SECTION 210513 - COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

1.1 QUALITY ASSURANCE

A. Products and materials shall demonstrate compliance with requirements specified in Section 016000 “Product Requirements.

B. Comply with the applicable requirements and recommendations of local Saudi Building Code (SBC) and the latest applicable local regulations for materials, tests, installation, and identification, as listed in, but not limited to, the “Saudi Fire Code”, SBC 801, and the standards listed below in this section; whichever is more stringent.

C. Comply with NEMA MG1.

D. Comply with IEC 60034.

E. Comply with IEC 60072.

F. Comply with IEC 60529.

1.2 GENERAL MOTOR REQUIREMENTS

A. Motors shall be of the energy efficient design.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

D. Motors 0.746 kW (1 HP) and Larger: Three phase.

E. Motors smaller than 0.746 (1 HP): Single phase.

1.3 MOTOR CHARACTERISTICS

A. Motors shall be NEMA design B or design N or NY as applicable to IEC 60034-12, unless otherwise recommended by manufacturer and approved by the Engineer for high torque applications.

B. Duty: Continuous duty at ambient temperature of 46.1 deg C and at altitude of 625 m above sea level.

C. Service Factor: 1.15 according to NEMA MG1 or shall be duty type S1 - continuous running duty to IEC 60034-1, unless otherwise indicated. Motors used for excessive intermittent periodic operation shall be suitably designed for the expected number of starts. Motors’ dimensions shall comply with NEMA MG1 or IEC 60072 as applicable.

D. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

E. Low Voltage Motors’ Enclosure: Totally enclosed, fan-cooled type (TEFC) to NEMA MG1 or IC 411 to IEC 60034-6 as applicable, unless otherwise indicated or recommended by manufacturer and approved by the Engineer.

F. Medium Voltage Motors' Enclosures: Totally enclosed, air to air cooled (TEAAC) to NEMA MG1 or IC 611 to IEC 60034-6 as applicable or totally enclosed, water to air cooled (TEWAC) to NEMA MG1 or IC 817 to IEC 60034-6 as applicable. Enclosure type shall be as recommended by manufacturer and approved by the Engineer, unless otherwise indicated.

G. Degree of Protection (IP): Motors shall be IP55 to IEC 60529 for outdoor use and IP54 to IEC 60529 for indoor motors as a minimum .

H. Temperature Rise: Shall not exceed 80 deg. C based on 50 deg. C (122 deg. F) ambient temperature, unless otherwise indicated or recommended by manufacturer and approved by the Engineer for specific applications such as: overhead cranes or submersible pumps, where temperature rise not exceeding 105 deg. C may be used.

I. Motors that utilize a Variable Frequency Drive (VFD) shall be inverter duty to NEMA MG1 or Class I to IEC 60034-18-41and shall be classified as energy efficiency to NEMA MG1 or high efficiency class IE2 to IEC 60034-30.

J. Low Voltage Motors Terminal Boxes: Shall have the same motor's degree of protection.

K. Medium Voltage Motors Terminal Boxes: Shall have the same motor's degree of protection and shall be designed for differential CT's and/or surge protection (surge arrestor and surge capacitor). Enough space shall be provided below main terminal box for cable connection.

L. Include built-in terminal blocks and built in thermistors PTC100 / RTD200 for winding protection for all low voltage motors rated 50 HP and above and for all low voltage VFD motors.

M. Include built-in terminal blocks and built in thermistors PTC100 / RTD200 for winding and bearing protection for all medium voltage motors.

N. The contractor is responsible for coordination between the motor and motor controller suppliers to ensure compatibility, proper starting and satisfactory operation.

1.4 MATERIALS

A. Polyphase Motors: Design B, medium induction motors.

1. Efficiency: Premium efficient, as defined in NEMA MG 1 or class IE3 to IEC 60034-30 unless otherwise indicated.
2. Service Factor: 1.15.
3. Stator: Copper windings unless otherwise indicated.
4. Multispeed Motors: [**Variable torque**] [**Separate winding for each speed**].
5. Rotor: Random-wound, squirrel cage.
6. Bearings:Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
7. Temperature Rise: Match insulation rating.
8. Insulation: Unless otherwise indicated, Class F for motors with temperature rise 80 deg. C and Class H for motors with temperature rise 105 deg. C as indicated in paragraph 2.1 M above..
9. Code Letter Designation:

    a. Motors 15 HP and Larger: NEMA starting Code F or Code G.
    b. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

10. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

B. Additional Requirements for Polyphase Motors:

1. Motors used with reduced-voltage and multispeed controllers.
2. Premium-efficient and inverter-duty motors used with variable-frequency controllers.
3. Severe-duty motors: Where indicated, motors are totally enclosed with 1.15 minimum service factor to NEMA MG1 and IEEE 841.

C. Single-Phase Motors:

1. Motors Larger Than 1/20 HP: Permanent-split capacitor; split phase; capacitor start, inductor run; or capacitor start, capacitor run to suit starting torque and requirements of specific motor application. Class B insulation may be used, unless otherwise indicated.
2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Motors 1/20 HP and Smaller: Shaded-pole type.
5. Internal thermal protection.

END OF SECTION 210513

SECTION 210517 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

1.1 QUALITY ASSURANCE

A. Products and materials shall demonstrate compliance with requirements specified in Section 016000 “Product Requirements.

B. Comply with the applicable requirements and recommendations of local Saudi Building Code (SBC) and the latest applicable local regulations for materials and installation for sleeves and sleeve seals for fire suppression piping, as listed in, but not limited to, the “Saudi Building Code – General“, SBC 201, and the standards listed below in this section; whichever is more stringent.

1.2 SLEEVES WITHOUT WATERSTOP

A. Cast-Iron Pipe Sleeves: Cast or fabricated of ductile iron, with plain ends.

B. Steel Pipe Sleeves: Hot-dip galvanized, ASTM A53/A53M, Type E, Grade B, Schedule 40, with plain ends.

C. Galvanized Steel Pipe: ASTM A53/A 53M, Schedule 40, zinc coated, with plain ends.

D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.

E. PVC Pipe: ASTM D1785, Schedule 40.

F. Molded-PVC Sleeves: With nailing flange.

G. Molded-PE or -PP Sleeves: Removable, with nailing flange.

1.3 SLEEVES WITH WATERSTOP

A. Cast-Iron Pipe Sleeves: Cast or fabricated ductile iron, with plain ends and integral waterstop collar.

B. Manufactured, [**PVC/HDPE**] [**ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized-steel**] sleeve-type, waterstop assembly for imbedding in concrete slab or wall.

1.4 STACK-SLEEVE FITTINGS

A. Manufactured, galvanized cast-iron sleeve with integral cast flashing flange, with underdeck clamp.

1.5 SLEEVE-SEAL SYSTEMS

A. Field-assembled, modular sealing-element unit for filling annular space between piping and sleeve.

1. Sealing Elements: Nitrile (Buna N.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel.

1.6 GROUT

A. Nonshrink, factory packaged; ASTM C1107/C1107M, Grade B.

1.7 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Exterior Concrete Walls above Grade: Sleeves with waterstops.

1. Piping Smaller than NPS 6 (DN 150): Galvanized Steel pipe sleeves
2. Piping NPS 6 (DN 150) and Larger: Galvanized Steel pipe sleeves

B. Exterior Concrete Walls below Grade: Sleeves with waterstops.

1. Piping Smaller Than NPS 6 (DN 150): Galvanized Steel pipe sleeves with sleeve-seal system.
2. Piping NPS 6 (DN 150) and Larger: Galvanized Steel pipe sleeves with sleeve-seal system.

C. Concrete Slabs-on-Grade: Sleeves with waterstops.

1. Piping Smaller Than NPS 6 (DN 150) : Galvanized Steel pipe sleeves with sleeve-seal system.
2. Piping NPS 6 (DN 150) and Larger: Galvanized Steel pipe sleeves with sleeve-seal system.

D. Concrete Slabs above Grade that are Not Fire Rated nor Smoke Rated: Sleeves with waterstops.

1. Piping Smaller Than NPS 6 (DN 150): Galvanized Steel pipe sleeves.
2. Piping NPS 6 (DN 150) and Larger: Galvanized Steel pipe sleeves.

E. Interior Walls and Partitions that are Not Fire Rated nor Smoke Rated: Sleeves without waterstops.

1. Piping Smaller Than NPS 6 (DN 150): Galvanized Steel pipe sleeves
2. Piping NPS 6 (DN 150) and Larger: Galvanized-steel sheet sleeves.

END OF SECTION 210517

SECTION 210518 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

1.1 SUMMARY

A. Section includes:

1. Escutcheons.
2. Floor plates.

1.2 QUALITY ASSURANCE

A. Products and materials shall demonstrate compliance with requirements specified in Section 016000 “Product Requirements.

B. Comply with the applicable requirements and recommendations of local Saudi Building Code (SBC) and the latest applicable local regulations, for materials, and installation for escutcheons for fire suppression piping, and as per the standards listed below in this section; whichever is more stringent.

1.3 PRODUCTS

A. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One-piece deep pattern.
2. Chrome-Plated Piping: One-piece steel one-piece cast brass or split-plate steel with polished, chrome-plated finish.
3. Insulated Piping: One-piece steel with polished, chrome-plated finish.
4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish or One-piece cast brass with polished brass finish.
5. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish or One-piece cast brass with polished brass finish.
6. Bare Piping in Unfinished Service Spaces: One-piece steel with polished, chrome-plated finish or One-piece cast brass with rough-brass finish.
7. Bare Piping in Equipment Rooms: One-piece steel with polished, chrome-plated finish or One-piece cast brass with rough brass finish.

B. Floor Plates: Split-plate, stamped steel with concealed hinge.

END OF SECTION 210518

SECTION 210548 - VIBRATION AND SEISMIC CONTROLS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

1.1 QUALITY ASSURANCE

A. Products and materials shall demonstrate compliance with requirements specified in Section 016000 “Product Requirements.

B. Comply with the applicable requirements and recommendations of local Saudi Building Code (SBC) and the latest applicable local regulations for vibration and seismic controls, as listed in, but not limited to, the “Saudi Building Code-General”, SBC 201, “Saudi Mechanical Code” SBC 501, and “Saudi Fire Code” SBC 801, and the standards listed below in this section; whichever is more stringent.

C. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

E. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval by ICC-ES or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

1.2 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Applicable Wind-Restraint Loading Reference: Comply with ASCE/SEI 7-10.
2. Basic Wind Speed (3 second gust): 45 m/s.
3. Risk Category: II as per SBC 201.
4. Exposure Category: D as per SBC 201.
5. .

B. Seismic-Restraint Loading:

1. Applicable Seismic-Restraint Reference: Comply with SBC and ASCE 7-10.
2. Building Site Classification: D.
3. Building importance factor = 1.
4. Design Spectral Response Acceleration at Short Periods (0.2 Second): 5% Critical damping Ss=0.55g.
5. Design Spectral Response Acceleration at Short Periods (1.0 Second): 5% Critical damping S1 =0.13g.

1.3 COMPONENTS

A. Vibration Isolators:

1. Elastomeric Isolation Pads: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area. Material to be oil and water resistant with elastomeric properties.

    a. Sandwich Core Material: Resilient and elastomeric.
    b. Surface Pattern: Smooth, ribbed, or waffle pattern.
    c. Infused nonwoven cotton or synthetic fibers.
    d. Load-bearing metal plates adhered to pads.

2. Double-Deflection, Elastomeric Isolation Mounts: Molded, oil- and water-resistant rubber, neoprene, or other elastomeric material.
3. Restrained Elastomeric Isolation Mounts: All-directional isolator with seismic restraints; molded, oil-resistant elastomeric material with cast-ductile-iron or welded-steel housing.
4. Elastomeric hangers.
5. Pipe–Riser Resilient Support: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 13-mm-thick neoprene.

    a. Steel and neoprene vertical-limit stops.
    b. Maximum Load Per Support: 3.45 MPa on isolation material providing equal isolation in all directions.

6. Resilient Pipe Guides: Telescopic arrangement of two steel tubes or post-and-sleeve arrangement separated by a minimum 13-mm-thick neoprene.

B. Seismic-Restraint Devices:

1. Snubbers: Welded structural-steel shapes and replaceable resilient isolation washers and bushings.
    a. Post-Installed Concrete Anchor Bolts: Secure to concrete surface with post-installed concrete anchors. Anchors to be seismically prequalified in accordance with ACI 355.2;0, drill in, and stud-wedge or female wedge type.
    b. Preset Concrete Inserts: Seismically prequalified in accordance with ICC-ES AC446 testing.
    c. Anchors in Masonry: Design in accordance with TMS 402.
    d. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.

2. Restraints - Rigid: MFMA-4, shop- or field- fabricated bracing assembly made of AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe as per NFPA 13, or other rigid steel brace member.
3. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.
4. Resilient Isolation Washers and Bushings: One-piece, molded, oil and water-resistant elastomeric material, with a flat washer face.
5. Anchor Bolts: Mechanical or Adhesive type, seismic rated, tested according to ASTM E488/E488M.
6. Post-installed concrete anchors must comply with all requirements of IBC.

    a. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.

END OF SECTION 210548

SECTION 210553 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

1.1 QUALITY ASSURANCE

A. Products and materials shall demonstrate compliance with requirements specified in Section 016000 “Product Requirements.

B. Comply with the applicable requirements and recommendations of local Saudi Building Code (SBC) and the latest applicable local regulations for identification fire suppression piping and equipment, as listed in, but not limited to, the “Saudi Fire Code”, SBC 801, and the standards listed below in this section; whichever is more stringent.

C. Quality Standard for Piping Identification: ASME A13.1.

1.2 PRODUCTS

A. Equipment Labels: Polished brass or aluminum, 0.8 mm thick, with fasteners.

B. Warning Signs and Labels: Multilayer, multicolor, plastic labels for mechanical engraving, 3.2 mm thick, with fasteners.

C. Pipe Labels: Pretensioned.

D. Stencils: Brass.

E. Valve Tags: Polished brass or aluminum, 0.8 mm thick, with brass wire link chain, beaded chain, or S-hook fasteners.

F. Warning Tags: 75 by 133 mm minimum; brass grommet and wire fasteners.

END OF SECTION 210553

SECTION 211119 – FIRE DEPARTMENT CONNECTIONS

1.1 QUALITY ASSURANCE

A. Products and materials shall demonstrate compliance with requirements specified in Section 016000 “Product Requirements.

B. Comply with the applicable requirements and recommendations of local Saudi Building Code (SBC) and the latest applicable local regulations for materials, tests, installation, and identification, as listed in the, but not limited to, “Saudi Fire Code”, SBC 801, and the standards listed below in this section; whichever is more stringent.

C. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with other requirements indicated.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7 and SBC 201.

1.3 FIRE-DEPARTMENT CONNECTIONS

A. Exposed-Type Fire-Department Connection:

1. Standard: UL 405.
2. Type: Exposed, projecting, for wall mounting.
3. Pressure Rating: 1200 kPa minimum.
4. Body Material: Cast-brass.
5. Inlets: Brass with threads according to NFPA P1963.
6. Extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Round, brass, wall type.
9. Outlet: Back, with pipe threads.
10. Number of Inlets: [**Two**] [**Three**].
11. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE or STANDPIPE."
12. Finish: Polished chrome plated.
13. Outlet Size: As per fire system flow rate.

B. Flush-Type Fire-Department Connection:

1. Standard: UL 405.
2. Type: Flush, for wall mounting.
3. Pressure Rating: 1200 kPa minimum.
4. Body Material: Cast brass.
5. Inlets: Brass with threads according to NFPA 1963.
6. Extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, brass, wall type.
9. Outlet: With pipe threads.
10. Body Style: Horizontal.
11. Number of Inlets: As per fire system flow rate and according to NFPA 1963 and matching local fire department sizes and threads.
12. Outlet Location: As indicated on Drawings.
13. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE or STANDPIPE."

14. Finish: Polished chrome plated.
15. Outlet Size: As per fire system flow rate.

END OF SECTION 211119

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

1.1 QUALITY ASSURANCE

A. Products and materials shall demonstrate compliance with requirements specified in Section 016000 “Product Requirements.

B. Comply with the applicable requirements and recommendations of local Saudi Building Code (SBC) and the latest applicable local regulations for materials, tests, installation, and identification, as listed in the “Saudi Building Code – General”, SBC 201, and “Saudi Fire Code”, SBC 801, and the standards listed below in this section; whichever is more stringent.

C. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of fire-suppression piping that are similar to those indicated for this Project in material, design, and extent.

E. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

F. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with other requirements indicated.

G. Sprinkler Components: Listing/approval stamp, label, or other marking by a testing agency acceptable to Engineer and authorities having jurisdiction.

H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to Engineer.

I. NFPA Standards: Equipment, specialties, accessories, installation, and testing complying with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 13D, "Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes."
3. NFPA 13R, "Installation of Sprinkler Systems in Low-Rise Residential Occupancies."
4. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
5. NFPA 230, "Standard for the Fire Protection of Storage."

1.2 PERFORMANCE REQUIREMENTS

A. Quality Standards: NFPA 13, NFPA 70, and obtain approval from Engineer and authorities having jurisdiction.

1. Sprinkler system design shall be approved by authorities having jurisdiction.

    a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
    b. Sprinkler Occupancy Hazard Classifications: as per NFPA 13 requirements.

2. Minimum Density for Automatic-Sprinkler Piping Design:

    a. Light-Hazard Occupancy: 4.1 mm/min. over 139-sq. m area.
    b. Ordinary-Hazard, Group 1 Occupancy: 6.1 mm/min. over 139-sq. m area.
    c. Ordinary-Hazard, Group 2 Occupancy: 8.1 mm/min. over 139-sq. m area.
    d. Special Occupancy Hazard: As determined by authorities having jurisdiction.

3. Minimum Density for Deluge-Sprinkler Piping Design:

    a. Ordinary-Hazard, Group 1 Occupancy: 6.1 mm/min. over entire area.
    b. Ordinary-Hazard, Group 2 Occupancy: 8.1 mm/min. over entire area.
    c. Special Occupancy Hazard: As determined by authorities having jurisdiction.

4. Maximum protection area per sprinkler according to NFPA 13 requirements.

B. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7. See Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

1.3 PIPING AND FITTINGS MATERIALS

A. Standard-Weight, ASTM A 53/A 53M, ASTM A 135/A 135M, or ASTM A 795/A 135M hot-dip galvanized-steel pipe where indicated; Schedule 40 in DN150 and smaller, and Schedule 30 in DN200 and larger..

B. Galvanized-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.

C. Galvanized- and Uncoated-Steel Couplings: ASTM A865/A865M, threaded.

D. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

E. Malleable- or Ductile-Iron Unions: UL 860.

F. Malleable-Iron Threaded Fittings: ASME B16.3.

G. Cast-Iron Flanges: ASME 16.1, Class 125.

H. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 3.2 mm thick.

    a. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
    b. Class 250, Cast Iron Flanges and Class 300, Steel, Raised-Face Flanges: Ring-type gaskets.

2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

I. Steel Welding Fittings: ASTM A234/A234M, ASME B16.9, or ASME B16.11.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

J. Grooved-Joint, Steel-Pipe Appurtenances:
1. Pressure Rating: 1200-kPa minimum.
2. Galvanizedor Painted Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

K. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 1200-kPa pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

L. Piping between Fire Department Connections and Check Valves: Use galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.

M. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved-end fittings.

N. Standard-Pressure, Wet-Pipe Sprinkler System, DN 100 and Smaller:
1. Standard-weight, black-steel pipe and uncoated, plain-end-pipe fittings.

O. Standard-Pressure, Wet-Pipe Sprinkler System, DN 125 and Larger:
1. Standard-weight, black-steel pipe with plain ends and welding fittings.

1.4 SPRINKLER MATERIALS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating for Automatic Sprinklers: 1200-kPa minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.

D. Sprinkler Types:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers as indicated.
3. Wall Mounting: Sidewall sprinklers.
4. Deluge-Sprinkler Systems: Upright and pendent, open sprinklers.
5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.

E. Sprinkler Finishes:

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Residential Sprinklers: Dull chrome.
5. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

1.5 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 1200-kPa minimum.
2. High-Pressure Piping Specialty Valves: 1725-kPa minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm valves.

1. Standard: UL 193.
2. Pressure Rating: 1200-kPa minimum
3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, retarding chamber, and fill-line attachment with strainer.
4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Zone/Floor Control Valves:

1. Floor control valves assembly consisting of UL listed FM approved indicating-type floor control valve with supervisory switch, pressure gauge, water flow switch , test drain valve assembly and check valve; installation and piping arrangement to be as per NFPA 13 appendix A
2. Floor control valves rated for minimum of 1200 Pa working pressure

H. Deluge valves.

1. Standard: UL 260.
2. Pressure Rating: 1200-kPa minimum
3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, drip cup assembly piped without valves and separate from main drain line, and fill-line attachment with strainer, and push-rod chamber supply connection.
4. Wet, Pilot-Line Trim Set: Include gage to read push-rod chamber pressure, globe valve for manual operation of deluge valve, and connection for actuation device.

Retain subparagraph above or below. Retain above for wet sprinklers, hydraulic manual control, or solenoid-valve actuation. Retain below for dry sprinklers and provide air supply.

5. Dry, Pilot-Line Trim Set: Include dry, pilot-line actuator; air- and water-pressure gages; low-air-pressure warning switch; air- relief valve; and actuation device. Dry, pilot-line actuator includes cast-iron, 1200-kPa working-pressure, air- operated, diaphragm-type valve with resilient facing plate, resilient diaphragm, and replaceable bronze seat. Valve includes threaded water and air inlets and water outlet. Loss of air pressure on dry, pilot-line side allows pilot-line actuator to open and causes deluge valve to open immediately.

I. Pressure-Regulating Valves:

1. Standard: UL 1468
2. Pressure Rating: 2760-kPa minimum.
3. Design: Brass. Include DN40 or DN65, female NPS inlet and outlet; adjustable setting feature; and straight or 90-degree angle pattern design as indicated.
4. Finish: Rough chrome-plated.

J. Automatic (ball drip) drain valves.

1. Standard: UL 1726.
2. Pressure Rating: 1200-kPa minimum.

K. Air Vents: Automatic or Automatic assembly.

1. Standard: UL listed or FM Global approved for use in wet-pipe fire sprinkler systems.
2. Minimum Water Working Pressure Rating: 1207 kPa.

1.6 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch outlet fittings.

1. Standard: UL 213.
2. Pressure Rating: 1200-kPa minimum.
3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.

B. Flow detection and test assemblies.

1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 1200-kPa minimum.
3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.

C. Branch line testers.

1. Standard: UL 199.
2. Pressure Rating: 1200 kPa.
3. Body Material: Brass.

D. Sprinkler inspector's test fittings.

1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 1200-kPa minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.

E. Adjustable drop nipples.

1. Standard: UL 1474.
2. Pressure Rating: 1725-kPa minimum.
3. Body Material: Steel pipe with EPDM-rubber O-ring seals.

F. Sprinkler Escutcheons:

1. Ceiling Mounting: Chrome-plated steel, one piece, flat or Chrome-plated steel, two piece, with 25-mm vertical adjustment.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

1.7 ALARM DEVICES

A. Water-motor-operated alarm.

1. Standard: UL 753.
2. Type: Mechanically operated, with Pelton wheel.
3. Alarm Gong: Cast aluminum with red-enamel factory finish.

B. Electrically operated alarm bell.

1. Electric Bell:

a. Standard: UL 464.
b. Type: Vibrating, metal alarm bell.
c. Finish: Red-enamel or polyester powder-coat factory finish, suitable for outdoor use with approved and listed weatherproof backbox.

2. Strobe/Horn:

a. Standard: UL 464.
b. Tone: Selectable, steady, Temporal-3 (T-3) in accordance with ISO 8201 and ANSI/ASA S3.41, 2400 Hz, electromechanical, broadband.
c. Finish: Red, suitable for outdoor use with approved and listed weatherproof backbox. White letters on housing identifying device as for “Fire.”

C. Water-flow indicators.

1. Standard: UL 346.
2. Water-Flow Detector: Electrically supervised, vane-type water-flow detector.
3. Type: Paddle operated.
4. Pressure Rating: 1725 kPa.

D. Pressure switches.

1. Standard: UL 753.
2. Type: Electrically supervised water-flow switch with retard feature.

E. Valve supervisory switches.

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Indicator-post supervisory switches.

1. Standard: UL 346.
2. Type: Electrically supervised.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 MANUAL CONTROL STATIONS

A. Listed in UL’s “Fire Protection Equipment Directory” or FM Global’s “Approval Guide” for hydraulic operation, with union, DN 15 pipe nipple, and bronze ball valve.

1.9 CONTROL PANELS

A. Single-area, two-area, or single-area cross-zoned control panel as indicated, including NEMA ICS 6, Type 1 enclosure, detector, alarm, and solenoid-valve circuitry for operation of deluge valves, with electric or hydraulic-operation, manual control stations.

1. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" when used with thermal detectors and Class A detector circuit wiring.

2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.10 PRESSURE GAUGES

A. Standard: UL 393.

B. 0- to 1725-kPa minimum range.

END OF SECTION 211313

SECTION 211339 - FOAM-WATER SYSTEMS

1.1 SYSTEM DESCRIPTION

A. Engineered, fixed,, automatically actuated, low-expansion, AFFF fire-extinguishing system for flammable-liquid fires. System includes diaphragm proportioning tanks and devices.

1.2 QUALITY ASSURANCE

A. Products and materials shall demonstrate compliance with the requirements specified in Section 016000 “Product Requirements.”

B. Comply with the applicable requirements and recommendations of local Saudi Building Code and the latest applicable local regulations for materials, tests, installation, and identification, as listed in, but not limited to, the “Saudi Building Fire Code”, SBC 201, 501 and 801, and the standards listed below in this section; whichever is more stringent.

C. Quality Standards: NFPA 11, NFPA 13, and NFPA 16.

D. UL listed or FM Approved for use in fire-protection systems.

E. ASME Compliance: Fabricate piping to comply with ASME B31.1.

F. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of low-expansion, AFFF fire-extinguishing systems that are similar to those indicated for this Project in material, design, and extent.

G. Comply with Saudi General Authority of Civil Aviation (GACA) for foam suppression systems for helipads.

1.3 PERFORMANCE REQUIREMENTS

A. Design, fixed-type, automatically actuated, low-expansion, AFFF fire-extinguishing systems for Class B, flammable-liquid fires and obtain approval from Engineer and authorities having jurisdiction. Include use of 3 percent AFFF concentrate for 3 percent concentrate and 97 percent water foam solution to be discharged from closed sprinklers and other discharge devices as appropriate for areas being protected.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

C. Minimum Working-Pressure Rating: 1200 kPa.

D. Unless authorities having jurisdiction have stricter requirements, minimum design parameters, as follows:

1. Solution: 3 percent foam-water solution.
2. Sprinkler Spacing: Maximum of 9.5 sq. m per sprinkler, and maximum 3.7-m spacing.
3. Design Density: Minimum 0.108 L/s per sq. m.
4. Foam Supply: Minimum 10-minute discharge time.
5. Water Supply: Minimum 60 minutes.

6. Remote Area: Minimum 476-sq. m design area for closed-sprinkler systems. Open-sprinkler systems shall discharge over the entire system area.
7. Sprinkler Temperature Rating: Maximum 121 to 149 deg C at a roof or ceiling, and 57 to 77 deg C for intermediate sprinklers.

E. Seismic Performance: Fire-suppression piping shall withstand the effects of earthquake motions determined in accordance with NFPA 13.

1.4 PRODUCTS

A. Concentrate Piping Materials: Schedule 40, Black steel with iron, ASTM A53/A53M, Type E or Type S or ASTM A 135/A 135M and Schedule 40, Galvanized-Steel Pipe, ASTM A53/A53M, Type E or Type S, as per “INSTALLTION” below; pipe ends formed to match joining method.

1. Gray-Iron Threaded Fittings, Classes 125 and 250: ASME B16.4. Provide galvanized fittings for use with galvanized steel pipe.
2. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1.
3. Malleable Iron Threaded Fittings, Classes 150 and 300: ASME B16.3. Provide galvanized fittings for use with galvanized-steel pipe.
4. Grooved-End Fittings: UL listed and FM approved; ASTM A 47/A 47M malleable-iron or ASTM A 536 ductile-iron castings; with dimensions matching steel pipe and ends factory grooved according to AWWA C606.
5. Joining Materials

Coordinate joining material selections with pipe and pipe fitting selections.

a. Keyed Couplings: UL 213, AWWA C606, approved or listed for fire protection service, and matching steel pipe dimensions. Include ASTM A 536, ductile-iron housing, rubber gasket, and steel bolts and nuts.

B. Valves: Listed for fire-protection service and compatible with foam concentrate.

1. Valves DN50 and Smaller: Bronze body with threaded ends according to the following:
   a. Gate Valves: UL 262, OS&Y type or, if not available in size required, provide MSS 80, Class 125 or Class 150 as required, rising-stem type acceptable to authorities having jurisdiction.
   b. Check Valves: UL 312, swing-check type or, if not available in size required, provide MSS 80, Class 125 or Class 150 as required, swing-check type acceptable to authorities having jurisdiction.

2. Valves DN65 and Larger: Cast-iron body with flanged ends according to the following:

   a. Gate Valves: UL 262, OS&Y type.
   b. Check Valves: UL 312, swing-check type.

C. Proportioning Tanks: Buna-N, Bladder type; complying with UL 162 and ASME Boiler and Pressure Vessel Code: Section VIII; designed for use with foam-concentrate pumps and for specific type of foam concentrate used. Include bladder, internal piping, fill and drain, glass sight gage, piping, and valves. Contain concentrate in the bladder. horizontal design with saddle or vertical design with skirt support[**and with seismic restraints**].

D. Foam-Concentrate Pumps: Listed for use in foam-water systems in accordance with NFPA 20. Include supply-side pressure relief valve and drain cock or valve.

E. Venturi-type proportioning controllers complying with UL 162 and of capacity to match design at minimum and maximum flow.

F. Water-operated, ball- or deluge-type concentrate control valves.

G. Bronze concentrate strainers with stainless-steel mesh.

H. Pressure gauges complying with UL 393.

I. Foam Concentrate: 3 percent AFFF, comply with UL 162 and NFPA 11.

J. Discharge Devices, UL listed or FM approved and listed for use with type of foam concentrate used:

1. Closed, non-air-aspirating-type sprinklers.
2. Spray nozzles.

K. Monitoring devices, complying with UL 753, NFPA 11, NFPA 16, and NFPA 72.

1. Valve supervisory switches
2. Pressure switches, UL listed or FM approved.
3. Flow switches, UL listed or FM approved.

L. Alarm Devices, FM approved or NRTL listed:

1. Bells.
2. Horns.
3. Strobe lights.

1.5 MONITORS

A. Manual Monitor:

1. Type: Stationary.
2. Standard: UL Listed /FM Approved.
3. Application: Suitable for use with water, AFFF Solution and most foam concentrate.
4. UL 401 brass nozzle, adjustable from fog spray to straight stream to shutoff nozzle.
5. 360-degree horizontal rotation, with locking device.
6. 80-degree elevation and 60-degree depression vertical rotation with locking device.
7. Double or Single brass or stainless-steel tube waterway as per design requirements.
8. Waterway Size: DN 65 minimum.
9. Water Stream Flow: as per design requiremnts.
10. Operation: Lever ot Wheel.
11. Base Inlet Size: DN 65, DN 80, or DN 100 as per design requirements.
12. Finish: Red-painted body with brass trim.

B. Water-Powered Oscillating Monitors Assembly:

1. Source Limitations: Obtain Oscillator Base, Monitor, Nozzle and all related accessories from single manufacturer.
2. Unit Type: Stationary.
3. Standard: UL Listed /FM Approved.
4. Application: Suitable for use with water, AFFF Solution and most foam concentrate.
5. Oscillating Base Unit:

a. Operation: Automatic Water powered oscillation mechanism.
b. Construction: Stainless Steel 304 Grade main body and bearing with flanged connection, and oscillator housing.
c. Characteristics: Bronze automatic drain valve and easily accessible speed control valve, and oscillation-arc setting mechanism, with brass test connector and check valve.

6. Nozzle:

   a. Connection: DN 65,
   b. Construction: Corrosion proof brass with Built-in Grid as stream shaper for maximum reach and with heavy duty protective bumper
   c. Discharge Pattern: Constant flow, adjustable from fog spray to straight stream to shutoff.
   d. Application: Water/foam

7. Monitor: Automatic water Powered Oscillation as per the following:

   a. Horizontal Rotation: Minimum 120 degrees arc of oscillation with locking device.
   b. Vertical Rotation: Minimum 85 degrees (-20 degrees ,+65 degrees) with locking device unless otherwise indicated.
   c. Construction: Corrosion resistant brass or Stainless Steel with vanes at each elbow to reduce friction loss and improving the range of stream unless otherwise specified. Heavy duty stainless steel ball bearing at each swivel joint,
   d. Single tiller bar for manual positioning and control
   e. Waterway: Double or Single brass or stainless-steel tube as per design requirements.
   f. Requires no external wiring or Hydraulic control for operation.

8. Base Inlet Size: DN 65, DN 80, or DN 100 as per design requirements.
9. Inlet and Outlet End Connection: Flanged ANSI Class 150
10. Monitor Flow: As per design requirements.
11. Operating Inlet Pressure: between 2.8 Bar and 12 Bar Double reduction oil bath gearbox.
13. Finish: Red-painted body with brass trim.

1.6 INSTALLATION

A. Piping Applications:

1. AFFF-Concentrate Piping: Schedule 40 steel pipe.
   a. Do not use galvanized pipe or fittings.
   b. Do not use cast-iron fittings for dry piping that may be exposed to fire.

2. Foam-Concentrate Piping: Black-steel pipe; malleable- or cast-iron threaded fittings; and threaded joints.

   a. Do not use galvanized pipe or fittings.
   b. Do not use cast-iron fittings for dry piping that may be exposed to fire.

3. Foam-Solution Piping DN50 and Smaller: Galvanized-steel pipe; galvanized, malleable- or cast-iron threaded fittings; and threaded joints.

   a. Do not use cast-iron fittings for dry piping that may be exposed to fire.

4. Foam-Solution Piping DN65 to DN150 : Galvanized-steel pipe; galvanized, malleable- or cast-iron threaded fittings; and threaded joints.

   a. Do not use cast-iron fittings for dry piping that may be exposed to fire.

5. Foam-Solution Piping DN65 to DN150 : Galvanized-steel pipe, grooved-end fittings, keyed couplings, and grooved joints.
6. Foam-Solution Piping and Larger: Galvanized-steel pipe; galvanized, cast-iron threaded fittings; and threaded joints.

7. Foam-Solution Piping DN200 and Larger: Galvanized-steel pipe, grooved-end fittings, keyed couplings, and grooved joints.

B. Proportioning tanks filled with foam concentrate after field quality-control testing.

1.7 FIELD QUALITY CONTROL

A. Professional engineer to inspect and certify installation.

END OF SECTION 211339

SECTION 212200 - CLEAN-AGENT FIRE-EXTINGUISHING SYSTEMS

1.1 SUBMITTALS

A. Permit approved drawings, prepared according to NFPA 2001.

1.2 QUALITY ASSURANCE

A. Products and materials shall demonstrate compliance with the requirements specified in Section 016000 “Product Requirements.”

B. Comply with the applicable requirements and recommendations of local Saudi Building Code (SBC) and the latest applicable local regulations for materials, tests, installation, and identification, as listed in, but not limited to, the “Saudi Building Code”, SBC 201, 501 and “Saudi Fire Code” SBC 801, and the standards listed below in this section; whichever is more stringent.

C. FM Approved and NRTL-listed components.

D. Listing in UL's "Fire Protection Equipment Directory."

E. ASME Compliance: Fabricate piping to comply with ASME B31.1, "Power Piping."

F. NFPA Compliance: Fabricate and label clean-agent extinguishing systems to comply with NFPA 2001, "Clean Agent Fire Extinguishing Systems."

G. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of clean-agent extinguishing systems that are similar to those indicated for this Project in material, design, and extent.

1.3 PERFORMANCE REQUIREMENTS

A. Design clean-agent fire-extinguishing system and obtain approval from authorities having jurisdiction. Design system for Class A, Class B, or Class C fires as appropriate for areas being protected, and include safety factor. Use clean agent indicated and in concentration suitable for normally occupied areas.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

C. UL Compliance: Provide equipment components complying with UL 1058, "Halogenated Agent Extinguishing System Units," and are UL listed for clean-agent extinguishing system units in UL's "Fire Protection Equipment Directory."

D. Seismic Performance: Fire-suppression piping shall withstand the effects of earthquake motions determined in accordance with NFPA 13, ASCE/SEI 7 and SBC 201, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads.".

1.4 CLEAN AGENT SYSTEMS

A. Source Limitations: Obtain clean-agent systems from single source from single manufacturer.

B. Description: Clean-agent fire-extinguishing system shall be an engineered system for total flooding of the hazard area including the room cavity above the ceiling, below the ceiling, and below the raised floor. System includes separate zones above and below the ceiling and beneath the raised floor. If smoke is detected below the raised floor, extinguishing agent shall be discharged in the underfloor zone only. If smoke is detected below the ceiling, extinguishing agent shall be discharged in zones above and below the ceiling and below the floor. If smoke is detected above the ceiling, extinguishing agent shall be discharged in the zone above the ceiling only.

C. Performance Requirements:

1. Discharge IG-541 (INERGEN) within 60 seconds and maintain 38 percent concentration by volume at 21 deg C for 10-minute holding time in hazard areas. Minimum 15-MPa calculated working pressure upstream from orifice union, minimum 6895-kPa calculated working pressure downstream from orifice union, and 15-MPa initial charging pressure.

D. Detection: Cross zoned.

1.5 COMPONENTS

A. Extinguishing-Agent Containers: ASME-code steel tanks, with manifold for multiple storage containers and with reserve-supply storage containers.

B. Extinguishing Agent: IG-541.

C. Discharge Nozzles: Manufacturer’s standard one-piece brass or aluminum alloy.

D. A pressure relief vent shall be provided where required based on the enclosure test evaluation as per NFPA 2001 & FSSA guide to maintain pressure within specified enclosure pressure limit.

E. Fire Control Panels:

1. FM Approved or NRTL listed.
2. 120/240 V ac.
3. Enclosure: NEMA ICS, TYPE 1, enameled-steel cabinet.
4. Mounting: As shown on drawings.
5. Separate supervised circuits for each independent hazard area.
6. Automatic switchover to standby power.
7. Storage container, low-pressure indicator.
8. Service disconnect.
9. Control interface capability with Building Control System, if applicable, and Fire Alarm System for general alarm, control panel fault and cylinder low pressure

F. Annunciator Panel: Graphic type showing protected, hazard-area plans, and locations of detectors and abort, EPO, and manual stations.

G. Standby power.

H. Detection Devices:

1. NFPA 2001, NFPA 72, and UL 268.
2. 24 V dc, nominal.
3. Photoelectric detectors.

I. Manual Stations:

1. Surface or Semirecessed mounted with clear plastic hinged guard, FM approved or NRTL listed.

2. Manual release.
3. Abort switch.
4. EPO switch.

J. Switches, FM approved or NRTL listed:

1. Low-agent pressure switches.
2. Power transfer switches.
3. Abort switches.
4. Door closers.

K. Alarm Devices, FM approved or NRTL listed:

1. Bells.
2. Horns.
3. Strobe lights.

L. Oxygen Deficiency Monitor.

1.6 PIPING APPLICATIONS FOR 15-MPa CHARGING PRESSURE

A. Piping between Storage Containers and Orifice Union:

1. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
2. Fittings Working Pressure: 13.8 MPa minimum.
3. Flanged Joints: Class 600 minimum.
4. All Sizes: Black, Schedule 80, steel pipe; forged-steel welding fittings; and welded joints.

B. Piping Downstream from Orifice Union:

1. Flanged pipe and fittings and flanged joints may be used to connect to specialties and accessories and where required for maintenance.
2. Fittings Working Pressure: 6900 kPa minimum.
3. Flanged Joints: Class 300 minimum.
4. All Sizes: Black, Schedule 40 or 80, steel pipe; forged-steel welding fittings; and welded joints.

1.7 FIELD QUALITY CONTROL

A. Professional Engineer: Inspect installed clean-agent extinguishing systems, prepare installation report, and certify that installation complies with the Contract Documents and calculations, and comments of authorities having jurisdiction.

B. Testing: By Contractor engaged.

END OF SECTION 212200

SECTION 213113 - ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS

1.1 QUALITY ASSURANCE

A. Product and equipment shall demonstrate compliance with requirements specified in Section 016000 “Product Requirements.”

B. Comply with the applicable requirements and recommendations of local Saudi Building Code (SBC) and the latest applicable local regulations for materials, tests, installation, and identification, as listed in, but not limited to, the “Saudi Fire Code”, SBC 801, and the standards listed below in this section; whichever is more stringent.

C. Manufacturer Qualifications: Firms whose fire pumps, pressure-maintenance pumps, drivers, controllers, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with requirements indicated.

D. Source Limitations: Obtain fire-pump and pressure-maintenance-pump units through one source with responsibility and accountability to respond to and resolve problems regarding compatibility, installation, performance, and acceptance of units.

E. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.

F. Comply with standards of authorities having jurisdiction pertaining to materials, hose threads, and installation.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working-Pressure Rating: 1200 kPa.

B. Quality Standards: NFPA 20 and NFPA 70.

C. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7, and SBC 201.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 PRODUCTS

A. Horizontally Mounted, Single-Stage, Split-Case Fire Pumps:

1. Standard: UL 448, factory-assembled and –tested as a one package in country of origin (UL listed & FM approved).
2. Casing: Axially split case, cast iron.
3. Impeller: Cast bronze.
4. Wear Rings: Replaceable bronze.
5. Shaft and Sleeve: Stainless steel shaft with bronze sleeve.
6. Shaft Bearings: Grease-lubricated ball bearings in cast iron housing.

7. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
8. Mounting: Pump and driver on same base, with horizontal shafts.
9. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment, with metal guard.
10. Inlet Flange: ASME B16.1, Class 125 or Class 250 as required.
11. Outlet Flange: ASME B16.1, Class 125 or Class 250 as required.
12. Driver:

    a. Standard: UL 1004-5.
    b. Type: Electric motor; NEMA MG 1, polyphase Design B, totally enclosed, fan cooled, squirrel-cage, induction motor. Motor shall comply with Division 21 Section “Common Motor Requirements for Fire Suppression Equipment”. Include construction complying with NFPA 20 and NFPA 70, and include wiring compatible with controller used.
    c. Finish: Manufacturer's standard red paint applied to factory-assembled and -tested unit before shipping.

13. Volts: 400 V.
14. Phase: Three.
15. Frequency 60 Hz

B. Horizontally Mounted, Multistage, Split-Case Fire Pumps:

1. Standard: UL 448.
2. Number of Stages: Two.
3. Casing: Axially split case, cast iron.
4. Impeller: Cast bronze.
5. Wear Rings: Replaceable bronze.
6. Shaft and Sleeve: Stainless steel shaft with bronze sleeve.
7. Shaft Bearings: Grease-lubricated ball bearings in cast iron housing.
8. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
9. Mounting: Pump and driver on same base, with horizontal shafts.
10. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment, with metal guard.
11. Inlet Flange: ASME B16.1, Class 125 or Class 250 as required.
12. Outlet Flange: ASME B16.1, Class 125 or Class 250 as required.
13. Driver:

    a. Standard: UL 1004-5.
    b. Type: Electric motor; NEMA MG 1, polyphase Design B, totally enclosed, fan cooled, squirrel-cage, induction motor. Motor shall comply with Division 21 Section “Common Motor Requirements for Fire Suppression Equipment”. Include construction complying with NFPA 20 and NFPA 70, and include wiring compatible with controller used.
    c. Finish: Manufacturer's standard red paint applied to factory-assembled and -tested unit before shipping.

14. Volts: 400 V.
15. Phase: Three.
16. Frequency 60 Hz

C. Fire Pump Controllers:

1. General: Combined automatic and nonautomatic operation; factory assembled and wired; factory tested for capacities and electrical characteristics; and with the following features:

a. Enclosure: UL 50, Type 12, water proof, indoor, unless special-purpose enclosure is indicated.
b. Controls, devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used, and specific items listed for each controller type.
c. Nameplate: Complete with capacity, characteristics, approvals and listings, and other pertinent data.
d. Controller Sensing Pipes: Fabricate pipe and fittings according to NFPA 20 with nonferrous-metal sensing piping, DN15, with globe valves for testing controller mechanism from system to pump controller as indicated. Include bronze check valve with 2.4-mm orifice in clapper or ground-face union with noncorrosive diaphragm having 2.4-mm orifice.

2. Description: UL 218 and NFPA 20; listed for electric-drive, fire-pump service.
3. Motor Starting: Reduced-voltage soft starter or auto transformer type as per manufacturer's recommendation, unless otherwise specified or shown on the Drawings.
4. Surge arresters in compliance with IEEE C62.1 or IEEE C62.11 and shall be installed in common mode to eliminate overvoltage between each phase and earth. As an alternative, the controller shall withstand without any damage 10 kV impulse in accordance with IEEE C62.41 or ANSI/UL 1449.
5. Pressure-switch actuated control.

a. Water-pressure-actuated switch and pressure transducer with independent high- and low-calibrated adjustments responsive to water pressure in fire-suppression piping.
b. System pressure recorder, electric ac driven, with spring backup.

6. Emergency Start: Mechanically operated start handle that closes and retains the motor RUN contactor independent of all electric or pressure actuators.
7. Method of Stopping: Nonautomatic.
8. Rate controllers for scheduled horsepower. Include short-circuit withstand rating at least equal to short-circuit current available at controller location. Take into account cable size and distance from substation or supply transformers.
9. Interlocked isolating switch and MCCB (Molded-case circuit breaker); with a common, externally mounted operating handle, and providing locked-rotor protection, complying with NFPA 20 requirements.
10. Door-Mounted Operator Interface and Controls: Monitor, display, and control the devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used

a. Include audible alarm, with silence push button.
b. Include nonautomatic START and STOP push buttons or switches.

11. Automatic Transfer Switches:

a. Complies with NFPA 20, UL 218, UL 1008 and FM approved.
b. Integral with controller as a listed combination fire-pump controller and power transfer switch and shall be housed in a barriered compartment of the fire pump controller or in a separate enclosure attached to the controller and marked "Fire Pump Power Transfer Switch".
c. Automatically transfers fire-pump controller from normal power supply to alternate power supply in event of power failure and retransfers to normal power supply upon return of power supply with a time delay till the normal source is stabilized, unless the alternate source fails.
d. Electrically operated and mechanically held.
e. Allows manual transfer from one source to the other.
f. Local and Remote Alarm and Status Indications:

1) Normal source available.
2) Alternate source available.

3) In normal position.
4) In alternate position.
5) Isolating means open.

g. Audible alarm, with silence push button.
h. Nonautomatic (manual, nonelectric) means of transfer.
i. Engine test push button.
j. Start generator output contacts.
k. Timer for weekly generator tests.

D. Fire-Pump Accessories and Specialties:

1. Match fire-pump suction and discharge ratings as required for fire-pump capacity rating, and complying with NFPA-20 requirements.
2. Automatic air-release valves complying with NFPA 20 for installation.
3. Circulation Relief Valves: UL 1478, Brass.
4. Relief Valves: UL 1478, Bronze or cast iron.
5. Suction and discharge gages
6. Inlet Fitting: Eccentric tapered reducer.
7. Outlet Fitting: Concentric tapered reducer.
8. Discharge Cone: Closed or open type.

E. Alarm Panels: Factory-assembled and -wired remote panel complying with UL 508 and requirements in NFPA 20. Include audible and visible alarms matching controller type

1. Enclosure: NEMA 250, Type 2, remote wall-mounting type with manufacturer's standard red paint.
2. Features: Include manufacturer's standard features and the following:

a. Motor-operating condition.
b. Loss-of-line power.
c. Phase reversal.

F. Flowmeter Systems: UL listed or FM Approved able to indicate flow to not less than 175 percent of fire-pump rated capacity.

1. Pressure Rating: 1200 kPa minimum.
2. Sensor: Annubar probe, orifice plate, or venturi.
3. Permanently mounted, compatible with flow sensor.

1.4 SOURCE QUALITY CONTROL

A. Factory Testing: Hydraulically test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."

1. Test at 150 percent of shutoff head plus suction head, but not less than 1725 kPa. Produce certified test curves and inspection reports showing head capacity and brake horsepower of each pump.
2. Verification of Performance: Rate fire pumps according to UL 448.

END OF SECTION 213113

SECTION 213413 - PRESSURE-MAINTENANCE PUMPS

1.1 QUALITY ASSURANCE

A. Product and equipment shall demonstrate compliance with requirements specified in Section 016000 “Product Requirements.

B. Comply with the applicable requirements and recommendations of local Saudi Building Code (SBC) and the latest applicable local regulations for materials, tests, installation, and identification, as listed in, but not limited to, the “Saudi Fire Code”, SBC 801, and the standards listed below in this section; whichever is more stringent.

C. Manufacturer Qualifications: Firms whose fire pumps, pressure-maintenance pumps, drivers, controllers, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Fire Protection Approval Guide" and that comply with requirements indicated.

D. Source Limitations: Obtain fire-pump and pressure-maintenance-pump units through one source with responsibility and accountability to respond to and resolve problems regarding compatibility, installation, performance, and acceptance of units.

E. Provide listing/approval stamp, label, or other marking on equipment made to specified standards.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Comply with standards of authorities having jurisdiction pertaining to materials, hose threads, and installation.

H. Comply with NFPA 20, "Installation of Stationary Pumps for Fire Protection," for pressure maintenance pumps, drivers, controllers, accessories, and installation.

1.2 PERFORMANCE REQUIREMENTS

A. Fire-Pump Systems: Fire-pump and pressure-maintenance-pump units that comply with performance requirements specified and are compatible with building fire-suppression systems.

B. Controller shall comply with UL 508 factory assembled, wired, and tested across-the-line for combined automatic and manual operation

C. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig (1200 kPa) minimum unless higher pressure rating is indicated.

D. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7, and SBC 201.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 VERTICAL, MULTISTAGE, PRESSURE-MAINTENANCE PUMPS

A. Factory-assembled and -tested multistage, barrel-type vertical pump as defined in HI 2.1-2.2 and HI 2.3; for surface installation with pump and motor direct coupled and mounted vertically.

B. Pump Construction:

1. Barrel: Stainless steel.
2. Suction and Discharge Chamber: Cast iron with flanged inlet and outlet.
3. Pump Head/Motor Mount: Cast iron.
4. Impellers: Stainless steel, balanced, and keyed to shaft.
5. Pump Shaft: Stainless steel.
6. Seal: Mechanical type with carbon rotating face and silicon-carbide stationary seat.
7. Wear Rings: Teflon.
8. Intermediate Chamber Bearings: Aluminum-oxide ceramic or bronze.
9. Chamber-Base Bearing: Tungsten carbide.
10. O-Rings: EPDM or NBR.

C. Motor: Single speed with permanently lubricated ball bearings and rigidly mounted to pump head.

D. Power Cord: Factory-connected to motor for field connection to controller, at least3 m long.

E. Working Pressure: 1200 kPa minimum.

1.4 CONTROLLERS FOR PRESSURE-MAINTENANCE PUMPS

A. General Requirements for Pressure-Maintenance-Pump Controllers:

1. Type: UL 508 factory assembled, -wired, and tested, across-the-line; for combined automatic and manual operation.
2. Enclosure: UL 508 and NEMA 250, Type 12 for wall-mounting.
3. Factory assembled, wired, and tested.
4. Finish: Manufacturer's standard color paint.

B. Rate controller for scheduled horsepower and include the following:

1. Fusible disconnect switch.
2. Pressure switch.
3. Hand-off-auto selector switch.
4. Pilot light.
5. Running period timer.

1.5 PRESSURE-MAINTENANCE-PUMP SPECIALTIES AND ACCESSORIES

A. Match pressure-maintenance-pump suction and discharge ratings as required for pump capacity rating. Include the following:

1. Circulation relief valve.
2. Suction and discharge pressure gages.

END OF SECTION 213413