**SAM Control System Detailed Specifications**

**SYSTEM FUNCTIONALITY**

A SAM control system shall be provided. The control system shall automatically control the following elements of the pumping process:

* Open tank to pump automatically and re-circulate water as needed to protect the pump
* Open discharge valves and charge to an operator set pressure and then maintain that pressure by gating the discharge valves as necessary and/or managing the pump discharge pressure.
* Control engine speed as needed to maintain individual line discharge pressures set by the operator
* Automatically switch sources from tank to hydrant or from tank to draft functions at the operator request without requiring the operator to independently manipulate the valve positions
* Automatically refill the tank when secondary water supply is available
* When flowing from a pressurized source, the system will monitor the intake pressure and reduce engine speed, so it does not drop below purchaser specified pressure 10-30psi and alert the user if the system has low supply pressure
* Alert the operator audibly and visually of any problems with the system or with water flow and pressure settings

The system shall include automatic control of the following system components:

* Intake valve(s)
* Tank to pump valve
* Tank fill valve
* Discharge valve(s)
* Engine speed

The system shall accomplish the above by having the discharge valves, intake valves, and pressure governor on networks with all components in communication with each other at all times. These components must be configured, networked, and tested as part of the pump assembly prior to shipment to the OEM.

The system shall operate in two modes – automatic and manual.

The system shall include two control center interfaces, a pump controller interface and a throttle control knob which provide all necessary system control in both automatic and manual mode.

The system shall include the following base components installed on the panel:

* Dual SAM Control Screens
* Pump Controller
* Twister throttle
* Audio speakers – two each on the Driver and Officer panels
* Primer Control button
* Buzzer – One each on the Driver and Officer panels
* Emergency Idle button located nearby secondary SAM Control Center
* MIV activation buttons installed near each large intake
* ITL Water Tank Level (Optional red, yellow, green, blue or multicolored)

**SYSTEM CONTROL INTERFACE SCREENS**

**Dual Control Center Screens typically installed on Operator and Officer panels**

The control center shall be a 10.6” display with a bonded LCD, anti-glare coating and PCAP touch screen. It shall include 2 CAN network inputs and a USB 2.0 connection. The operating voltage shall be 6-36VDC, shall have an operating temperature of -40°F to 185°F and shall have a environmental rating of IP67.

Automatic mode: The interface shall include the following features available

* It shall display up to 6 active discharges in discharge control boxes Within each box, it shall show the set pressure and the actual pressure of the discharge. It shall indicate the color of the discharges in each discharge box as well as display any the status of the active discharges and provide a low flow indication if the nozzle is closed or there is a kink in the line. It shall also indicate if there are any problems with the valve and shall indicate whether CAFS or FOAM is active if a SmartFOAM or SmartCAFS system is included.
* It shall show the available intakes and the status of the intake valves.
* It shall show the water tank level and foam tank level
* It shall show the status of the tank and indicate whether the intake(s) is supplying water to the pump or whether the tank is supplying water to the pump
* If an intake valve is open, the control center shall display the intake pressure
* It shall include 4 configurable quickset circles that can be used to quickly set the pressure and open discharge lines by dragging the quickset circles to the target in the discharge area of the display
* It shall include an information center to indicate things that are happening with the system as they are occurring
* It shall include pop-up warning boxes to indicate any problems with the system or warning regarding water flow throughout the system

When in auto mode, the control center interface shall allow the operator to do the following from the interface:

* Set pressure on individual discharges
* Adjust the set pressure
* Close the discharge line
* Select an intake to open
* Select whether the intakes are set to draft or pressurized water source
* Switch back to tank water and close the intake

When in automatic mode the operator will not be required to operate any individual discharge valves, governor settings, or any individual intake settings.

IF SmartFOAM or SmartCAFS system is installed, the operator shall be able to also do the following from the control center:

* Turn on CAFS to wet, medium or dry or foam only from the discharge control screen
* Turn on FOAM to a preset percentage from the discharge control screen
* Turn CAFS or FOAM off

Manual mode: The control center interface shall include a manual mode. When in manual mode, the operator shall have control over each of the intakes and discharges from the control center. Each discharge valve shall show line pressure and valve position and allow the operator to open and close the valve. The manual control screen shall include a way to send the system back to auto mode if the operator chooses.

**Pump Controller**

The pump controller shall be a 7” display with a bonded LCD, anti-glare coating and PCAP touch screen. It shall include three NTSC/PAL video inputs, 2 CAN network inputs and a USB 2.0 connection. The operating voltage shall be 6-36VDC, shall have an operating temperature of -40°F to 185°F and shall have an environmental rating of IP67.

Automatic mode: When the system is in auto mode, the interface shall include the following features:

* A separate touch screen interface consisting of several pages that can be accessed by the operator. These pages to include:
	+ Home screen
	+ Tank
	+ Pump info
	+ Video
	+ Engine Data
* The home screen shall include master intake pressure, master discharge pressure and engine speed, status of tank fill and tank to pump valves, pump capacity and status box that indicates system is in AUTO mode. The pump capacity shall be a real time indication of the current flow and available flow from the pump based on intake pressure and other dynamic factors used to calculate the real time pump capacity at high flows. The flow shall update automatically as conditions change.
* The tank screen shall indicate status of tank to pump and tank fill valves as well as an indication that tank to pump and tank fill valves are being automatically controlled by system in auto mode.
* The pump information screen shall include the following information:
	+ Pump capacity
	+ Anode status for three (3) installed anodes
	+ Gearbox oil status
	+ Autolube oil status
	+ Gearbox temperature
	+ Pump temperature
	+ Pump details including: Pump Model, Rating, Gearbox, Gear Ratio, Pump Assy Plate No, Gearbox Assy Plate No, Manufacture date, Hale Pump Factory Test Data
* The video screen shall include a display of a video feed and allow the user to toggle between up to 3 available video inputs.
* The Engine Data screen shall include battery voltage, coolant temperature, oil pressure, transmission temperature and warnings.

Manual mode: The pump controller interface will revert to standard pressure governor operations when manual mode is requested by user or when the system defaults to manual mode.

The pump info, video and engine data tabs shall be the same as operation described in auto mode. The home screen and tank screen shall have the following functions.

The home screen shall include pressure governor controls, pump capacity indication and tank to pump and tank fill valve status indication. The home screen shall include the following:

* Mode select. Allows the user to select PSI or RPM mode
* Master intake and master discharge pressure display
* Increase and decrease buttons to increase and decrease the pressure or RPM depending on what mode is selected
* User configurable quickset circles for pressure and RPM
* Indication of set pressure when in PSI mode
* Status of tank fill and tank to pump valve and indication if system is recirculating
* Pump capacity indication

The tank screen shall include control of the tank to pump and tank fill valves and indication of valve position. The operator shall be able to open or close the tank fill and tank to pump valve when in manual mode.

**Throttle Control Knob**

A throttle control knob shall be provided to control the speed of the engine. The throttle control knob shall include a master IDLE button that sends the engine to IDLE and switches the SAM system to manual mode when pressed. The throttle control knob shall communicate using J1939 CAN data link protocol. It shall have two indicator LEDs on it. One to indicate ACTIVE and the second to indicate THROTTLE READY. The operating voltage shall be 9-32VDC, shall have an operating temperature of -40°F to 185°F and shall have an environmental rating of IP67.

**SYSTEM WARNINGS**

The system shall provide audible warnings when the following conditions occur:

* Pump Engaged, SAM ready
* SAM disabled
* Discharge Opening
* Low Intake Pressure
* Low tank water
* Out of water
* Hydrant established
* Draft established
* Draft problem
* High LDH Pressure

**SYSTEM REQUIREMENTS**

The system shall allow for the following number of valves:

* 4 intake valves
* 12 discharge valves
* 1 tank to pump valve
* 1 tank fill valve

The system requires that the following components be specified:

* Qmax or QMax-XS pump
* Akron Brass electric valves with pressure transducers for all discharge valves
* Hale electric MIV intake valves on all large diameter intakes
* Class 1 ITL-40 tank level gauge
* Hale Primer

The system shall include all necessary harnessing and electronic modules to provide system functionality described above. The system shall be shipped from the pump manufacturer with all required valves, electronic modules, sensors, harnessing, and panel mounted components necessary for the function of the system. The system shall be configured and tested at the pump manufacturer prior to shipment to the OEM.

**SAM SYSTEM OPTIONS**

**OPTIONAL - Third SAM CONTROL CENTERS**

An auxiliary SAM Control Center shall be provided. It shall have identical function to the primary control center and meet the following specifications:

Automatic mode: The interface shall include the following features available:

* It shall display up to 6 active discharges in discharge control boxes Within each box, it shall show the set pressure and the actual pressure of the discharge. It shall indicate the color of the discharges in each discharge box as well as display any the status of the active discharges and provide a low flow indication if the nozzle is closed or there is a kink in the line. It shall also indicate if there are any problems with the valve and shall indicate whether CAFS or FOAM is active if a SmartFOAM or SmartCAFS system is included.
* It shall show the available intakes and the status of the intake valves.
* It shall show the water tank level and foam tank level
* It shall show the status of the tank and indicate whether the intake(s) is supplying water to the pump or whether the tank is supplying water to the pump
* If an intake valve is open, the control center shall display the intake pressure
* It shall include 4 configurable quickset circles that can be used to quickly set the pressure and open discharge lines by dragging the quickset circles to the target in the discharge area of the display
* It shall include an information center to indicate things that are happening with the system as they are occurring
* It shall include pop-up warning boxes to indicate any problems with the system or warning regarding water flow throughout the system

When in auto mode, the control center interface shall allow the operator to do the following from the interface:

* Set pressure on individual discharges
* Adjust the set pressure
* Close the discharge line
* Select an intake to open
* Select whether the intakes are set to draft or pressurized water source
* Switch back to tank water and close the intake

When in automatic mode the operator will not be required to operate any individual discharge valves, governor settings, or any individual intake settings.

IF SmartFOAM or SmartCAFS system is installed, the operator shall be able to also do the following from the control center:

* Turn on CAFS to wet, medium or dry or foam only from the discharge control screen
* Turn on FOAM to a preset percentage from the discharge control screen
* Turn CAFS or FOAM off

Manual mode: The control center interface shall include a manual mode. When in manual mode, the operator shall have control over each of the intakes and discharges from the control center. Each discharge valve shall show line pressure and valve position and allow the operator to open and close the valve. The manual control screen shall include a way to send the system back to auto mode if the operator chooses.

The control center shall be a 10.6” display with a bonded LCD, anti-glare coating and PCAP touch screen. It shall include 2 CAN network inputs and a USB 2.0 connection. The operating voltage shall be 6-36VDC, shall have an operating temperature of -40°F to 185°F and shall have an environmental rating of IP67.

**OPTIONAL - SAM Wireless Control Center Tablet**

A wireless control tablet shall be provided. The wireless tablet shall provide the same level of control as the control center. Operation shall require the user to purposefully complete an action through dragging or multiple steps to avoid any accidental activation of the system.

The wireless tablet shall have the following functionality:

Automatic mode: The interface shall include the following features available:

* It shall display up to 6 active discharges in discharge control boxes Within each box, it shall show the set pressure and the actual pressure of the discharge. It shall indicate the color of the discharges in each discharge box as well as display any the status of the active discharges and provide a low flow indication if the nozzle is closed or there is a kink in the line. It shall also indicate if there are any problems with the valve and shall indicate whether CAFS or FOAM is active if a SmartFOAM or SmartCAFS system is included.
* It shall show the available intakes and the status of the intake valves.
* It shall show the water tank level and foam tank level
* It shall show the status of the tank and indicate whether the intake(s) is supplying water to the pump or whether the tank is supplying water to the pump
* If an intake valve is open, the control center shall display the intake pressure
* It shall include 4 configurable quickset circles that can be used to quickly set the pressure and open discharge lines by dragging the quickset circles to the target in the discharge area of the display
* It shall include an information center to indicate things that are happening with the system as they are occurring
* It shall include pop-up warning boxes to indicate any problems with the system or warning regarding water flow throughout the system

When in auto mode, the control center interface shall allow the operator to do the following from the interface:

* Set pressure on individual discharges
* Adjust the set pressure
* Close the discharge line
* Select an intake to open
* Select whether the intakes are set to draft or pressurized water source
* Switch back to tank water and close the intake

When in automatic mode the operator will not be required to operate any individual discharge valves, governor settings, or any individual intake settings.

IF SmartFOAM or SmartCAFS system is installed, the operator shall be able to also do the following from the control center:

* Turn on CAFS to wet, medium or dry or foam only from the discharge control screen
* Turn on FOAM to a preset percentage from the discharge control screen
* Turn CAFS or FOAM off

Manual mode: The control center interface shall include a manual mode. When in manual mode, the operator shall have control over each of the intakes and discharges from the control center. Each discharge valve shall show line pressure and valve position and allow the operator to open and close the valve. The manual control screen shall include a way to send the system back to auto mode if the operator chooses.

The wireless tablet shall measure 9.2” W x 5.9” H x 0.87” D and be an 8” diagonal widescreen display. The screen shall be a scratch resistant glass. The tablet shall weigh less than 2 lbs and respond to touch in wet conditions and with a gloved hand. The screen shall be a 10-point project capacitive touch screen. It shall communicate with the SAM control center through a wireless 802.11 network and meet FCC Class B, FCC/SAR and UL regulations. It shall have an operating temperature of 14°F to 122°F, a storage temperature of -4°F to 140°F and shall have a environmental rating of IP65. The tablet shall meet MIL-STD 810G, 516.6 IV for drop/shock requiring 26 repeated drops from 5 foot elevation. A mounting dock and charging cord shall be provided.

**OPTIONAL - SAM Control Center and Pump Controller Screen Covers**

A screen cover shall be provided for each SAM Control Center and the Pump Control screens. A panel hinged at the top of the screen covers shall be capable of being flipped up when SAM is in operation. When SAM is not in operation the panel shall cover the entirety of the screen.

**OPTIONAL - SAM™ Smart Nozzle With N2P Technology Detailed Specifications**

**SYSTEM FUNCTIONALITY**

A SAM Smart Nozzle system shall be provided. The wireless, battery-operated Smart Control Console is an integrated unit mounted to the inlet of the Akron nozzle. The system shall include the following components:

* Two SAM Smart Nozzles – Available with Akron’s Turbojet™, Assault, and Smooth Bore Nozzles
* Truck installed radio interface and antenna
* Batteries, spare set of batteries and a USB charger

The Smart Nozzle shall include space for two batteries that are easily removeable to facilitate charging. Two additional batteries and charger shall be included with each SAM Smart Nozzle.

The SAM Smart Nozzle shall be designed to work with SAM automated systems. The nozzle will include an easy-to-read incorporated tank level gauge. When the system is operating off the apparatus tank the gauge will work as a normal tank level gauge with green (full tank), yellow (partially filled tank), and red (low tank) lights indicating the tank level. The tank level gauge will flash red when running out of water is imminent. When the apparatus transitions to a permanent water source besides the tank the tank level gauge will switch to a blue light indicating the transition has been made.

The SAM Smart Nozzle will include two function buttons on each side of the Smart Control Console. When the two buttons are pressed simultaneously, for a minimum of 2 seconds, the SAM Smart Nozzle communicates with the SAM system to charge the line. The SAM system will open the valve corresponding to the preconnect and set it a pressure level to achieve the calibrated nozzle pressure.

The SAM Smart Nozzle uses wireless technology that allows it to operate up to 300 feet of preconnected hose into structures.

The SAM Smart Nozzle shall include an integrated pressure transducer. The pressure transducer feeds pressures back to the SAM system in a continuous closed loop system. This closed loop system automatically maintains the proper nozzle calibrated pressure of the nozzle. The SAM Smart Nozzle maintains the calibrated pressure during elevation changes of up to five (5) floors above and two (2) floors below grade. If communication is lost between the SAM Smart Nozzle and the SAM system, the system will maintain the last known setting of the valve and the nozzle will still function as a normal handline nozzle.

When used with a SAM system the SAM Smart Nozzle allows for kinked hose detection. When the system sees low pressure at the nozzle the system triggers an increase of pressure at the valve on the apparatus. If the nozzle pressure does not rise, the pressure in the line is increased, up to 20 psi, to overcome the kink. Once the kink is overcome the system transitions to the normal line pressure required to attain the correct nozzle pressure.

With the SAM Smart Nozzle installed, the pump operator will be able to see valve pressure, rated nozzle pressure, actual nozzle pressure, hose/friction loss, battery life and signal strength for each discharge on the SAM display.

The system requires that the following components be specified:

* SAM System
* SAM BOOST System