257 schematically denotes electrical control signal communication between the input/output modules of the controller 285 and the electrical components of the system such as the solenoid valves controlling air to the air operated valves, the pump motor M drive controls and the pressure transducers.

Pump 210 is a positive displacement pump manufactured by Wanner Engineering, Hydra-Cell Model H-25, capable of generating pressure greater than or equal to 500 psig. FIG. 4, prior art, illustrates 400 pump curves 401, 402 for the Hydra-Cell Model H-25 pump wherein various operating pressures, speeds and flow rates are illustrated. FIG. 4 indicates that if speed is increased for a given flow rate that pump output pressure is controlled. Pump output pressure varies as a function of speed and flow rate. Different pumps with different output curves and operating speeds for constant volumetric output may be used.

The controller is automatically booted once power is available, namely, once the portable generator G mounted on the exterior of the front of the trailer is started. Alternatively, power may be available at the test site from the local utility or municipality. From the touch screen interface 285, the specified pressures (set points) 392 for the service pressure test may be set for each of the hose lines coupled to fittings 101-110 to be tested. The control system program is written using Rockwell RSLogix 5000 software along with Panel View plus touch screen interface software. Communication between devices is made through a custom-made RS Linx software program. The pressure transducers are Honeywell Sensotec FP2000 outputting 4-20 ma dc or 0-10V dc. An Allen Bradley Power Flex 22C-B033N103 variable frequency-variable speed drive controls the motor and runs the Hydra-Cell pump 210. A control algorithm, preferably a proportional plus integral plus derivative algorithm having the general form of K.DELTA.P(t)+K.sub.1.intg..DELTA.P(t)+K.sub.2d/dt .DELTA.P(t), 382, outputs a speed command to the variable frequency-variable speed drive to control the motor M. The speed rate of change command, however, is limited by the controller to a rate of change equivalent to 15 psi/sec pump output pressure as sensed by the pressure transducers of each test conduit. The 15 psi/s speed output is included in the fire hose test procedure NFPA 1962, Edition 2003 procedure for testing fire hose.

Each of the branch test conduits is nominally 2.5 inches in diameter and include a ball valve having a pneumatic operator, a pressure transducer downstream of the ball valve and elbow and terminal end fitting for interconnection with the fire hose. Most of the metal piping and interconnections used in the test apparatus are 2.5 inches in diameter. FIG. 2A is a perspective view 200A of the interior of the trailer illustrating the valving arrangement, pressure reducing valve, sensors and pump. FIG. 2B is an enlargement 200B of a portion of FIG. 2A illustrating two isolation valves (sometimes referred to herein as manifold valves) 214, 215 and pressure sensors. FIG. 2B also illustrates pressure transducers 234, 235 in the branch test conduits.

Referring to FIGS. 2 and 2A, water inlet line 201 includes an in-line strainer 294 to remove dirt which may be in the fire hydrant piping once the inlet line 201 is interconnected with the fire hydrant (or other source) not shown. Water inlet pressure of approximately 80-150 psig is monitored by the pressure transducer 290 on the inlet water supply and is a permissive to opening main valve 203. In other words, if a sufficient actual line pressure is not sensed upstream of the main valve 203, then the main valve will not open even if commanded to do so. Main valve 203 is an air operated ball valve which requires air pressure applied to the operators/actuators to open and closes under the force of the spring in the operator/actuator. Use of air to open, spring to close valves allows quick closure of the ball valves and this is especially important for the isolation valves for the branch test conduits. The ball valves used have minimal leakage under pressure and employ seats. Plastic seats may also be used. Air compressor 243A is diagrammatically shown in FIG. 2 but does not appear in FIGS. 2A and 2B.

Referring to FIG. 2A, air is distributed through an air header 265 to the pneumatic operators of all of the valves, 224-233, 203 and 298. All of the valves, 224-233, 203 and 298, are preferably Jamesbury ball valves using teflon seats. Water is communicated from the inlet 201, through strainer 294, through main valve 203 and into and through pressure reducing valve 204 where its pressure is reduced to 45 psig+/-5 psi. Forty five

psig (45 psig+/-5 psi) was chosen to meet the NFPA standard for the low pressure test. A pressure reducing valve is arranged in series with the positive displacement pump if the pump is running. The pressure reducing valve is arranged in series in a pump bypass conduit. The apparatus may reside in a vehicle trailer enabling the trailer to service fire stations regionally on a yearly or semi-annual testing schedule. Use of the vehicle and the invention residing therein enables the testing of a plurality of fire hoses at one time, at different pressures and sizes resulting in cost, time and accuracy advantages.

Outlet pressure of the pressure reducing valve 204 is monitored and measured by pressure transducer 291 interconnected with the outlet of the pressure reducing valve. A certain liberty has been taken in FIG. 2 using a pressure gauge symbol for the pressure transducers 290, 291, 292 and 234-243. Those skilled in the art will readily recognize that a pressure gauge may be used in conjunction with a pressure transducer. A pressure transducer senses and transmits 257 an electrical signal to a controller 285 and a display device and touch screen interface. A typical pressure gauge is read visually.

Pump 210 is driven by the motor M which is controlled by the variable frequency-variable speed drive. A generator mounted on the exterior of the vehicle trailer 120 provides power to the pump motor and to the compressor. Pump suction line 208 is nominally 1.25 inches in diameter. Pump discharge line 212 is nominally 1 inch in diameter. The pump suction and discharge lines are flexible hose lines. Other water header conduit diameters and piping and flexible hose line specifications may be used depending on the particular application of the test apparatus and methods.

The generator G is mounted on the front of the trailer and resides between the trailer and the vehicle. Check valve 207 prevents reverse flow through the pump when it is not operating during the low pressure test and/or while municipal water is being supplied to the water header conduit 213. Further, when the pump M is running, check valve 206 ensures that the pump will not back feed into the municipal water system and possibly damage the pressure reducing valve. Relief valve 211 is on the outlet of the pump and is typically set at 450 psig. Water header conduit (i.e. pump outlet) pressure is sensed and transmitted by transducer 292. Pneumatically operated 298A drain valve 298 is interconnected by water conduit 299 and serves to relieve pressure in the water header conduit 213 when desired.

Branch test conduits include interconnecting pipes or conduits 214, 215, 216, 217, 218, 219, 220, 221, 222, 223 arranged in parallel with each other and fed by water header conduit 213. Water header conduit 213 is nominally 2.5 inches in diameter as are the branch test conduits. As used herein the branch test conduits include the interconnecting conduits 214, 215, 216, 217, 218, 219, 220, 221, 222, 223 and the respective isolation valves 224, 225, 226, 227, 228, 229, 230, 231, 232, 233 and the respective elbows and fittings 101, 102, 103, 104, 105, 106, 107, 108, 109, 110. Each of the isolation valves includes a respective pneumatic operator (air operator) 224A, 225A, 226A, 227A, 228A, 229A, 230A, 231A, 232A, 233A. Each of the branch test conduits also include a respective pressure transducer 234, 235, 236, 237, 238, 239, 240, 241, 242, 243.

Each of the pressure transducers measures actual line pressure in the branch test conduit and the hose. The isolation valve of each of the branch test conduits is closed when the specified pressure (1.05 times service test pressure) of each of the branch test conduit and the hose is achieved. The isolation valve of each of the branch test conduits closes during pressurization if and when the pressure transducer measures a sufficient actual line pressure loss with respect to time in each of the branch test conduits and hoses.

FIGS. 3, 3A, 3B and 3C illustrate a diagrammatic 300, 300A, 300B and 300C process flow chart. FIGS. 3, 3A, 3B and 3C do not represent all of the process steps employed but rather indicate cardinal points in the process. Referring to FIG. 3, to begin testing the fire hoses, the hoses must first be coupled to the respective

fittings illustrated in FIGS. 1, 1B and 1F. Each of the hoses must be secured in a clamp 181 or in a rack restraining all the hoses so as to protect the test personnel in the event of a hose burst or blow out. In the low pressure test, the couplings/fittings are first marked with a bar code 171 or other identifying indicia. After removal of the protective cap 201B, the water inlet line 201 is coupled to a fire hydrant or some other water source (not shown). Flange 201A secures the pipe section 201 in the trailer. The main valve 203 is then opened 301 along with the manifold valves (isolation valves) 302. The hoses and couplings are checked for leaks at 45 psig+/-5 psi as indicated by reference numeral 303 in the process flow diagram. By checking for leaks it is meant that a visual check for leaks is made by test personnel. During the low pressure test, personnel may walk near the hose lines. However, during the service pressure test, personnel must stand at least 15 feet away from the leftmost hose when the hose field or array is viewed from the perspective of the trailer 120.

If a leak 305 is observed in a hose and/or a coupling of a hose, then the low pressure test is discontinued 334 and the main valve 203 and the manifold valves (isolation valves) are closed 336, 338. At this time the valves that are in the fittings at the end of the test lines are closed. The next step is to open the drain valve 340, 298, followed by the step of opening the manifold valves to drain 342, followed by the step of repairing the hose or coupling 344. Once the repair of the hose(s) or coupling(s) is made or the hose is removed, the step of closing the drain 346 is performed followed by the step of opening the main valve and pressurizing 348 the water header conduit 213 and pressurizing the branch test conduit and hose which was repaired. The isolation valve/manifold valve of the repaired line(s) is then closed 350. The test is then continued 352, 354 and all the manifold valves (isolation valves) are opened 302 and the process is repeated until all hoses are not leaking and all couplings are not leaking for a sufficient amount of time. If no leaks in the hoses or couplings are found as set forth in the process flow diagram by reference numeral 304, air is bled 308 from the valves 134 at the ends of the hoses and from the air bleed port (109B, 110B) on each of the fittings. Each hose is marked 310 in proximity to its fittings/couplings and the compressor is shutdown as indicated by reference numeral 312. If a large enough generator is used then it is not necessary to shutdown the air compressor as a condition precedent to the service pressure test. All valve manipulations are controlled by the controller 285 as stated previously herein and the position of each valve may be controlled in manual mode by the touch screen interface.

In the low pressure test, the couplings/fittings are first marked with a bar code 171 or other identifying indicia. See FIGS. 1C and 1D. The hoses are checked for leaks at 45 psig+/-5 psi. The hoses are coupled to a respective hose fitting 101-110 of a respective branch test conduit 214-223. Each of the branch test conduits includes an isolation valve 224-233, a pressure transducer 234-243 downstream of the isolation valve, and a hose fitting downstream of the isolation valve. Low pressure testing is performed on the hoses with the isolation valves open in the low pressure test. During the service pressure test the isolation valves are closed as described below in more detail. The branch test conduit and hose fittings are preferably made of metal which can be stainless or some other grade of steel. The isolation valve is preferably a ball valve with an air to open, spring to close actuator. The valve does not modulate, it is either fully open or fully closed. Water is supplied to a pressure reducing valve set to regulate pressure at 45 psig+/-5 psi. The pressure reducing valve 204 communicates with a water header conduit 213 which supplies water to and pressurizes the plurality of branch test conduits 214-223.

During the low pressure test, pressure in each of the branch test conduits and the hoses is measured while the isolation valve of each of the branch test conduits is open. During pressurization up to 45 psig+/-5 psi, if a given pressure transducer measures a sufficient pressure loss with respect to time in any of the branch test conduits and/or when a leak is visually observed in the hose, the isolation valve is closed. Once the low pressure test has been satisfactorily completed the service pressure test is performed.

Now, the hoses are ready to be tested nominally at 1.05 times their service test pressures. The requirement for the service pressure test is that each of the hose lines maintain a test pressure for a period of three (3) minutes. The process described herein takes the actual line pressure above the service test pressure by 5% and some degradation thereafter is permitted provided that the hose maintains an actual line pressure above the service test pressure. Pump 210 is started by the controller 285 and the controller receives actual line pressure signals from each of the transducers 234-243, 290, 291 and 292. Strobe annunciators as represented by A in FIG. 2 and the actual strobe lights 109A, 109B as indicated in FIG. 1 are provided for safety. Reference numeral 314 in the process flow diagram indicates the starting of the pump 210. The controller 285 takes the derivative of the line pressure with respect to time, namely, dALP(t)/dt and compares that value to a permitted decrease in the line pressure with respect to time, -J. In other words as long as the pressure is increasing in a given hose line with respect to time, or as long as pressure does not decrease too much in a given hose line with respect to time, the test continues. In other words as long as the relationship of dALP(t)/dt.gtoreq.-J, is satisfied then the test continues as indicated by decisional diamond 360 and reference numeral 361. The test process disclosed herein allows a plurality of hoses to be simultaneously tested at specified pressures, or more accurately, at pressures at least equal to the service test pressure of the hose and up to a specified pressure or set point for the hose which is 1.05 times the service test pressure of the hoses.

The specified pressure (set point) is 1.05 times the service test pressure. Once the set point pressure is achieved, the hose goes through a three minute stabilization period if it is composed of section of hose which in total are 300 feet in length. During the stabilization period, depending on several factors such as the age of the hose, the size of the hose, the service test pressure of the hose, temperature of the water, temperature of the ambient air and the type of hose being tested, the hose expands and as it expands it changes its interior volume. As the volume of the hose increases the pressure therein tends to decrease. So, the present algorithm used in the controller pressurizes the hose to a pressure 5% higher than the service test pressure. If the derivative of the actual line pressure with respect to time is not greater than or equal to -J as indicated by reference numeral 362, the testing continues. A rate of pressure decrease greater than -J condition signifies a possible hose break or burst and the manifold valve (isolation valve) for the hose under test is quickly closed (if not already closed) and the hose is then inspected as indicated in steps 370 and 371. Applying this derivative pressure control algorithm protects test personnel which may be in the vicinity of the hose. It also protects the pump from wild swings on its curves as the system resistance goes down dramatically when a hose bursts or breaks.

If the derivative of the actual line pressures are satisfied then, on a hose by hose basis, beginning with the hose having the lowest specified pressure (1.05 times service test pressure), a proportional plus integral plus derivative algorithm 382 is applied to the pressure error signal, to with, the instantaneous difference of the specified pressure (set point 392) minus the actual line pressure 388, 390 as measured by the pressure transducer downstream of the isolation valve as indicated by reference numeral 380 in the process flow diagram. Pump speed is determined by the PID (proportional plus integral plus derivative) algorithm 382 which is generally in the form of: pump speed=K.DELTA.P(t)+K.sub.1.intg..DELTA.P(t)+K.sub.2d/dt .DELTA.P(t) where K, K.sub.1, and K.sub.2 are scaling or weighting factors for each of the components of the algorithm. Biasing may be applied to the algorithm. The rate of change of pump speed output 382 is limited 384 by the controller such that the rate of change of the actual line pressure in the respective line does not exceed 15 psi/second resulting in an output pressure 388. Pump speed rate of change output limiter 384 transmits a speed command to the pump motor speed controls 386.

When the actual line pressure, to with, the output pressure for the hose line exceeds the specified pressure (and, in fact overshoots the set point) 316, then the manifold (isolation valve) closes and the pump is stopped

318. The pump will only be stopped if the hose line just described was the last hose line with the highest set point. In other words, the process can be thought of as a seamless step-wise service pressure test. Specifically, for example, if 10 hoses are being tested and each hose tested has a different service test pressure for fighting fires, for example, 100 psig, 125 psig, 150 psig, 175, psig, 200 psig, 225, psig, 250 psig, 275 psig, 300 psig, and 325 psig, the test apparatus and process will first satisfy the 100 psig conduit test branch by raising the actual line pressure from a starting point near 45 psig+/-5 psi (when the pump is first activated) at a controlled rate to 105 psig (1.05 times the service test pressure of 100 psig). At this time the isolation valves for all the test branches are open. When 105 psig (5% greater than the specified pressure, i.e., 1.05 times the service test pressure) is reached the isolation valve in the branch test conduit will close while the isolation valves for the other branch test conduits remain open communicating fluid to the other hoses being tested. Next, the controller seamlessly (simultaneously) in parallel commands a speed output to the motor to increase the speed to obtain the required specified pressure (set point) for the next hose to be tested, namely, approximately 131.25 psig (1.05 times service test pressure of 125 psig). The process is repeated until the specified pressures (set points) are satisfied in all of the hose lines. If a branch test conduit is not used, the set point will be entered as zero for the line and its isolation valve will remain closed during the low pressure test and the service pressure test.

Once the actual line pressure in the hose is sufficiently greater than the set point as sensed by the pressure transducer of the respective line downstream of the isolation valve, a stabilization period is commenced and continues for at least three minutes as indicated by reference numerals 319, 320 in the process flow schematic. The stabilization period provides the hose time to expand if it is going to expand.

If after the three minute stabilization period the actual line pressure is greater than or equal to the service test pressure 320A, then the hose line pressure test 324 commences for a period of three minutes. If the actual line pressure is greater than or equal to 90% of the service test pressure for a period of three minutes 326, the hose passes the test 330. If the actual line pressure is not greater than or equal to 90% of the service test pressure 392, 328 then the hose fails the test 332.

If the actual line pressure is not greater than or equal to the service test pressure during the stabilization period 320B, then the pump is restarted and the process steps 361, 380, 382, 384, 386, and 388 described above are repeated thus boosting the pressure in the respective hose line until the actual line pressure is greater than or equal to the set point 316. The pump 210 is then stopped 318 if there are no other hose lines requiring a pressure increase or boost and the hose is then stabilized for another three minute period. If the actual line pressure is greater than or equal to the service test pressure for at least three minutes 320A, then the service pressure test 334 is commenced again. If the actual line pressure is greater than or equal to service test pressure the hose passes the test 330 and if it does not the hose fails the test 332.

REFERENCE NUMERALS

A--schematic pressurization strobe light LP--line pressure -J--rate of decrease of line pressure M--motor 100--perspective view of a vehicle trailer wherein hose fittings and elbows protrude from a side of the trailer 100A--enlargement of a portion of the fittings and alarms 100B--schematic of a trailer with the hose layout illustrating ten hose lines before pressurization thereof 100C--an enlargement of a portion of a hose in its depressurized state illustrating the coupling and an end portion of one of the hoses with an identifying bar code placed thereon 100D--an enlargement of a portion of a hose in its pressurized state illustrating the coupling and an end portion of one of the hoses with an identifying bar code placed thereon 100E--cross-sectional view 100E taken along the lines 1E-E of FIG. 1B 100F--a schematic of a trailer with the hose layout illustrating ten hose lines after pressurization thereof 100G--side view of one of the smaller diameter hoses in

the pressurized state 100H--an enlarged portion FIG. 1F illustrating a section of hose 100I--a side view of one of the hose lines illustrating an adapter hose and hoses of different diameter interconnected together 101--hose fitting and elbow 101A--strobe annunciator 102--hose fitting and elbow 102A--strobe annunciator 103--hose fitting and elbow 103A--strobe annunciator 104--hose fitting and elbow 104A--strobe annunciator 105--hose fitting and elbow 105A--strobe annunciator 106--hose fitting and elbow 106A--strobe annunciator 107--hose fitting and elbow 107A--strobe annunciator 108--hose fitting and elbow 108A--strobe annunciator 109--hose fitting and elbow 109A--strobe annunciator 110--hose fitting and elbow 110A--strobe annunciator 111--drain conduit 120--trailer 131, 132, 133, 135, 136, 137--hose section 134--bleed fitting 171--bar code 180--surface, parking lot or unused road 172, 172A--coupling 199--adapter hose 200--a schematic of the control system illustrating the valving arrangement, pressure reducing valve, pressure sensors, controller and pump 200A--is a perspective view of the interior of the trailer illustrating the valving arrangement, pressure reducing valve, sensors and pump 200B--an enlargement of a portion of FIG. 2A illustrating two line valves (manifold valves) and pressure sensors 201--water inlet 201B--water inlet cap 202--water inlet to strainer 203--main valve 203A--main valve operator 204--pressure reducing valve 205--water inlet 206, 207--check valve 208--pump suction line 210--positive displacement pump 211--pressure relief valve 212--pump discharge line 213--pump discharge header 214, 215, 216, 217, 218, 219, 220, 221, 222, 223--branch conduit or manifold conduit 224, 225, 226, 227, 228, 229, 230, 231, 232, 233--branch or manifold valves 224A, 225A, 226A, 227A, 228A, 229A, 230A, 231A, 232A, 233--air to open spring to close valve operators 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 290, 291, 292--pressure transducers 243A--air compressor 257--electrical/electronic lines 265--air header 285--controller 294--in-line strainer 298--drain valve 298A--drain valve operator 299--drain valve line 300, 300A, 300B, 300C--diagrammatic flow chart 301--start test open main valve 302--open manifold valves pressurize to 45 psig+/-5 psi 303--hose or coupling leak 304--no 305--yes 308--bleed air from nipple 310--mark hose 312--shut down air compressor 314--start pump 316--close manifold valve(s) at line pressure greater than or equal to test pressure 318--stop pump 319--stabilize line pressure for at least (3) minutes 320--all line pressures greater than or equal to test pressure 320A--yes 320B--no 324--actual pressure in each line greater than or equal to line pressure(s) (set points) for for at least (3) minutes 326--yes 328--no 330--pass test 332--fail test 334--manifold pause test 336--close main 338--close all manifold valves 340--open drain valve 342--open manifold valve to drain 344--repair hose or coupling 346--close drain 348--open main pressurize to 45 psig+/-5 psi 350--close manifold valve 352--unpause test 354--initialize low pressure test 360--derivative of line pressure with respect to time is greater than or equal to minus J 361--yes 362--no 370--close manifold (isolation valve) 371--inspect hose 380--differential pressure, .DELTA.P, equals (LP) line pressures minus actual line pressures(s) 382--pump speed equals K.DELTA.P(t) plus K.sub.1.intg..DELTA.P(t) plus K.sub.2d/dt .DELTA.P(t) 384--pump speed rate of change limiter 386--pump motor speed controls 388--pump output pressure 390--feedback pump output pressure signal 400--illustrates pump curves for various operating pressures 401--200 psi 402--500 psi

Those skilled in the art will recognize that the invention has been set forth by way of examples. Accordingly, those skilled in the art will recognize that changes may be made to the examples without departing from the spirit and scope of the appended claims.

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