**Design Envelope Fire Pump Unit**

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Typical Specifications

ARMSTRONG GUIDE NOTE: This master specification section includes ARMSTRONG GUIDE NOTEs identified as “ARMSTRONG GUIDE NOTE” for information purposes and to assist the specification writer in making appropriate decisions. The ARMSTRONG GUIDE NOTE always immediately precedes the text to which it is referring. The section serves as a guideline only and should be edited with deletions and additions to meet specific project requirements.

ARMSTRONG GUIDE NOTE: This specification section follows the recommendations of the Construction Specifications Institute, Project Resource Manual including MasterFormat™, SectionFormat™, and PageFormat™. Optional text is indicated by square brackets [ ]; delete the optional text including the brackets in the final copy of the specification. Delete the ARMSTRONG GUIDE NOTEs in the final copy of the specification. Trade/brand names with appropriate product model numbers, styles and types are used in ARMSTRONG GUIDE NOTEs and in the specification text Article or Paragraph titled “Acceptable Material”.

1. GENERAL
	1. SUMMARY OF WORK

This Section specifies Self-regulating Variable Speed Fire Pump, Vertical inline design fire pump with Pump Casing and Pump Impeller, Pressure Transducer on suction and discharge, Electric Motor, Variable Frequency converter (drive), Automatic-Bypass, Microprocessor speed control module.

* 1. RELATED REQUIREMENTS

ARMSTRONG GUIDE NOTE: Include in this Paragraph only those sections and documents that directly affect the work of this section. If a reader of this section could reasonably expect to find a product or component specified in this section, but it is actually specified elsewhere, then the related section number(s) should be listed in the Paragraph below. Do not include Division 00 Documents or Division 01 Sections since it is assumed that all technical sections are related to all project Division 00 Documents and Division 01 Sections to some degree. Refer to other documents with caution since referencing them may cause them to be considered a legal part of the Contract. Edit the following paragraphs to suit specific project conditions.

* + 1. Section [26 05 00 – Common Work Results for Electrical: electrical connections].

ARMSTRONG GUIDE NOTE: In the following Article, include only those reference standards which appear in the finished version of the project specification.

* 1. REFERENCE STANDARDS
		1. National Fire Protection Association (NFPA)
			1. NFPA 2022, Section 4.8 – Self Regulating Variable Speed Fire Pump
		2. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME).
		3. ANSI/ASME B16.5- [2009], Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
		4. American National Standards Institute/International Electrical Commission (ANSI/IEC).
			1. IEC 60529- [2004], Degrees of Protection Provided by Enclosures (IP Code).
		5. ASTM International (ASTM).
			1. ASTM A48/A48M- [2003 (2008)], Standard Specification for Gray Iron Castings.
			2. ASTM A536- [1984 (2009)], Standard Specification for Ductile Iron Castings.
			3. ASTM A582/A582M- [2005], Standard Specification for Free-Machining Stainless Steel Bars.
			4. ASTM B584- [2011], Standard Specification for Copper Alloy Sand Castings for General Applications.
		6. CSA International (CSA).
			1. CAN/CSA C22.2 No.108- [2001 (R2010)], Liquid Pumps.
		7. National Electrical and Manufacturers Association (NEMA).
			1. NEMA MG-1 Standard- [2009, Revision 2010], Motors and Generators, Revision 1.
		8. Underwriter’s Laboratories (UL).
			1. UL 218C Outline of Investigation for Self-Regulating Adjustable Speed Fire Pump Units
	2. ADMINISTRATIVE REQUIREMENTS
		1. Co-ordination: Co-ordinate work of this Section with work of other trades for proper time and sequence to avoid construction delays.
		2. Pre-installation Meeting: Convene pre-installation meeting after Award of Contract and one week prior to commencing work of this Section to verify project requirements, substrate conditions and coordination with other building sub-trades, and to review manufacturer’s written installation instructions.
			1. Comply with Section 01 31 19 Project Meetings and co-ordinate with other similar pre- installation meetings.
			2. Notify attendees 2 weeks prior to meeting and ensure meeting attendees include as minimum:
				1. Owner;
				2. Consultant;
				3. Mechanical Subcontractor;
				4. Manufacturer’s Technical Representative.
			3. Ensure meeting agenda includes review of methods and procedures related to Design Envelope fire pump unit installation including co-ordination with related work.
			4. Record meeting proceedings including corrective measures and other actions required to ensure successful completion of work and distribute to each attendee within 1 week of meeting.

ARMSTRONG GUIDE NOTE: Article below includes submittals of relevant data to be furnished by Contractor.

* 1. ACTION AND INFORMATIONAL SUBMITTALS
		1. Make submittals in accordance with Contract Conditions and Section 01 33 00 Submittal Procedures.
		2. Product Data: Submit product data including manufacturer’s literature for Design Envelope Fire pump unit, controls, components and accessories, indicating compliance with specified requirements and material characteristics.
			1. Submit list on pump manufacturer’s letterhead of materials, components and accessories to be incorporated into Work.
			2. Include Design Envelope Fire pump unit performance curves indication where project pumps appear in curve range with pre-defined performance envelope showing optimum efficiency region.
			3. Include product names, types and series numbers.
			4. Include contact information for manufacturer and their representative for this Project.
		3. Shop Drawings: Submit shop drawings indicating dimensions and materials for pump components and controls
			1. Show pump and control enclosure dimensions on shop drawings.
			2. Include control system wiring diagrams.
		4. Test Reports:
			1. Submit test reports with each Design Envelope Fire Pump Unit showing compliance with specified performance characteristics
			2. Test reports shall also detail the accuracy of the pump flow and head readout, compared with the test rig calibrated instruments.
		5. Field Reports: Submit manufacturer’s field reports within 3 days of each manufacturer representative’s site visit and inspection.
		6. Installer Qualifications:
			1. Submit [verification of manufacturer’s approval of installer] [letter verifying installer’s experience with work similar to work of this Section].
	2. CLOSEOUT SUBMITTALS
		1. Operation and Maintenance Data: Supply maintenance data including marked performance curves for each Design Envelope Fire pump unit for incorporation into manual specified in Section 01 78 00 Closeout Submittals.
	3. QUALITY ASSURANCE
		1. The Design Envelope Fire pump unit and controls shall be integrated by the Fire Pump Unit manufacturer in the factory, including assembly, wiring, programming and testing. Flow and Head sensorless data shall be mapped in the integrated controls using tested performance measurements for each Electric fire pump. Actual flow and head readings on site shall be available digitally for external systems and on the Fire Pump unit local display.
		2. The complete Design Envelop Fire Pump Unit shall be Underwriter’s Laboratories listed to UL218C and shall also be Factory Mutual approved.
		3. A certified test report shall accompany each pumping unit shipped to site. The Certified test report shall contain:
			1. Test compliance with specified performance characteristics.
			2. Test reports shall also detail the accuracy of the controls flow and head readout, compared with the test rig calibrated instruments.

ARMSTRONG GUIDE NOTE: The following Article although not part of Quality Assurance, can be used to enhance the quality of materials by ensuring that they are delivered and handled properly at the work site.

* 1. DELIVERY STORAGE AND HANDLING
		1. Delivery and Requirements:
			1. Deliver material in accordance with Section 01 61 00 Common Product Requirements.
			2. Deliver materials and components in manufacturer’s original packaging with identification labels intact and in sizes to suit project.
				1. Include manufacturer's name, job number, pump location, and pump model and series numbers on identification labels.
		2. Storage and Handling Requirements: Store materials off ground and protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
			1. Exercise care to avoid damage during unloading and storing.
			2. Leave pump port protection plates in place until pumps are ready to connect to piping.
			3. Do not place cable slings around pump shaft or integrated control enclosure.
		3. Packaging Waste Management:

ARMSTRONG GUIDE NOTE: For smaller projects that do not have a separate Section for waste management and disposal, delete the following paragraph.

* + - 1. Separate and recycle waste packaging materials in accordance with Section 01 74 19 Construction Waste Management and Disposal.
			2. Remove waste packaging materials from site and dispose of packaging materials at appropriate recycling facilities.

ARMSTRONG GUIDE NOTE: For smaller projects that do not have a Waste Management Plan, delete the option referring to a Waste Management Plan.

* + - 1. Collect and separate for disposal paper and plastic material in appropriate on-site storage containers for recycling [in accordance with Waste Management Plan].
	1. FIELD CONDITIONS

ARMSTRONG GUIDE NOTE: To avoid the controls unit getting overheated, the ambient temperature is not to exceed 104°F / 40°C when installed at sea level. Operating in higher ambient temperatures will require de-rating of the control’s unit. Verify maximum temperatures with manufacturer for elevations other than sea level.

* + 1. Ambient Temperature: [104] °F] [40°C] maximum at [sea level] [up to [3,300 feet] [1,000m] above sea level].
		2. Relative Humidity: [95] % maximum.
	1. WARRANTY
		1. Project Warranty: Refer to Contract Conditions for project warranty provisions.
		2. Manufacturer’s warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty document executed by authorized company official. Manufacturer’s warranty is in addition to and not intended to limit other rights Owner may have under Contract Conditions.

ARMSTRONG GUIDE NOTE: Coordinate article below with manufacturer’s warranty requirements. Note that Armstrong’s Design Envelope units carry an 18 months warranty from date of shipment, or 12 months from date of installation, whichever comes first. To receive an additional 6 months of standard coverage, Owner may register the pump unit at www.armstrongfluidtechnology.com/warrantyregistration

* + 1. Warranty period: [18] months from date of shipment, or [12] months from date of installation, whichever comes first. To receive an additional [6] months of standard coverage, Owner may register the pump unit at http://armstrongfluidtechnology.com/registration
1. PRODUCTS
	1. MANUFACTURER
		1. Armstrong Fluid Technology, 23 Bertrand Avenue, Toronto, Ontario, M1L 2P3, Canada, Phone: (416) 755 2291, FAX: (416) 759-9101, e-mail: info@armstrongfluidtechnology.com. URL: [www.armstrongfluidtechnology.com](http://www.armstrongfluidtechnology.com).
	2. DESCRIPTION
		1. Self-Regulating Variable Speed Fire Pump, vertical inline design envelope fire pump with Pump Casing and Pump impeller, Pressure transducer on suction and discharge, Electric Motor, Variable frequency converter, Automatic-bypass, Microprocessor speed control module.
			1. Include casing drain plug and ¼ inch suction and discharge gauge ports.
		2. Acceptable Material: ARMSTRONG, Design Envelope Fire pump unit.
	3. DESIGN CRITERIA
		1. Design the fire pump to maintain exact required pressure at the pump unit discharge to ensure optimum pressure levels in the fire system regardless of flow demand and minimize any over-pressurization of individual components.

ARMSTRONG GUIDE NOTE: Pump head can be specified at design conditions and maximum head capability at design flow for the specific pump selected. The maximum head is displayed on the selection software pump curve and it could be specified that the data be detailed on submittals.

* + 1. Design pumping units to UL 218C.
		2. Pump Operating Conditions:
			1. Rated Flow (Pump head): [\_\_\_\_\_\_].
			2. Constant Discharge Pressure (Pump Pressure): [\_\_\_\_\_\_].
			3. Maximum Suction Pressure. [\_\_\_\_\_\_].
			4. Minimum Suction Pressure. [\_\_\_\_\_\_].
			5. Constant Boost Pressure: [\_\_\_\_\_\_]. (Minimum Constant Boost pressure = “Required Constant Discharge Pressure” - “Minimum Suction Pressure”)
			6. “Maximum Discharge Pressure” = [\_\_\_\_\_\_]. (“Churn Pressure + Maximum Suction Pressure”)
			7. “Constant Speed” (Rated Pressure): The pressure produced by the pump at rated speed at rated flow.

ARMSTRONG GUIDE NOTE: Use 175 psig at ≤140°F and 100 psig at 300°] for ANSI/ASME Class 150 flanged piping systems

[175 psig at 140°F] for lower temperatures and [100 psig at 300°F] maximum for fluid temperatures higher than 140°F

ARMSTRONG GUIDE NOTE: Use 375 psig at ≤100°F and 275 psig at 300°F for ANSI/ASME Class 300 flanged piping systems.

[375 psig at 100°F] for lower temperatures and [275 psig at 300°F] maximum for fluid temperatures higher than 100°F

* 1. MATERIALS
		1. Casing: [Ductile iron ASTM A536 GR 65-45-12].
			1. Test casing to 150 % maximum working pressure.
			2. Drill and tap casing for gauge ports on both suction and discharge connections.
			3. Drill and tap casing at lowest point for drain port.
		2. Impeller: Bronze ASTM C87850, CB B584-84400 or Stainless Steel ASTM A743/743M CF8M, fully enclosed and dynamically balanced to ANSI G6.3 and fitted to shaft with key. Material will be chosen at the manufacturers discretion to optimize performance.
		3. Pump Shafts:
			1. 43PF Split-coupled: Stainless steel to ASTM A582/A582M, [Grade 416] [Grade 316].

ARMSTRONG GUIDE NOTE: Note that rigid couplings maintain permanent shaft alignment. NO FIELD SHAFT ALIGNMENT IS NECESSARY ON ARMSTRONG DE 4300 pumping units

* + 1. Coupling: Rigid spacer type, high tensile aluminum.
			1. Design coupling for easy removal on site to reveal space between pump and motor shaft.
				1. Ensure revealed space is sufficient for removal of mechanical seal components without disturbing pump, controls or motor.
				2. Include coupling guard.

ARMSTRONG GUIDE NOTE: Flanges are suitable for the following system pressures with ambient temperature fluid: ANSI Class 125 is suitable to 175psig; ANSI Class 250 is suitable to 375psig

* + 1. Flanges: To ANSI/ASME B16.5, Class [125] [250]
		2. Flush Line: 3/8-inch braided stainless steel complete with vent.
		3. Gasket: Synthetic fiber
		4. Packing Gland [Graphite packing with lantern ring]
	1. MOTOR
		1. Electric motors shall comply with the applicable requirements of UL 1004-5, Fire Pump Motors and UL 1004, Rotating Electrical Machines - General Requirements, and UL 1004-7 (electronically protected motors).
		2. Electric motors intended for variable speed use shall be rated for inverter duty, rated 600 V or less, rated 50 Hz or 60 Hz, and comply with UL 1004-8.
		3. NEMA Premium® Motor: To ANSI/NEMA MG 1
			1. UL Listed for fire duty *(Listing Standard)*
			2. Horsepower: [\_\_\_\_\_\_] HP.
			3. Enclosure: [ODP] [TEFC].
			4. Efficiency: NEMA Premium efficiency To NEMA MG-1 table 12.12
			5. Power supply: [200 – 240] [380 -480] [525 - 600] V, [60] Hertz, 3 phase or 230 V, 60 Hertz, 1 phase input power to 7.5hp
	2. PUMP CONTROLS

ARMSTRONG GUIDE NOTE: All integrated controls need a minimum of UL Type 4 (IP66) enclosure as water splashes may occur.

* + 1. Control: Integrated with UL type 4 minimum enclosure rating and menu-driven graphical keypad interface.
			1. Minimum system pressure to be maintained: [\_\_\_\_\_\_] [feet] [psig] head
			2. Enclosure: UL Type NEMA4
			3. Cooling: Fan cooled through back panel.
			4. Ambient working conditions: [14°F to +113°F], up to [3300] feet above sea level.
			5. Analog I/O: 2 Current or voltage inputs minimum,
			6. Digital I/O: 2 inputs programmable, 2 programmable outputs.
			7. Pulse inputs: 2 programmable minimum.
			8. Relay outputs: 2 programmable minimum.
			9. Communications ports: 1- RS485.
			10. Auto alarm reset.
		2. Software: Ensure software for Sensorless control includes automatic speed control.
			1. Operating mode under Sensorless control: Constant Pressure Control (CPC).
			2. Ensure control mode setting and minimum/maximum head set points are user adjustable by an authorized service technician.
			3. Have a visible display panel capable of showing, as a minimum, set pressure, maximum permissible power draw, all phase-to- phase voltages, all phase amperages, boost pressure, calculated rpm, calculated flow, alerts, and faults with an accuracy within ±2 percent.
		3. The integrated pump controller shall include all the hardware and software required for operating the pump in the following modes:
			1. Maintain constant discharge pressure as measured by the discharge pressure transducer.
			2. Maintain constant discharge pressure as calculated from the sum of the suction pressure, as measured by the suction pressure transducer and the pump head, calculated using the Sensorless map. This mode is automatically activated if the discharge pressure sensor fails.
			3. Maintain constant pump head calculated using the Sensorless map. This mode is automatically activated if the both the suction and discharge pressure sensor fail.
			4. Maintain automatic bypass mode if the variable frequency drive fails to achieve setpoint pressure within 20 seconds.
				1. The supply voltage is directly applied to the motor through a [Across-the-Line] [Soft-start] starter.
				2. The pump controls shall also include a manual switch operable without opening any electrical enclosure, which mechanically pushes this contactor closed. This allows to power the motor even if the voltage is too low to power the contactor coil.
				3. For testing purposes, bypass mode may be manually selected as part of the annual flow test.
			5. The Integrated pump controller shall include a 4.3” color touchscreen which shall display the following:
				1. Set pressure,
				2. Maximum permissible power draw,
				3. All phase-to- phase voltages,
				4. All phase-to-phase amperages,
				5. Boost pressure,
				6. Calculated RPM,
				7. Calculated flow,
				8. Alerts and faults
	1. PUMP MOTOR AND CONTROLS PROTECTION
		1. Include protection as follows:
			1. Motor phase to phase fault.
			2. Motor phase to ground fault.
			3. Loss of supply phase.
			4. Over voltage.
			5. Under voltage.
			6. Motor over temperature.
			7. Inverter overload.
			8. Over current
		2. Ensure controls run automatic motor adaptation (AMA) for superior motor protection and control.
	2. FABRICATION
		1. Pre-program integrated intelligent controls for each pump before pump leaves factory.
			1. Install flush / vent line in factory.
				1. Ensure flush / vent line runs from seal chamber to [pump discharge] [pump suction].
			2. Mark pumps and controls with coordinated identification.
	3. ACCESSORIES

ARMSTRONG GUIDE NOTE: Use the following paragraphs if required by seismic criteria applicable to project location.

* + 1. Pressure Gauges: 3½ inch diameter sized to meet system pressure requirements.
1. EXECUTION
	1. INSTALLERS
		1. Use only installers who meet the requirements of NFPA 20 2022 Edition Section 4.3.3.
	2. EXAMINATION
		1. Verification of Conditions: Verify that conditions of piping previously installed under other Sections or Contracts are acceptable for pump installation in accordance with manufacturer’s written recommendations.
			1. Visually inspect piping, piping configuration and piping location in presence of Consultant.
			2. Inform Consultant of unacceptable conditions immediately upon discovery.
			3. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant.
	3. PREPARATION
		1. Weld pipe flanges to piping system for installation of pump.
			1. Ensure suction and discharge pipe flanges are aligned and square to pipe.
	4. INSTALLATION

ARMSTRONG GUIDE NOTE: View F100.12 installation and operating instructions (I&O) at: http://armstrongfluidtechnology.com/en/resources-and-tools/installation-and-maintenance-and-parts/installation-and-operating-instructions

* + 1. Install pumps level in accordance with pump manufacturer’s written recommendations
		2. Support pump using mounting feet for the pump installation.
			1. Ensure no pipe strain is imposed on pump flanges.
		3. Install pressure gauges on suction and discharge pump connections.
		4. Connect pumps and integrated control system to electrical distribution system to NFPA 70 regulations and with authority having jurisdiction in accordance with Section [26 05 00 – Common Work Results for Electrical].
		5. Do not run pumps dry to check rotation.
	1. FIELD QUALITY CONTROL
		1. Field Inspection: Coordinate field inspection in accordance with Section [01 45 00 Quality Control].

ARMSTRONG GUIDE NOTE: Specify requirements if manufacturers are to provide field quality control with onsite personnel for instruction or supervision of product installation, application, erection or construction. Manufacturer field reports are included under PART 1, Action and Informational Submittals.

* + 1. Manufacturer’s Services:

ARMSTRONG GUIDE NOTE: Use the following Paragraphs only when manufacturer’s field services are provided and are required to verify the quality of the installed components. Establish the number and duration of periodic site visits required by manufacturer and specify below. Consult manufacturer for services required. Delete if field services are not required.

* + - 1. Coordinate manufacturer’s services with Section [01 45 00 - Quality Control].
				1. Have manufacturer review work involved in handling, installation, protection, and cleaning of hydronic pumps and components, and submit written reports in acceptable format to verify compliance of Work with Contract conditions.
			2. Manufacturer’s Field Services: Provide manufacturer’s field services consisting of product use recommendations and periodic site visits for product installation review in accordance with manufacturer’s instructions.
				1. Report any inconsistencies from manufacturer’s recommendations immediately to Consultant.
			3. Schedule site visits to review work at stages listed:
				1. After delivery and storage of pumps, controls and components, and when preparatory work on which Work of this Section depends is complete, but before installation begins.
				2. Upon completion of Work, after cleaning is carried out.
				3. Obtain reports within three days of review and submit immediately to Consultant.
	1. COMMISSIONING
		1. Validate alignment, rotation, motor current draw, flows and pressures in accordance with manufacturers recommendations
		2. On-site commissioning of Design Envelope Fire Pump Units and Pump Manager
	2. CLEANING

ARMSTRONG GUIDE NOTE: For smaller projects that do not have a separate Division 01 Section for cleaning, delete the reference to Section 01 74 00 – Cleaning in the following two Paragraphs.

* + 1. Progress Cleaning: Perform cleanup as work progresses [in accordance with Section 01 74 00 Cleaning and Waste Management].
			1. Leave work area clean end of each day.
		2. Final leaning: Upon completion, remove surplus materials, rubbish, tools, and equipment [in accordance with Section 01 74 00 – Cleaning and Waste Management].
		3. Waste Management:
			1. Co-ordinate recycling of waste materials with 01 74 19 Construction Waste Management and Disposal.
			2. Collect recyclable waste and dispose of or recycle field generated construction waste created during construction or final cleaning related to work of this Section.
			3. Remove recycling containers and bins from site and dispose of materials at appropriate facility.
	1. PROTECTION
		1. Protect installed products and components from damage during construction.
		2. Repair damage to adjacent materials caused by hydronic pump installation.

ARMSTRONG GUIDE NOTE: The following refers to Pump Manager. A performance management service (under the industry category of automated fault detection and diagnostics) to remotely and automatically track and help manage pump performance with analytic and diagnostic Alerts, web assessible trends and automated reports available to the building end user/owner. Pump Manager helps sustain optimal performance and efficiency, minimize unexpected failures and provide predictable maintenance costs. An option for a discount on Extended Warranty for the corresponding pumps is available with a Pump Manager subscription.

* + 1. Pump Manager [building owners are to go to
		<http://armstrongfluidtechnology.com/registration> to activate].

END OF SECTION