SECTION 21 3000

FIRE PUMPS

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LANL MASTER SPECIFICATION SECTION

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| Rev. 0: New specification section adopting content aligned with commercial industry practice. |

Word file at <http://engstandards.lanl.gov>

This template must be edited for each project.  In doing so, specifier must add job-specific requirements.  Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.  Once the choice is made or text supplied, remove the brackets.  The specification section must also be edited to delete requirements for processes, items, or designs that are not included in the project -- and specifier’s notes such as these.  This template is tailored to meet requirements contained in the LANL Engineering Standards Manual (ESM). To seek a variance from requirements in this section that are applicable, contact the Engineering Standards Manual Fire [POC](http://engstandards.lanl.gov/POCs.shtml#fire). Please contact POC with suggestions for improvement as well.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Note that DOE-STD-1066 Appendices A and B are not applicable to the Work specified herein. Consider the scope and purpose of DOE documents as pertains to commercial construction before editing such requirements into this specification section.

This template is developed for ML-4 projects.  For ML-1, 2, and 3 applications, additional requirements and independent reviews should be added if increased confidence in procurement or execution is desired; see ESM Chapter 1 Section Z10 Specifications and Quality sections.
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1. GENERAL
2. SECTION INCLUDES
3. Inline Fire Pump.
4. End-suction Fire Pump.
5. Split-case Fire Pump.
6. Vertical Turbine Fire Pump.
7. Electric Motor Drive.
8. Diesel Engine Drive.
9. Pressure Maintenance Pump.
10. Fire Pump Package Systems.
11. RELATED SECTIONS
12. Section 01 2500, Substitution Procedures.
13. Section 01 3300, Submittal Procedures.
14. Section 01 3545, Water Discharge Requirements.
15. Section 01 4000, Quality Requirements – Non-Nuclear.
16. Section 01 7700, Closeout Procedures.
17. Section 01 7839, Project Record Documents.
18. Section 01 9100, *Commissioning.*
19. Section 21 0500, Common Work Results for Fire Suppression.
20. Section 21 0523, General-Duty Valves for Water-Based Fire-Suppression Piping.
21. Section 21 1200, Fire Suppression Standpipes.
22. Section 21 1300, Fire-Suppression Sprinkler Systems.
23. Section 22 0713, Plumbing and HVAC Insulation.
24. Section 26 2933, Controllers for Fire Pump Drivers.
25. Section 28 4600, Fire Detection and Alarm.

1.3 REFERENCES

1. ASCE 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures
2. NEMA MG 1 – Motors and Generators.
3. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
4. NFPA 13 – Standard for the Installation of Sprinkler Systems.
5. NFPA 20 – Standard for the Installation of Stationary Pumps for Fire Protection.
6. NFPA 25 – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
7. NFPA 37 – Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.
8. UL 448 – Centrifugal Stationary Pumps for Fire-Protection Service.
9. UL 778 – Motor-Operated Water Pumps.
10. UL 1004-5 – Fire Pump Motors.
11. UL 1247 – Diesel Engines for Driving Centrifugal Fire Pumps.
12. UL 1478 – Fire Pump Relief Valves.

1.4 ACTION SUBMITTALS

1. Product Data: Provide manufacturer’s literature including general assembly, pump curves showing performance characteristics with pump and system, operating point indicated, Net Positive Suction Head (NPSH) curve, controls, wiring diagrams, and service connections.
2. Shop Drawings: Shop Drawings shall be in accordance with NFPA 20, to include but not limited to indication of layout, general assembly, components, dimensions, weights, center of gravity, clearances, and methods of assembly.
3. Special Certification from Manufacturer (only applicable if Fire Pump is a Designated Seismic System)

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Commissioning Acceptance and Test Plans are typically generated by LANL Cx for nuclear facilities.

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1. Commissioning Acceptance and Test Plan: Provided by [LANL Cx, Subcontractor], the Commissioning Acceptance and Test Plan shall be submitted for approval by the Fire Marshal’s office prior to execution.
2. Test Reports: Indicate results of hydrostatic test, flushing, and field acceptance tests.

1.5 INFORMATIONAL SUBMITTALS

1. Project Record Documents: Record Documents reflecting final installed conditions. Include Drawings [3D Model] and the corresponding hydraulic calculations.
2. Provide a fully executed copy of the Contractor’s Materials and Test Certificate for Fire Pump Systems.
3. Operation Data: Include manufacturer’s instructions, start-up data, trouble-shooting check lists, for pumps, drivers, and controllers, in accordance with NFPA 20
4. Maintenance Data: Include manufacturers literature, cleaning procedures, replacement parts lists, and repair data for pumps, drivers and controllers.
5. Manufacturer’s standard warranty.

1.6 QUALITY ASSURANCE

1. Perform Work in accordance with [NFPA 13](https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=13) and [NFPA 20](https://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=NFPA%2020); where requirements differ comply with the most stringent.
2. Installer Qualifications: Company specializing in performing Work of this section [with minimum \_\_\_\_ years experience; with minimum \_\_\_\_ years experience and approved by the manufacturer; with documented experience; with documented experience and approved by the manufacturer; \_\_\_\_\_\_\_\_\_\_; or None - N/A].

1.7 DELIVERY, STORAGE, AND HANDLING

1. Deliver fire pumps and components in factory packing. Comply with manufacturer's rigging and installation instructions.
2. Protect fire pumps and components from physical damage including effects of weather, water, and construction debris.
3. Provide temporary inlet and outlet caps, and maintain in place until installation.
4. PRODUCTS

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Designated Seismic Systems (DSS): LANL Utility System is not seismically credited. Equipment that is designated DSS must be fed from a seismically credited generator or UPS.

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1. SEISMIC PERFORMANCE REQUIREMENTS
2. Component importance factor of 1.0 is default unless noted otherwise on engineering drawings. If Fire Pump is a Designated Seismic System (DSS), component importance factor is 1.5.
3. The following nonstructural components (Fire Pumps) are seismically exempt per ASCE 7, Section 13.1.4, but shall be positively attached to the structure provided that:
4. Component weighs 400 lbs or less with center of mass located 4 ft or less above the adjacent floor level, flexible connections are provided between the component and associated conduit (Note: trade size 2.5 or less is considered flexible), and component importance factor is equal to 1.0 or
5. Component weighs 20 lbs or less.
6. For Fire Pumps outside the above exemptions, Engineer of Record shall provide support/anchorage details for the fire pumps that meet seismic requirements per ESM Chapter 5, Section II and ASCE 7. If the Fire Pump is a DSS, manufacturer shall provide special certification per ASCE 7, Section 13.2.2.
7. FIRE PUMPS
8. Inline Fire Pump:
9. Manufacturers:
10. AC Fire Pump, a Xylem brand.
11. Aurora, a Pentair brand.
12. Fairbanks Nijhuis, a Pentair brand.
13. SPP Pumps, Inc.
14. SyncroFlo, Inc.
15. Substitutions: [Alternate products may be accepted, follow Section 01 2500, *Substitution Procedures*; or Not permitted – No substitutions].
16. [UL 448](http://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=UL%20448)[ and UL 778]; vertical- or horizontal-mounted, single-stage, close-coupled centrifugal pump for maximum working pressure of 186 psi.
17. Casing: Cast or ductile iron, or bronze with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
18. Impeller: Bronze, fully enclosed, keyed directly to motor shaft.
19. Shaft: Solid alloy steel with bronze sleeve.
20. Seal: Carbon rotating against a stationary ceramic seat​ [viton fitted],​ ​[225, 275, \_\_\_\_\_] degrees F maximum continuous operating temperature.
21. Performance: [As scheduled on the Drawings].
22. Capacity: \_\_\_\_\_ gpm at \_\_\_\_\_ psi of head.
23. Electric Motor Drive: \_\_\_\_ hp, \_\_\_\_ VAC, [single; three; or \_\_\_\_] phase, 60 Hz.
24. End-Suction Fire Pump:
25. Manufacturers:
26. AC Fire Pump, a Xylem brand.
27. Aurora, a Pentair brand.
28. Fairbanks Nijhuis, a Pentair brand.
29. Patterson Pump Company, a Gorman-Rupp Company.
30. SPP Pumps, Inc.
31. SyncroFlo, Inc.
32. Substitutions: [Alternate products may be accepted, follow Section 01 2500, *Substitution Procedures*; or Not permitted – No substitutions].
33. [UL 448](http://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=UL%20448)[ and UL 778]; horizontal-end-suction, single-stage centrifugal pump for maximum working pressure of 186 psi.
34. Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
35. Impeller: Bronze double suction fully enclosed, balanced and keyed to shaft.
36. Bearings: Grease lubricated ball bearings, replaceable without opening casing.
37. Shaft: Alloy steel with replaceable bronze shaft sleeve.
38. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 230 degrees F maximum continuous operating temperature.
39. Drive: Flexible coupling with coupling guard.
40. Baseplate: Fabricated steel with integral drain rim.
41. Performance: [As scheduled on the Drawings].
42. Capacity: \_\_\_\_\_ gpm at \_\_\_\_\_ psi of head.
43. Diesel Engine Drive: \_\_\_\_ hp.
44. Electric Motor Drive: \_\_\_\_ hp, \_\_\_\_ VAC, [single; three; or \_\_\_\_] phase, 60 Hz.
45. Split-Case Fire Pump:
46. Manufacturers:
47. AC Fire Pump, a Xylem brand.
48. Aurora, a Pentair brand.
49. Fairbanks Nijhuis, a Pentair brand.
50. Patterson Pump Company, a Gorman-Rupp Company.
51. SPP Pumps, Inc.
52. SyncroFlo, Inc.
53. Substitutions: [Alternate products may be accepted, follow Section 01 2500, *Substitution Procedures*; or Not permitted – No substitutions].
54. [UL 448](http://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=UL%20448)[ and UL 778]; vertical- or horizontal-mounted, [single-stage; multistage; or \_\_\_\_\_\_\_\_\_\_], double-suction centrifugal pump for maximum working pressure of 294 psi.
55. Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
56. Impeller: Bronze double suction fully enclosed, balanced and keyed to shaft.
57. Bearings: Grease lubricated ball bearings, replaceable without opening casing.
58. Shaft: Alloy steel with replaceable bronze shaft sleeve.
59. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 230 degrees F maximum continuous operating temperature.
60. Drive: Flexible coupling with coupling guard.
61. Baseplate: Cast iron[ or fabricated steel; \_\_\_\_\_\_\_\_\_\_\_\_\_; or None - N/A] with integral drain rim.
62. Performance:
63. Capacity: \_\_\_\_\_ gpm at \_\_\_\_\_ psi of head.
64. Diesel Engine Drive: \_\_\_\_ hp.
65. Electric Motor Drive: \_\_\_\_ hp, \_\_\_\_ VAC, [single; three; or \_\_\_\_] phase, 60 Hz.
66. Vertical Turbine Fire Pump:
67. Manufacturers:
68. Armstrong Fluid Technology.
69. Aurora, a Pentair brand.
70. Fairbanks Nijhuis, a Pentair brand.
71. Peerless Pump Company.
72. SPP Pumps, Inc.
73. SyncroFlo, Inc.
74. Substitutions: [Alternate products may be accepted, follow Section 01 2500, *Substitution Procedures*; or Not permitted – No substitutions].
75. [UL 448](http://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=UL%20448)[ and UL 778]; vertical, multistage centrifugal pump for well water source for maximum working pressure of 510 psi.
76. Casing: Cast iron rated for 1.20 times actual working pressure. Include discharge gauge, air vent, wear rings, seal flush connection, drain plug, and flanged discharge.
77. Impellers: Bronze, fully enclosed, keyed to shaft or secured with lock nut.
78. Shaft: Stainless steel or carbon steel with bronze or stainless steel sleeve through seal chamber.
79. Seals: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings.
80. Performance:
81. Capacity: \_\_\_\_\_ gpm at \_\_\_\_\_ psi of head.
82. Diesel Engine Drive: \_\_\_\_ hp.
83. Electric Motor Drive: \_\_\_\_ hp, \_\_\_\_ VAC, [single; three; or \_\_\_\_] phase, 60 Hz.
84. Accessories:
85. Eccentric suction reducer and Open Stem & Yoke (OS&Y) gate valve on suction side of pump.
86. Concentric increaser and check valve in pump discharge and OS&Y gate or butterfly valve on system side of check valve.
87. Fire pump bypass fitted with OS&Y gate or butterfly valves and check valve.
88. Main relief valve, [UL 1478](http://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=UL%201478)[ and enclosed type waste cone; and open type waste cone; \_\_\_\_\_\_\_\_\_\_\_\_\_\_; or None - N/A].
89. Suction pressure gauge, 4-1/2 inch diameter dial with snubber, valve cock and lever handle.
90. Discharge pressure gauge mounted on board attached to pump, with snubber, valve cock and lever handle.
91. 3/4 inch casing relief valve.
92. Float operated [3/4 inch; one inch; \_\_\_\_\_ inch] automatic air release valve.
93. Hose valve manifold with 2-1/2 inch hose gate valves with caps and chains.
94. Flow metering system for closed loop testing.
95. ELECTRIC MOTOR DRIVE
96. Motor: Squirrel cage induction type; listed for fire protection service in accordance with UL 1004-5; [NEMA MG 1](https://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=NEMA%20MG%201); in open drip-proof [NEMA 250](https://global.ihs.com/doc_detail.cfm?&rid=BSD&document_name=ANSI/NEMA%20250) enclosure, [3,500; 1,750; or \_\_\_\_] rpm.
97. Controller: Refer to Section 26 2933, *Controllers for Fire Pump Drivers.*
98. DIESEL ENGINE DRIVE
99. Diesel Engine: Comply with requirements of NFPA 20, [NFPA 37](https://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=NFPA%2037) and [UL 1247](http://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=UL%201247); automatic operation with overspeed/overcrank switch and drive, two contactor switches, low oil pressure and high water temperature warning switches, and fuel shut-off solenoid, with wiring terminating in junction box.
100. Include following engine accessories:
101. Stub shaft.
102. Oil bath air cleaner.
103. Water cooled exhaust manifold.
104. Heat exchanger.
105. Mechanical speed governor.
106. Fuel filter.
107. Lube oil filter and by-pass valve.
108. Lube oil cooler and relief valve.
109. Fuel pump.
110. Instrument panel with tachometer, hour meter, oil pressure gauge, water temperature gauge, ammeter, hand speed control and start switch.
111. Starting system including generator/alternator, starting motor and voltage regulator.
112. Exhaust silencer, residential type.
113. Flexible exhaust tubing, [24 inches; \_\_\_\_ inches] long.
114. Thermal insulation for personnel protection on exhaust shall comply with Section 22 0713, *Plumbing and HVAC Insulation*.
115. Cooling Water System: Closed system with cooling water supply to heat exchanger from fire pump discharge. Include four manual shut-off valves (including by-pass line), two strainers, pressure regulating valve, automatic solenoid valve and pressure gauge.
116. Storage Batteries: Dual lead acid batteries with cables and battery racks.
117. Fuel Tank: \_\_\_\_ gal above ground storage tank, fill pipe and cap, manual shut-off valve, flame arrestor, oil level gauge, braided bronze flexible connectors, seamless type L copper tubing with flared joints. Fill tank at completion.
118. Engine Controller: Refer to Section 26 2933, *Controllers for Fire Pump Drivers.*
119. PRESSURE MAINTENACE PUMP
120. Manufacturers:
121. Armstrong Fluid Technology.
122. Aurora, a Pentair brand.
123. Fairbanks Nijhuis, a Pentair brand.
124. Grundfos.
125. Talco Fire Systems.
126. Substitutions: [Alternate products may be accepted, follow Section 01 2500, *Substitution Procedures*; or Not permitted – No substitutions].
127. Electrically operated, horizontal or vertical, single or multi stage, [turbine; close-coupled; or \_\_\_\_\_\_\_\_] type centrifugal pump with standard open drip-proof horizontal motor.
128. Controller: Refer to Section 26 2933, *Controllers for Fire Pump Drivers*.
129. Performance:
130. Capacity: \_\_\_\_\_ gpm at \_\_\_\_\_ feet of head.
131. Electric Motor Drive: \_\_\_\_ hp, \_\_\_\_ VAC, [single; three; or \_\_\_\_] phase, 60 Hz.
132. FIRE PUMP PACKAGE SYSTEMS
133. Manufacturers:
134. Armstrong Fluid Technology.
135. SPP Pumps, Inc.
136. SyncroFlo, Inc.
137. Substitutions: [Alternate products may be accepted, follow Section 01 2500, *Substitution Procedures*; or Not permitted – No substitutions].
138. Description: Factory built, skid-mounted, custom-assembled fire pump package. Unit to be pretested and ready to use. Include system controller, piping, fittings, valves, and other required externally mounted components and accessories for field installation.
139. Package Configuration:
140. [One; Two; Three; or \_\_\_\_\_\_\_\_\_\_] [end-suction; split-case; turbine] type fire pump(s) with electric motor drive prewired into associated starter. [Package to include pressure maintenance pump prewired into associated starter].

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1. [One; Two; Three; or \_\_\_\_\_\_\_\_\_\_] [end-suction; split-case; turbine] type fire pump(s) with diesel engine drive and reserve tank. [Package to include pressure maintenance pump prewired into associated starter].
2. Pipe-installed system visual indicating flow meter prewired into junction box for remote monitoring.
3. Prewire alarm and trouble or fault contacts into central junction box or panel for field interface by fire alarm system.

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Select paragraph below if fire pump is outdoors.

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1. Package System Housing Enclosure:
2. Weatherproof enclosure with lockable door.
3. Thermostat-controlled enclosure heating and ventilation.
4. Indoor and outdoor lighting with respective light switches.
5. Insulated wall panel assembly according to climatic data in ESM Ch. 6, Section D30, Table D30GEN-1.
6. \_\_\_\_\_\_\_\_\_\_.
7. EXECUTION
8. INSTALLATION
9. Install fire pump in accordance with [NFPA 20](https://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=NFPA%2020) and manufacturer’s installation instructions.
10. Install diesel engine drive in accordance with NFPA 20, [NFPA 37](https://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=NFPA%2037) and manufacturer’s installation instructions.
11. Provide access space around pumps for service; no less than minimum as recommended by manufacturer.
12. Piping: Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For base mounted pumps, provide supports under elbows on pump suction and discharge; see Section 21 0500, *Common Work Results for Fire Suppression*.
13. Provide drains for bases and seals, piped to and discharging into floor drains.
14. Lubricate pumps before start-up.
15. Check, align, and certify pumps by qualified installer prior to start-up.
16. Provide supervisory alarm notifications using auxiliary dry contacts interconnected into fire alarm system for monitoring by LANL Emergency Operations Support Center (EOSC); see Section 28 4600, *Fire Detection and Alarm*.
17. FIELD QUALITY CONTROL

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Field acceptance tests are part of the formal process to verify compliance with NFPA 20; therefore, all pre-acceptance testing preparation should be complete before scheduling the tests for witnessing by authorities having jurisdiction.

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1. See Section 01 4000, *Quality Requirements – Non-Nuclear*, for additional requirements.
2. Perform hydrostatic testing, flushing, and field acceptance testing required by [NFPA 20](https://global.ihs.com/doc_detail.cfm?rid=BSD&document_name=NFPA%2020). Subcontractor shall coordinate date, time and location of field acceptance test with LANL STR and AHJ.
3. Flushing shall precede hydrostatic testing.
4. Flushing and hydrostatic testing shall precede field acceptance testing.
5. Perform field acceptance tests in the presence of Fire Marshal, and NFPA 20 required manufacturer’s representatives.
6. Acceptance Tests and Inspections:
7. Do not begin field acceptance testing until suction piping has been flushed and hydrostatically tested and the certificate for flushing and testing has been submitted to LANL STR, Design Agency, and AHJ.
8. Prior to starting, notify authorities having jurisdiction of the time and place of the acceptance testing.
9. Engage manufacturer's factory-authorized service representative to be present during the testing.
10. Perform field acceptance tests as outlined in NFPA 20.

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See Section 01 4000, *Quality Requirements – Non-Nuclear* for retesting and reinspecting requirements.

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1. Nonconforming Work:
2. Fire pumps will be considered defective if they do not pass tests and inspections.
3. For nonconformance, adjust and retest. Repeat until conformance is achieved.
4. Prepare test and inspection reports.
5. CLOSEOUT ACTIVITIES
6. See Section 01 7700, *Closeout Procedures* for additional requirements.
7. Demonstrate automatic operation of system including verification of pressure switch set points to LANL.
8. Use operation and maintenance data as reference during demonstration.
9. Briefly describe function, operation, and maintenance of each component.
10. Training: Train LANL's personnel on operation and maintenance of system.
11. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
12. Provide minimum of [two hours; one day; or \_\_\_\_\_] of training.
13. Instructor: Manufacturer's training personnel.
14. Location: [At project site; LANL's offsite classroom facilities may be used; Provide local classroom facilities; or At manufacturer's training facility; include travel expenses for [one member; two members; or \_\_\_\_\_ members] of LANL's staff].

END OF SECTION

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Do not delete the following reference information:

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THE FOLLOWING STATEMENT IS FOR LANL USE ONLY

This project specification section is based on LANL Master Specification Section 21 3000 Rev. 0, dated December 5, 2024.