



SPECIFICATIONS FOR

PTO DRIVEN

ULTRA HIGH PRESSURE PIERCING AND

FIRE FIGHTING SYSTEM

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SPECIFICATIONS FOR FIRE FIGHTING SYSTEM

FIRE FIGHTING AND PIERCING SPECIFICATIONS

Scope and General Design Requirements

A multi-purpose firefighting system which shall be provided for firefighter safety by offensively attacking fire and fire gases from a 'defensive position'. The ultra-high pressure piercing, cooling, and firefighting system shall allow the operator to attack fire from a safe exterior position without the firefighter entering the interior of an aircraft or structure.

The nozzle shall pierce the outer structure with ultra-high pressure water and aggregate enabling an exterior attack on the involved aircraft or structure. Once the outer surface or structure is penetrated, the system shall continue to inject ultra-high pressure water into the thermal layer which cools the interior, thus dropping temperatures in a matter of seconds.

The system shall be extremely effective on compartmental areas including aircraft of various types, other areas where firefighting activities are difficult and dangerous to access. The system shall have the ability to attack the fire in its' three dimensional gaseous phase, greatly reducing the potential for flash over or back-draft conditions. The system shall also have a unique ability to pierce and cut when necessary controlled by the nozzle operator.

Components and Module Design

The firefighting system shall consist of:

- Hydraulic drive package (Pump, Motor, Reservoir, Cooler, Control Valve)

- Water pump: Ultra high pressure positive displacement piston pump
- Wireless remote control system
- Electric rewind reel with high pressure attack hose
- Portable ultra-high pressure piercing nozzle with wireless control
- Abrasive vessel and injection system

The entire firefighting system shall be engineered with a hydraulic manifold induction system. The aggregate abrasive product shall not rust and shall be environmentally safe, allowing the unit to be kept loaded indefinitely and ready for use at all times.

The major components shall be assembled into a module assembly with an integral hydraulic drive system. The entire system shall be designed for installation by a professional mechanic using normal tools into a fire apparatus vehicle, with an OEM supplied PTO.

Safety and Standards Compliance

The system shall be designed for the safety of the operator and fire fighter in mind with a safety margin of 4:1 built into plumbing components.

Piercing and Cutting Capability

The system shall be capable of penetration through the following material:

- Concrete with thickness up to 2" inches (50 mm)
- Concrete block walls
- Steel surfaces with thickness up to 1/2" inch (12 mm)
- Aluminum surfaces with thickness up to 1" inch (25 mm)
- Wood material and plywood with thickness in 1/2" to 4" inches range (12 mm to 100 mm)
- Composite materials with thickness up to 4" inches (100 mm)
- Plexiglas material with thickness up to 1/4" inch (6 mm)

Performance Capabilities and Applications

a) The firefighting system shall be tested and proven to be highly effective in the following capabilities:

- Piercing
- Cutting
- Access
- Containment

b) The firefighting system shall be tested and proven to be highly effective in the following application and uses:

- ARFF
- Structural
- Transport

c) In addition, the system shall have the following attributes and operation features:

- Hydraulic drive motor for quick and dependable start-up under varying temperature and altitude conditions.
 - Completely forward deployable and self-contained unit for local installation by technicians.
 - Simple operator interface that requires limited training levels.
 - Unit shall be capable of operation in less than 15 seconds and penetration operations in less than 1 minute.
 - Use of abrasive material shall be non-corrosive allowing the unit to be ready for instant deployment in a pre-loaded state.

The unit shall include a fully contained automatic manifold induction system, which shall not require any valves downstream of the abrasive feed line.

ENCLOSURE MOUNTING

The firefighting system shall be packaged in a self-supporting framework with dimensions of 36" (915 mm) right to left, 24" (610 mm) front to rear (deep), and 26" (660 mm) top to bottom. The mounting assembly shall be powder coated and shall be designed to contain the specified major components of the system.

ULTRA HIGH PRESSURE FIRE PUMP SPECIFICATIONS

The firefighting system shall be equipped with a heavy duty high pressure plunger type positive displacement fire pump. The pump shall be driven as specified under the "drive system" section of these specifications.

The pump shall have the following features:

- Pump rating: 10 GPM @ 2,200 PSI (40 LPM @ 150 bar)
- System operational rating: 10 GPM @ 1,450PSI (40 LPM @ 100 bar)
- Brass Manifold
- Stainless Steel Check Valve
- Stainless Steel Plunger Rods
- Bronze Connecting Rods
- Tapered Roller Bearings
- Solid Ceramic Plungers
- Heavy Duty Flat Base
- High Pressure Seals
- Heat Treated Crankshaft

INSTRUCTIONS AND LABELING

A firefighting pump instruction nameplate and necessary warning labels shall be installed on the assembly (English language).

PANEL LIGHT

The pump control panel shall be provided with an LED 12 volt light with switch.

REXROTH HYDRAULIC DRIVE SYSTEM SPECIFICATIONS

Once the PTO is activated on the pump control panel via the master PTO switch the variable speed hydraulic drive motor is controlled via an pressure compensating flow control switch which will activate

when water flow in the fire pump circuit is sensed and allow the variable speed hydraulic drive pump to spool up to maximum flow regardless of engine RPM.

Once the flow condition in the water circuit is stopped it will send a return signal via the pressure sensor flow control switch which in turn will put the pump into standby mode that will allow the pump to flow 1 GPM @2400PSI until the situation is reversed.

As soon as the demand on the fire pump is replaced the hydraulic drive motor will spool up and pump 28GPM@2400PSI regardless of engine RMP.

Once the PyroLance PTO system is engaged and master/emergency stop switch is activated on the PyroLance control panel the system is active until either the PTO is disengaged or the E-Stop button is depressed.

The system shall:

1. Reduce engine RPM when the pump is in by-pass resulting in reduced engine wear.
2. Prolong pump life by reducing potential heat build-up while the pump is in by-pass.
3. Reduce fuel consumption because the engine is not continually running at full RPM.
4. Allow the PyroLance system to be shut down in case of emergency by activating the Master/Emergency stop switch.
5. Allow rapid on/off throttle response eliminating pressure control delays when the PyroLance system is in operation.

Hydraulic drive pump flow requirement shall be 28GPM@2400PSI and consist of the following:

- Hydraulic Pump
- Hydraulic Motor
- 40 gallon (152 L) Hydraulic Reservoir
- Hydraulic Cooler
- Thermostat
- PTO (Supplied by OEM)

The system shall be capable of delivering full rated output at 925 engine rpm.

The system shall be compatible with a PTO with the following specifications:

- 1.3 step up ratio.
- 1.25" – 14 Tooth Splined Shaft
- Left Hand Rotation
- 2 Bolt C Mount

PUMP CONTROL PANEL

The control panel shall be ergonomically designed and operator friendly. The panel shall be labeled and installed to be easily visible from the operator's position. The following instruments and controls shall be installed:

- Emergency Stop/Master Switch (red)
- Override water "on" push button
- Override abrasive "on" push button
- Override safety control button
- Control panel light and switch
- Two (2) UHP pressure gauges

PLUMBING

The firefighting system shall be plumbed with high pressure hydraulic type hose, plumbing and fittings. This shall include double wire braided high pressure hoses of various sizes, zinc plated steel hose ends, and plated steel hydraulic fittings. The threads shall be male and female NPT, JIC, SAE O-ring style in various sizes. Rigid plumbing shall be in zinc plated steel piping with pipe fittings of zinc plated steel.

BYPASS UNLOADER VALVE

The ultra-high pressure plumbing system shall include a bronze adjustable by-pass unloading valve set for the maximum working pressure of the system. The valve shall unload the main pump to the intake side of the pump.

PRESSURE SAFETY, EASY START, THERMAL RELIEF VALVE

The ultra-high pressure plumbing system shall include the following devices:

- a.) One (1) pressure safety relief valve which shall relieve water pressure to atmosphere; set at a slightly higher pressure than the unloading valve.
- b.) One (1) thermal relief valve which shall open if water temperatures exceed 145 F (62 C) degrees; designed to protect the pump from high temperature conditions and relieve the water to atmosphere.
- c.) One (1) EZ start valve.

INTAKE FILTER

A 1-1/4" (31 mm) water filter with 32 mesh stainless steel screen shall be installed in the water supply line to the fire pump. The filter shall be accessible for cleaning the screen.

ELECTRICAL WIRING

Necessary low voltage automatic circuit breaker protection shall be provide where required. Wiring shall be stranded copper automotive type, sized for the appropriate electrical load. Exposed wiring shall be protected with convoluted split plastic loom; such looms shall be mechanically secured. Wiring shall be run in protected areas or enclosed in metal panels where subject to mechanical injury. Electrical connections and termination of wiring shall be within weather proof plastic enclosures with waterproof strain reliefs and connectors.

WATER TANK SUPPLY LINE

A 1.25" (31 mm) water tank to fire pump line shall be installed as follows:

- a) From the fire pump to the water filter shall be a 1.25" (31.75mm) flexible transparent hose.
- b) One (1) 1.25" (31.75mm) manually operated valve with control handle.
- c) 15' (5 meters) of 1.25" (31 mm) flexible water hose with removable connections and clamping devices.

HIGH PRESSURE DISCHARGE GAUGES

Two (2) 2.5" (62 mm) liquid filled pressure gauges shall be installed. One (1) on the discharge side of the relief valve and one (1) on the intake side of abrasive vessel, with both gauges mounted on the pump panel.

ABRASIVE VESSEL

The location of the abrasive vessel shall be within the assembly. Piping shall be installed from the water control valve and from the abrasive vessel to a "T" connection and then to the hose reel.

The abrasive holding tank shall be automatically pressurized when the pump system is activated. When the vessel is pressurized, the abrasive shall flow to a "T" connection, where it combines with the ultra-high pressure water flow and directed to the hose reel and piercing nozzle.

The high pressure vessel shall be as follows:

- Capacity: Minimum of 2.5 gallons (9 liters).
- Filler opening: Large thread high pressure filler cap assembly.
- Storage vessel: Certified ASME type 3,000 PSI (200 bar) high pressure storage vessel
- A high pressure discharge gauge on the pump panel.
- Tank design: Steel vessel with abrasive material capable of being stored over a prolonged period, yet ready for immediate use.

ABRASIVE MATERIAL

Three (3) 1 gallon (3 L) plastic containers of Pyro-Shot abrasive material shall be supplied. The abrasive material shall be inert non-metallic material that will not rust, damage the environment, or damage the operator's protective clothing.

ELECTRIC REWIND HOSE REEL – ULTRA-HIGH PRESSURE

One (1) painted ultra-high pressure steel hose reel shall be installed. The reel shall have a leak proof ball bearing swing joint, electric 12 volt rewind provisions. The reel system shall have a minimum of 4:1 safety ratio and designed for a 2,000 PSI (135 bar) working pressure.

Each reel shall be equipped with a locking pin assembly.

The hose reel(s) shall be installed by the OEM.

The high pressure hose reel shall be supplied by a 1/2" (12 mm) hydraulic type wire braided flexible hose line.

One (1) push button electric rewind control shall be installed near the reel. The wiring from the hose reel electric box shall be protected with conduit or loom.

The hose reel shall be equipped with a electrical wiring junction box of plastic construction with a sealed cover assembly. The box shall house the reel solenoid, circuit breaker, and electrical wiring for the rewind control circuit and electric rewind motor power supply. The electrical supply shall be sized for the reel motor for both positive and neutral cables. The electrical supply wiring shall be supplied from the main electrical

supply box for high pressure pump skid or module. The supply line to the reel shall have a quick disconnect connection at the main electrical supply box.

One (1) stainless steel hose roller assembly shall be supplied with reel for protection of the hose during hose removal and rewind operations.

REEL MOUNTED ULTRA-HIGH PRESSURE HOSE

150 foot (45 m) length x 3/4" (19 mm) hose shall be installed with threaded couplings. The hose shall have a working pressure of 3,125 psi (215 bar).

WIRELESS ULTRA-HIGH PRESSURE PIERCING NOZZLE

The wireless ultra-high pressure piercing nozzle shall provide a hand operated trigger control for remote operation of water and aggregate flow. The system shall incorporate remote controlled communications using a wireless transmitter/receiver. In addition to this system, the unit shall include an 'override' system whereby both the water flow and abrasive flow can be controlled by a second operator at the pump panel utilizing "dead-man" control override switches.

For piercing operations both trigger and toggle switch shall be actuated, which shall remotely open the water valve and abrasive control valve. The nozzle shall include:

6. One (1) trigger to control the flow of water from the ultra-high pressure water pump unit. The trigger mechanism shall control the flow of water at a rate of 10 GPM (40 LPM)
7. One (1) toggle switch to control the flow of abrasive material from the storage vessel.
8. Piercing operation:
 - a. The nozzle tip shall be placed against the surface to be pierced.
 - b. Initially the operator shall activate the toggle switch and pull the trigger for combined flow of water and abrasive material flow at extremely high velocity.
 - c. The nozzle shall quickly cut a small hole through the material.
 - d. After the material is penetrated, the operator shall de-activate the abrasive switch toggle and shall continue the flow of ultra-high pressure water into the hazardous area.

Nozzle Design

The nozzle barrel shall have an internal diameter of 1" (25 mm) which shall extend through the nozzle body. The rigid hollow barrel extends between the rear inlet and nozzle tip.

An ergonomically designed shoulder support shall be mounted to the rear nozzle barrel area and positioned to provide additional support to an operator. The forward nozzle barrel shall have an integral grab handle to allow the operator to safely and accurately direct the fluid flow against a surface. The nozzle shall also be equipped with a three prong offset fixture with a splash plate to protect the operator from spray-back of fluid and debris during the cutting operations.

A replaceable nozzle tip shall be mounted at the forward end of the nozzle barrel. When the nozzle is activated the abrasive material and high pressure water shall exit the nozzle tip in a focused water jet capable of cutting through various materials.

After penetration, the ultra-high pressure water shall continue through the nozzle projecting a jet stream having water droplets of appropriate size and velocity to effectively knock-down a thermal column within a closed space.

Wireless Transmitter

The nozzle shall be equipped with an enclosed manifold area which shall house a micro-switch for each function (primary water flow trigger and abrasive material flow toggle switch).

A wireless transmitter shall send command signals back to the pump assembly micro-processor electronic control center. The nozzle wireless transmitter shall be battery powered with an operating time of no less than one day of continuous use.

The nozzle shall be also equipped with an emergency manual override system at the power unit panel with switches to activate abrasive and water flow. This shall enable use of the system should transmission be lost due to excessive RF interference or "out-of-line-of-sight" deployment of the hose line.

OPTIONS AND MODIFICATIONS: (INSERT OPTIONS AND MODIFICATIONS ONLY IN THIS SPACE)

FACTORY TESTING PRIOR TO SHIPMENT

The entire pump and the plumbing system shall undergo a complete factory test. These test results shall be provided with shipment.

CRATING

The equipment shall be properly crated, sealed, and protected for shipment. The crate shall be approximately: 54" (1372 mm) wide x 79" (2007 mm) long x 44" (1118 mm) high in size and less than 2,500 lbs. (1,134 kg) in weight.

WARRANTY

The PyroLance ultra-high pressure type firefighting system components shall be covered by a one (1) year parts and labor warranty. The installation portion of the warranty shall be covered by the final stage assembler.

TECHNICAL MANUAL

The ultra-high pressure firefighting system shall be covered by a highly detailed technical manual covering installation, testing, operation, maintenance, and parts. This manual shall have various levels of warnings and caution notices provided. The manual shall be spiral bound with divided sections with a CD electronic version.

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