# Engineering Technical Specification

| | |
|---|---|
| **Document Number/Ref** | Engineering Technical Specification |
| **Revision** | 04 |
| **Altek Project Number** | 2404-ALTAL |
| **Contract/PO Number** | PO5273979_0 |
| **Altek Product** | Alusalt |

| Revision | Date | Document Status | Reason for Issue | Prepared | Checked | Approved |
|---|---|---|---|---|---|---|
| 01 | 2024-12-17 | Working Document | For Information | | | |
| 02 | 2025-03-05 | Working Document | For Information | JAK | MB | |
| 03 | 2025-03-07 | Working Document | For Information | SG | SG | |
| 04 | 2025-04-02 | Working Document | For Information | MB | JAK | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

**Altek Europe Limited**
Lakeside House, Turnoaks Business Park, Burley Close,
Chesterfield, Derbyshire, S40 2UB
Tel: +44 (0) 1246 38 37 37
www.altek-al.com
Company Registration No: 6264798

## DOCUMENT REVISION HISTORY TRACKING RECORD

| Revision | Page(s) | Section | Comments |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

DOCUMENT **TEMPLATE** REVISION HISTORY

| Revision | Date | Editor | Checked | Approved | Reason for Revision |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

## TABLE OF CONTENTS


1. INTRODUCTION ..... 5

**PURPOSE** ..... **5**

**SCOPE** ..... **5**

2. STAKEHOLDERS ..... 5

**PROJECT TEAM** ..... **5**

3. GENERIC DESIGN REQUIREMENTS ..... 5

**ELECTRICAL** ..... **5**

**MECHANICAL** ..... **6**

4. TECHNICAL CODE REQUIREMENTS ..... 7

**FUEL GAS CODE** ..... **7**

**MECHANICAL CODE** ..... **7**

**BOILER AND PRESSURE VESSEL CODE** ..... **7**

**FIRE CODE** ..... **7**

**ELECTRIC CODE** ..... **8**

**BUILDING CODE** ..... **8**

**PLUMBING CODE** ..... **8**

5. TECHNICAL STANDARDS ..... 9

**ELECTRICAL** ..... **9**

**MECHANICAL** ..... **14**

6. VENDORS ..... 26

**ELECTRICAL** ..... **26**

**MECHANICAL** ..... **26**

**QUALITY AND CERTIFICATIONS** ..... **27**

**DOCUMENTATION** ..... **27**

**SUPPORT AND TRAINING** ..... **27**

**ALTEK ENGINEERING TECHNICAL SPECIFICATION** ..... **27**

# 1. Introduction

The information outlined in this document describes the technical information for the Alusalt 2404 Project.

**Purpose**

- Define Technical Specifications Altek will be required to use for the Alusalt-2404 project.

**Scope**

- Identifying specific Technical Specifications for regional and nation U.S codes and regulations. Highlighting specific detail Altek must take into consideration.

# 2. Stakeholders

**Project Team**

- Samuel Gummer – Engineering Manager
- James Kerrigher – Mechanical Engineer
- Michael Buchanan – Electrical and Electronics Engineer

# 3. Generic Design Requirements

**Electrical**

- 1 Common central PLC and 3 separate line PLC's.
- MCC Panel designs are fixed type design unless stated otherwise.
- Ethernet IP for software communication.
- Allen-Bradley PLC and switchgear where possible.
- Electrical drawings will be carried out in EPLAN or relevant electrical CAD software.
- 3-Phase 480V, 60Hz, single phase 120V 60Hz and 24V DC (USA Electrical Specifications).
- UPS system and diesel generator for backup power to be included.
- Minimum IP66/NEMA 4 (fine dust protection) enclosures are required for in field.
- Minimum IP55/NEMA 12 enclosures required within MCC room.

## Mechanical

Equipment Layout

- Optimize the layout for accessibility, safety, and maintenance.
- Ensure adequate space for operation and future expansion.
- Meet all regulatory and customer-specific layout requirements.

Structural Integrity

- Design structures to support all equipment and loads.
- Include provisions for dynamic loads and vibrations.
- Ensure compliance with relevant structural codes and standards.

Piping Systems

- Design piping for efficient flow and minimal pressure drop.
- Ensure proper support and flexibility to accommodate thermal expansion.
- Adhere to regulatory and customer-specific piping standards.

Other

- All 2D drawings to have dual metric and imperial dimensions.

## 4. Technical Code Requirements

### Fuel Gas Code

- Code: 2014 Indiana Fuel Gas Code (International Fuel Gas Code, 2012 Edition, second printing)
- ASME CSD-1—2009 Controls and Safety Devices for Automatically Fired Boilers
- "CSA S-1.3— (1995) Pressure Relief Device Standards—Part 3—Stationary Storage Containers for Compressed Gases"
- Referenced Standards
    - NFPA 37—10 Installation and Use of Stationary Combustion Engines and Gas Turbines
    - NFPA 85—11 Boiler and Combustion Systems Hazards Code
    - ASME B31.3—04 Process Piping

### Mechanical Code

- Code: 2014 Indiana Mechanical Code (International Mechanical Code, 2012 Edition, First Printing)
- Referenced Standards:
- NFPA 91—2010 Exhaust Systems for Air Conveying of Vapors, Gases, and Non-combustible Particulate Solids
- SMACNA/ANSI—2005 HVAC Duct Construction Standards-Metal and Flexible (2005)

### Boiler and Pressure Vessel Code

- Code
    - American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME B&PVC), 2019 edition
    - American Petroleum Institute - American Society of Mechanical Engineers Code for Unfired Pressure Vessels, 1951 edition,
    - National Board Inspection Code (NBIC) Parts 1, 2, 3, and 4, also known as the American National Standards Institute's (ANSI) NB-23 standard, 2019 edition.
    - American Petroleum Institute (API) Standard 510 Pressure Vessel Inspection Code, Tenth Edition
    - American Petroleum Institute API 579/ASME FFS-1 Fitness for Service Code, Second Edition

### Fire Code

- Code: 2014 Indiana Fire Code (International Fire Code, 2012 Edition, first printing)
- Referenced Standards:
    - NFPA 13—2010 Installation of Sprinkler Systems
    - NFPA 30—2012 Flammable and Combustible Liquids Code
    - NFPA 55—2010 Standard for the Storage, Use and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationery Containers Cylinders and Tanks
    - NFPA 72—2010 National Fire Alarm Code
    - "NFPA 85—2011 Boiler and Combustion System Hazards Code "
    - 
    - NFPA 654—06 Prevention of Fire and Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids
    - UL 142—2006 Steel Aboveground Tanks for Flammable and Combustible Liquids
    - "NEMA 250—2003 Enclosures for Electrical Equipment (1,000 Volt Maximum) "
    - API Std 2000— (1998) Venting Atmosphere and Low-pressure Storage Tanks: Nonrefrigerated and Refrigerated
    - ASME B31.1—2007 Power Piping with B31.1a—2008 Addenda

**Electric Code**

- Code: Indiana Electrical Code, 2009 Edition (National Electrical Code, 2008 Edition)
- Referenced Standards:
  - UL 508A Standard for Industrial Control Panels
  - NFPA 79 – Electrical Standard for Industrial Machinery

**Building Code**

- Code: 2014 Indiana Building Code (International Building Code, 2012 Edition, first printing)
- Referenced Standards
  - ANSI/AISC 341—2010 Seismic Provisions for Structural Steel Buildings
  - ANSI/AISC 360—2010 Specification for Structural Steel Buildings
  - AISI S100—07/S2—2010 North American Specification for the Design of Cold-formed Steel Structural Members, with Supplement 2, dated 2010.
  - ANSI A13.1—96 Scheme for the Identification of Piping Systems
  - ASCE 7—10 Minimum Design Loads for Buildings and Other Structures

**Plumbing Code**

- Code: Indiana Plumbing Code 2012 (International Plumbing Code, 2006 edition, second printing)

## 5. Technical Standards

### Electrical

**The following standards shall be incorporated into the design basis of equipment, process, supporting mechanical/electrical equipment and appurtenances, and structures. Where in conflict with governing codes, statues, regulations, or updated standards the stricter requirements shall apply.**

**National Electrical Code - NFPA 70 – Standard for electrical installations in premises and buildings in USA**

- **Scope:** The NEC covers the installation of electrical conductors, equipment, and raceways; signalling and communications conductors, equipment, and raceways; and optical fibre cables and raceways for public and private premises, including buildings, structures, mobile homes, recreational vehicles, and floating buildings.
- **Safety Requirements:** Establishes the minimum safety requirements for electrical installations to protect people and property from electrical hazards. This includes guidelines for wiring methods, grounding, overcurrent protection, and the installation of electrical equipment.
- **Adoption and Enforcement:** While the NEC itself is not a law, it is commonly mandated by state or local law. The "authority having jurisdiction" (AHJ) inspects for compliance with these minimum standards.
- **Updates and Revisions:** The NEC is revised every three years to incorporate the latest in technology and safety practices. The revision process involves public proposals and comments, ensuring that the code reflects current best practices and technological advancements.

**UL 508 - Standard of Safety for Industrial Control Equipment.**

- **Scope and Purpose:** UL 508 covers the safety requirements for industrial control panels and related equipment, ensuring they meet specific performance and safety standards.
- **Types of Equipment:** The standard applies to various types of control equipment, including motor controllers, overload relays, and disconnect switches.
- **Testing and Certification:** It includes guidelines for testing and certifying control panels to ensure they can safely operate under specified conditions.
- **Updates and Revisions:** The latest edition of UL 508 includes updates to address new technologies and industry practices, ensuring the standard remains relevant and effective.

**UL508A – Critical standard for designing industrial control panels.**

- **Scope:** Applies to industrial control panels operating at a supply voltage of 1,000 volts or less. Covers panels used in general industrial applications, excluding specific types like panel boards, access control, and fire protection signalling.
- **Component Selection:** Specifies requirements for selecting components to ensure they meet safety standards. Includes guidelines for overcurrent protection, wiring, and grounding.
- **Panel Design and Construction:** Provides criteria for the layout and spacing of components within the control panel. Ensures that panels are designed to prevent electrical hazards and facilitate safe operation.
- **Labelling and Documentation:** Requires proper labelling of control panels with information such as full-load current, voltage ratings, and safety warnings. Emphasizes the importance of maintaining accurate documentation for compliance and safety.

**National Electrical Code - NFPA 70E – Standard for electrical safety in the workplace**

- **Scope:** NFPA 70E covers electrical safety requirements for employees in the workplace.
- Hazard Identification and Risk Assessment: Requires conducting thorough hazard identification and risk assessments to evaluate potential electrical hazards and implement appropriate control measures.
- **Safe Work Practices:** Outlines safe work practices to be followed when working on or near electrical equipment. This includes procedures for de-energizing equipment, lockout/tagout (LOTO) protocols, and establishing electrically safe work conditions.
- **Personal Protective Equipment (PPE):** Specifies the selection, use, and maintenance of personal protective equipment, such as arc-rated clothing, gloves, and face shields, to protect workers from electrical hazards.
- **Arc Flash Hazard Analysis:** Provides guidelines for conducting arc flash hazard analyses to determine the potential energy levels of arc flashes and establish appropriate protective measures.

**National Electrical Code - NFPA 79 – Electrical Standard for Industrial Machinery**

- **Scope and Application:** Applies to the electrical/electronic equipment, apparatus, or systems of industrial machines operating at a supply voltage of 1,000 volts or less.
- **Electrical System Design:** Provides detailed guidelines on the design of electrical systems, including the selection of components, wiring layout, and integration of control systems. Ensures that electrical systems are both safe and efficient.
- **Wiring and Protection:** Specifies requirements for proper wiring methods, grounding, and overcurrent protection. Includes guidelines for the use of conductors, cables, and protective devices to prevent electrical hazards.
- **Control Circuits and Control Functions:** Covers the design and installation of control circuits and control functions to ensure safe operation of machinery. Addresses emergency stop functions, interlocks, and control devices.
- **Operator Interface and Control Devices:** Provides requirements for the design and placement of operator interface devices, such as push buttons, switches, and indicators. Ensures that these devices are easily accessible and clearly marked for safe operation.
- **Enclosures and Environmental Considerations:** Specifies requirements for enclosures to protect electrical equipment from environmental factors such as dust, moisture, and temperature. Includes guidelines for the selection of enclosures based on the operating environment.
- **Maintenance and Documentation:** Emphasizes the importance of regular maintenance and inspection of electrical systems to ensure ongoing safety and compliance. Requires proper documentation of electrical designs, modifications, and maintenance activities.

**UL845 – Low voltage motor control centres**

- **Scope:** Applies to motor control centres used in accordance with the U.S. National Electrical Code (NEC), ANSI/NFPA 70. Covers MCCs for circuits with available short-circuit currents up to 200,000 A rms symmetrical or 200,000 A dc. Applies to single- and three-phase MCCs operating at 50 and 60 Hz, and dc MCCs rated up to 1,000 V ac or dc.
- **Construction and Design:** Provides guidelines for the construction and design of MCCs to ensure safety and reliability. This includes requirements for enclosures, wiring, and spacing of components.
- **Testing and Certification:** Requires MCCs to undergo rigorous testing to ensure they meet safety and performance standards. This includes short-circuit testing, temperature rise testing, and dielectric voltage-withstand testing.

**IEC 62443 Security for industrial automation and control systems (cybersecurity)**

- **Scope and Purpose**: The standards address cybersecurity for operational technology (OT) in automation and control systems, aiming to protect these systems from cyber threat.

**Structure and Key Parts**:

- **IEC 62443-1-1**: Terminology, concepts, and models.
- **IEC 62443-2-1**: Establishing an industrial automation and control systems security program.
- **IEC 62443-3-3**: System security requirements and security levels.
- **IEC 62443-4-1**: Secure product development lifecycle requirements.
- **IEC 62443-4-2**: Technical security requirements for IACS components
- **Industry Application:** Applicable across various industries, including manufacturing, energy, water, transportation, and healthcare, ensuring that IACS are secure throughout their lifecycle.
- **Collaboration:** Developed in collaboration with the International Society of Automation (ISA), ensuring global relevance and adoption.

**NEMA 250 - Enclosures for Electrical Equipment (1000 V Maximum)**

- **Scope and Purpose:** NEMA 250 provides guidelines for the construction, testing, and performance of enclosures to ensure they protect electrical equipment from environmental hazards.
- **Enclosure Types**: The standard defines various types of enclosures, each designed to protect against specific environmental conditions. For example:
    - Type 1: Indoor use, protection against falling dirt.
    - Type 3: Indoor or outdoor use, protection against windblown dust, rain, sleet, and snow.
    - Type 4: Indoor or outdoor use, protection against splashing water, hose-directed water, and corrosion
- **Testing and Performance:** It includes requirements for testing enclosures to ensure they meet specified protection levels, such as resistance to water ingress and corrosion.
- **Applications:** Common applications include enclosures for industrial control panels, switchgear, and other electrical equipment used in various environments.

**NEMA MG-1 - Motors and Generators**

- **Scope and Purpose**: NEMA MG-1 covers both AC and DC motors and generators, providing detailed information on their construction, testing, performance, and efficiency.
- **Efficiency Standards**: It includes requirements for motor efficiency, aligning with U.S. Department of Energy regulations. Most single-speed induction motors from 1 to 500 hp must meet premium efficiency levels.
- **Performance and Testing:** The standard outlines procedures for efficiency and temperature rise testing, as well as performance characteristics and tolerances.
- **Safety and Construction**: It addresses safety aspects, including grounding means for field wiring and protection degrees for motor enclosures.
- **Applications:** Common applications include motors used in manufacturing plants, oil field exploration, heating and air conditioning systems, and water and fire protection pumping systems.

**IEEE 142: Recommended Practice for Grounding of Industrial and Commercial Power Systems.**

- **System Grounding:** It covers the grounding of various system components, including the neutral, the corner of the delta, and the midtap of one phase. It discusses the advantages and disadvantages of grounded versus ungrounded systems.
- **Equipment Grounding:** The standard provides recommendations for grounding the frames and enclosures of electrical apparatus such as motors, switchgear, transformers, buses, cables, conduits, building frames, and portable equipment.
- **Static Electricity:** It addresses the generation of static electricity, the processes that may produce it, how it is measured, and methods to prevent its generation or to safely discharge static charges to earth.
- **Lightning Protection:** Methods for protecting structures against the effects of lightning are included, emphasizing obtaining a low-resistance connection to earth.
- **Sensitive Electronic Equipment:** A separate chapter is dedicated to grounding practices for sensitive electronic equipment, ensuring their protection and proper operation.

**IEEE 519: Recommended Practices and Requirements for Harmonic Control in Electric Power Systems.**

- **Scope and Purpose:** IEEE 519 sets limits on voltage and current harmonic distortion to ensure the reliable operation of electrical systems and prevent equipment malfunction.
- **Harmonic Limits:** The standard specifies acceptable levels of harmonic distortion at the point of common coupling (PCC), where the utility connects to the user's electrical system. It includes limits for both individual harmonics and total harmonic distortion (THD).
- **Measurement and Evaluation:** It outlines methods for measuring harmonic distortion and provides statistical techniques for evaluating compliance.
- **Recent Updates:** The latest edition, IEEE 519-2022, introduces changes such as guidelines for installations with mixed loads and inverter-based resources (IBR/DER), and updated limits for even current harmonics.

**IEEE 1584-2004 IEEE Guide for Performing Arc-Flash Calculations.**

- **Purpose and Scope:** The standard aims to improve safety by providing a method to calculate the potential energy released during an arc flash, helping to determine appropriate protective measures.
- **Calculation Method:** It includes a detailed procedure for calculating incident energy and arc flash boundaries. This involves determining system parameters, fault currents, and protective device characteristics.
- **Arc Flash Hazard Analysis:** The guide outlines steps for conducting an arc flash hazard analysis, including collecting system data, calculating fault currents, and determining the duration of arcs.
- **Protective Measures:** Recommendations for personal protective equipment (PPE) and other safety measures based on the calculated incident energy levels are provided.

## Mechanical

**The following standards shall be incorporated into the design basis of equipment, process, supporting mechanical/electrical equipment and appurtenances, and structures. Where in conflict with governing codes, statues, regulations, or updated standards the stricter requirements shall apply.**

**ANSI/ISA-20**

- **Risk Assessment and Reduction -** Assess potential risks associated with instrumentation systems, including operational and environmental hazards. Implement strategies to reduce identified risks, such as using fail-safe mechanisms and redundancy. Conduct periodic reviews to update risk assessments and mitigation measures.
- **Applicability -** Applicable to the specification and communication of process measurement and control instruments. Suitable for various industries, including manufacturing, chemical processing, and energy. Ensure all instrumentation practices comply with ANSI/ISA-20 and other relevant standards.
- **Responsibilities -** Responsible for creating detailed specifications for instrumentation systems. Ensure proper installation and configuration of instrumentation systems according to guidelines. Regularly inspect and maintain instrumentation systems to ensure accurate performance.
- **Safety Measures -** Use appropriate protective equipment to safeguard personnel during installation and maintenance. Establish and follow safety protocols to prevent accidents and injuries. Develop and implement emergency procedures for dealing with instrumentation system failures.
- **Documentation and Verification -** Maintain detailed documentation of instrumentation specifications, installation procedures, and maintenance records. Implement verification processes to ensure instrumentation systems are functioning correctly. Keep records of compliance with ANSI/ISA-20 and other relevant standards.

**ANSI B11.0-2023 - Safety of Machinery**

- **Risk Assessment and Reduction:** The standard outlines procedures for identifying hazards, estimating, and evaluating risks, and implementing measures to reduce these risks throughout the machinery lifecycle.
- **Applicability:** It applies to new, existing, modified, or rebuilt power-driven machines used in various processes such as cutting, forming, and thermal techniques, as well as associated equipment for material handling and inspection.
- **Responsibilities:** Clarifies the responsibilities of machinery suppliers, users, modifiers, and purchasers of used machinery. It also introduces the concept of co-manufacturers and their associated responsibilities.
- **Safety Measures:** Provides detailed requirements for safeguarding, including provisions for whole-body access, remote operations, and radiation hazards.
- **Documentation and Verification:** Offers guidance on the necessary documentation and verification processes to ensure compliance with safety requirements.

**ASCE/SEI 7-2022 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures**

- **Design Loads:** The standard prescribes design loads for various hazards, including dead, live, soil, flood, tsunami, snow, rain, atmospheric ice, seismic, wind, and fire. It also provides guidance on evaluating load combinations.
- **Tornado-Resistant Design:** For the first time, the 2022 edition includes criteria for tornado-resistant design, reflecting new research and the increasing importance of designing for extreme weather events.
- **Digital Data:** The standard now requires the use of digital data uniquely identified in hazard-specific geodatabases for all environmental hazards. This data is available via open access from the ASCE 7 Hazard Tool.
- **Updated Criteria:** The 2022 edition includes substantial improvements to the design criteria for atmospheric icing, earthquake, tsunami, rain, snow, and wind. It also introduces new models for more accurate snow loads and a new multipoint seismic spectrum for certain soft-soil sites.
- **Collaboration and Updates:** The standard is updated every six years by hundreds of volunteer professionals, incorporating new engineering research, evolving construction techniques, and changing societal expectations.

**ASME PTC 19.5 – guidelines for flow measurement**

- **Risk Assessment and Reduction -** Assess potential hazards associated with flow measurement devices and processes. Implement strategies to reduce identified risks, such as using appropriate safety devices and procedures. Conduct regular risk assessments and update mitigation measures as necessary.
- **Applicability -** Applicable to various flow measurement devices and techniques used in industrial processes. Ensure all flow measurement practices comply with ASME PTC 19.5 and other relevant standards. Suitable for use in industries such as power generation, chemical processing, and oil and gas.
- **Responsibilities –** Design Engineers responsible for selecting appropriate flow measurement devices and ensuring they meet design specifications. Ensure proper installation of flow measurement devices according to guidelines. Regularly inspect and maintain flow measurement devices to ensure accurate performance.
- **Safety Measures -** Use appropriate protective equipment to safeguard personnel during installation and maintenance. Establish and follow safety protocols to prevent accidents and injuries. Develop and implement emergency procedures for dealing with flow measurement device failures.
- **Documentation and Verification -** Maintain detailed documentation of flow measurement device specifications, installation procedures, and maintenance records. Implement verification processes to ensure flow measurement devices are functioning correctly. Keep records of compliance with ASME PTC 19.5 and other relevant standards.

**ASME B16.5-2020 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24, Metric/Inch Standard**

- **Pressure**-Temperature Ratings: Specifies the maximum allowable working pressures for different materials and grades at various temperatures.
- **Materials:** Covers the materials used for manufacturing flanges and flanged fittings, including cast, forged, and plate materials.
- **Dimensions and Tolerances:** Provides detailed dimensions and tolerances for flanges and flanged fittings to ensure proper fit and function.
- **Marking and Testing:** Outlines the requirements for marking flanges and fittings, as well as the necessary testing procedures to verify compliance.
- Designating Openings: Describes the methods for designating openings in flanges and fittings.
- Flange Bolting, Gaskets, and Joints: Includes requirements and recommendations for flange bolting, gaskets, and the assembly of flange joints.

**ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves**

- **Scope:** ASME B16.10 specifies the face-to-face and end-to-end dimensions of valves to ensure compatibility and interchangeability within piping systems. This standard is crucial for maintaining uniformity across valves produced by different manufacturers, facilitating easier installation, maintenance, and replacement.
- **Risk Assessment and Reduction** - The standard helps mitigate risks associated with valve installation and operation by providing precise dimensions that ensure proper fit and function within piping systems. Risk Reduction, by standardizing dimensions, ASME B16.10 reduces the risk of mismatched components, which can lead to leaks, system failures, and safety hazards.
- **Applicability** - ASME B16.10 applies to a variety of valve types, including gate, globe, plug, ball, check, and butterfly valves. It covers valves with flanged and butt-welded ends. The standard is relevant to industries such as oil and gas, chemical processing, power generation, and water treatment, where precise valve dimensions are critical for system integrity.
- **Responsibilities** – Manufacturers are responsible for producing valves that conform to the specified dimensions, ensuring compatibility and interchangeability. Engineers and Designers must select and specify valves that meet ASME B16.10 requirements to ensure proper fit and function within piping systems. Installers and Inspectors: Required to verify that installed valves comply with the standard to maintain system safety and reliability.
- **Safety Measures** - The standard provides detailed dimensions for various valve types, ensuring that they can be safely integrated into piping systems without modifications. Inspection and Testing, ensures that valves meet the specified dimensions through rigorous inspection and testing procedures, reducing the risk of installation errors and system failures.
- **Documentation and Verification -** Manufacturers must maintain detailed records of valve dimensions and compliance with ASME B16.10 to ensure traceability and accountability. Regular audits and inspections are necessary to verify that valves conform to the standard, ensuring ongoing compliance and system integrity.

**ASME B16.34 - Valves**

- **Risk Assessment and Reduction** - Evaluates potential risks associated with valve operation, including pressure, temperature, and fluid compatibility. Specifies materials and manufacturing processes to enhance valve durability and reliability, reducing leaks and failures.
- **Applicability** - Applies to flanged, threaded, and welding-end valves, including cast, forged, and fabricated types. Covers pressure-temperature ratings, dimensions, tolerances, and materials. Relevant to oil and gas, chemical processing, power generation, and water treatment industries.
- **Responsibilities** - Manufacturers: Produce valves conforming to ASME B16.34 specifications. Engineers and Designers, select and specify valves that meet the standard's requirements. Verify compliance of installed valves with ASME B16.34.
- **Safety Measures -** Outlines design criteria, including allowable stress, pressure design thickness, and material selection. Mandates rigorous testing protocols, such as hydrostatic and non-destructive examinations. Provides guidelines for safe operation and maintenance, including procedures for repairs and alterations.
- **Documentation and Verification -** Maintain detailed records of design calculations, material specifications, manufacturing processes, inspection reports, and testing results. Conduct regular audits and inspections to ensure ongoing compliance with the standard.

**ASME B20.1-2024 - Safety Standard for Conveyors and Related Equipment**

- **Scope:** Applies to conveyors handling bulk materials, packages, or units, designed for permanent, temporary, or portable operation. It excludes conveyors primarily used for moving people.
- **General Safety Guidelines:** Provides comprehensive safety guidelines for backstops, gates, switches, maintenance, lubrication, headroom, controls, operation, and fire safety.
- **Specific Safety Guidelines:** Includes detailed safety requirements for different types of conveyors, such as fixed belt conveyors, en masse conveyors, mobile conveyors, pusher bar conveyors, and tow conveyors.
- **Design and Installation:** Offers specifications for the design, installation, commissioning, and periodic inspection of vertical reciprocating conveyors.
- **Exclusions:** Does not apply to conveyors covered by other specific standards or equipment like industrial trucks, tractors, trailers, cranes, hoists, and platform elevators

**ASME B31**

**ASME B31.1 - Power Piping**

- ASME B31.1, also known as the Power Piping Code, establishes the minimum requirements for the design, materials, fabrication, erection, testing, inspection, operation, and maintenance of power piping systems. These systems are typically found in electric power generating stations, industrial and institutional plants, geothermal heating systems, and central and district heating and cooling systems.
- **Risk Assessment**: ASME B31.1 emphasizes the importance of conducting thorough risk assessments to identify potential hazards associated with power piping systems. This includes evaluating the effects of pressure, temperature, and external forces on the piping. Risk Reduction: The code provides guidelines for designing piping systems to withstand identified risks, including specifying materials and construction methods that enhance safety and reliability.
- **Applicability -** ASME B31.1 applies to power piping systems that transport steam, water, oil, gas, and other fluids under high pressure and temperature. It covers boiler-external piping for power boilers and high-temperature, high-pressure water boilers.
- Industries: The code is relevant to various industries, including thermal and nuclear power plants, combined cycle plants, and other high-pressure applications.
- **Responsibilities -** Designers and Engineers: Responsible for ensuring that the design of power piping systems complies with ASME B31.1 requirements, including material selection, stress analysis, and flexibility considerations.
- **Safety Measures -** The code outlines design criteria, including allowable stress, pressure design thickness, and flexibility analysis, to ensure the safety and reliability of power piping systems.
- Inspection and Testing: ASME B31.1 mandates hydrostatic testing, non-destructive examination (NDE), and other inspection techniques to verify the integrity of the piping systems.
- Operation and Maintenance: Provides guidelines for the safe operation and maintenance of power piping systems, including procedures for handling repairs, alterations, and integrity assessments.
- **Documentation and Verification -** Detailed records of design calculations, material specifications, fabrication procedures, inspection reports, and testing results must be maintained to ensure compliance with ASME B31.1.

**ASME B31.3-2022 - Process Piping**

- **Scope:** Applicable to piping typically found in petroleum refineries, chemical, pharmaceutical, textile, paper, semiconductor, and cryogenic plants, as well as related processing plants and terminals.
- **Materials and Components:** Specifies the materials and components used in piping systems, ensuring they meet the necessary standards for safety and performance.
- **Design and Fabrication:** Provides detailed guidelines for the design and fabrication of piping systems, including stress analysis, flexibility, and support requirements.
- **Assembly and Erection:** Covers the proper methods for assembling and erecting piping systems to ensure they are installed correctly and safely.
- **Examination and Inspection:** Outlines the procedures for examining and inspecting piping systems to verify their integrity and compliance with the standard.
- **Testing:** Specifies the testing requirements for piping systems, including pressure testing and leak testing, to ensure they are safe for operation.
- **UPVC**

**ASME B31.4-2022 - Pipeline Transportation Systems for Liquids and Slurries**

- **Scope:** Applicable to pipeline systems transporting liquids such as petroleum, refined products, and liquid anhydrous ammonia, as well as aqueous slurries of non-hazardous materials like coal and mineral ores.
- **Design and Materials:** Specifies requirements for the design and materials used in pipeline systems to ensure they meet necessary safety and performance standards.
- **Construction and Assembly:** Provides detailed guidelines for the construction and assembly of pipeline systems, including welding, bolting, and joining methods.
- **Inspection and Testing:** Outlines procedures for the inspection and testing of pipeline systems to verify their integrity and compliance with the standard.
- **Operation and Maintenance:** Includes requirements for the safe operation and maintenance of pipeline systems, addressing aspects such as pressure control, leak detection, and emergency response.
- **Safety Measures:** Emphasises the importance of safety measures to protect the public, operating personnel, and the environment.

**ASME B31.12-2023 - Hydrogen Piping and Pipelines**

- **Scope:** Applicable to piping and pipelines handling gaseous hydrogen and hydrogen mixtures, as well as piping in liquid hydrogen service. It covers up to and including the joint connecting the piping to associated pressure vessels and equipment, but not the vessels and equipment themselves.
- **General Requirements:** Includes definitions and requirements for materials, welding, brazing, heat treating, forming, testing, inspection, examination, operation, and maintenance. It also addresses quality system topics common to other parts of the standard.
- **Industrial Piping (Part IP):** Specifies requirements for components, design, fabrication, assembly, erection, inspection, examination, and testing of industrial hydrogen piping.
- **Pipelines (Part PL):** Sets forth requirements for components, design, installation, and testing of hydrogen pipelines.
- **Appendices:** Contains mandatory and non-mandatory appendices providing additional guidance and information.

**ASME B40.100 - Pressure Gauges**

- **Risk Assessment and Reduction -** Evaluates potential risks associated with pressure gauge operation, including pressure surges and environmental factors. Specifies the use of diaphragm seals, snubbers, and pressure limiting valves to enhance gauge durability and reliability, reducing the risk of failures and safety hazards.
- **Applicability -** Applies to analogue, dial-type pressure gauges that use elastic elements to mechanically sense pressure and indicate it via a pointer on a graduated scale. Relevant to HVAC, aviation, healthcare, defence, agriculture, and other industries where accurate pressure measurement is critical.
- **Responsibilities -** Produce pressure gauges and attachments that conform to ASME B40.100 specifications. Engineers and Designers, select and specify pressure gauges that meet the standard's requirements to ensure proper fit and function within systems. Verify compliance of installed pressure gauges with ASME B40.100 to maintain system safety and reliability.
- **Safety Measures -** Outlines design criteria, including allowable stress and material selection, to ensure the safety and reliability of pressure gauges. Mandates rigorous testing protocols, such as hydrostatic and non-destructive examinations, to verify gauge integrity and performance. Provides guidelines for the safe operation and maintenance of pressure gauges, including procedures for handling repairs and alterations.
- **Documentation and Verification -** Maintain detailed records of design calculations, material specifications, manufacturing processes, inspection reports, and testing results.
- **Verification -** Conduct regular audits and inspections to ensure ongoing compliance with the standard.

**ASME BPVC. VIII.1 – Pressure Vessels Division 1**

- ASME BPVC. VIII.1 deals with regulations about the design, fabrication, inspection, testing and certification of pressure vessels that operate under internal and external pressures surpassing 15 pounds per square inch gauge (PSIG). These vessels could be either fired or unfired.

**ASME BPVC. VIII.2 - Pressure Vessels Division 2**

- ASME BPVC. VIII.2 deals with the rules and regulations about the construction of pressure vessels.

**ASME BPVC. VIII.3 - Pressure Vessels Division 3**

- ASME BPCV. VIII.3 provides rules that to pressure vessels that operate at pressures, either internal or external, exceeding 10,000 psi. Division 3 does not establish maximum pressure limits for either of the preceding Section VIII divisions, nor does it establish a minimum pressure limit for itself.

**ISO 12100 - Risk Assessment – Harmonised with ANSI B11**

- **Risk Assessment and Reduction**: The standard details procedures for identifying hazards, estimating, and evaluating risks, and implementing measures to reduce these risks throughout the machinery lifecycle.
- **Applicability**: It applies to new, existing, modified, or rebuilt power-driven machines used in various processes such as cutting, forming, and thermal techniques, as well as associated equipment for material handling and inspection.
- **Responsibilities**: Clarifies the responsibilities of machinery suppliers, users, modifiers, and purchasers of used machinery. It also introduces the concept of co-manufacturers and their associated responsibilities.
- **Safety Measures:** Provides detailed requirements for safeguarding, including provisions for whole-body access, remote operations, and radiation hazards.
- **Documentation and Verification**: Offers guidance on the necessary documentation and verification processes to ensure compliance with safety requirements.

**OSHA 1910.23 Walking-Working Surfaces - Ladders**

- **Scope**: This section covers the general requirements for all ladders. This covers all ladders, except when the ladder is used in an emergency, designed into or is an integral part of the machine or equipment.
- **Design and Materials**: Specifies the requirements for the design, manufacture, and materials to be used to ensure they meet necessary safety and performance standards.
- **Construction and Assembly**: Provides detailed guidelines for the construction for ladder systems.
- **Inspection and Testing**: Outlines procedures for the inspection and testing of ladder systems to verify their integrity and compliance with the standards.
- **Operation and Maintenance**: Includes requirements for safe operation and maintenance of ladder systems, addressing aspects such procedures for defected ladder system.
- **Safety Measures:** Emphasises the importance of safety measures to protect the operating personnel.

**OSHA 1910.25 Walking-Working Surfaces - Stairways**

- **Scope**: This section covers all stairways (including standard, spiral, ship and alternating tread-type stairs (stairs that change in pitch due to change in height at the point of attachment) such as those serving floating roof tanks, stairs on scaffolds, stairs designed into machines or equipment and stairs on self-propelled motorized equipment.
- **Design and Materials**: Specifies the requirements for the design, manufacture, and materials to be used to ensure they meet necessary safety and performance standards.
- **Construction and Assembly**: Provides detailed guidelines for the construction for stairs including, stairway landings and platforms stair gates and loadings.
- **Inspection**: Outlines procedures for the inspection of stairs to verify their integrity and compliance with the standards.
- **Safety Measures:** Emphasises the importance of safety measures to protect the operating personnel.

**OSHA 1910.28 Walking-Working Surfaces – Duty to have fall protection and falling object protection.**

- **Scope**: This section covers exposure to fall and falling hazards. Except for fall protection systems.
- **Designs**: Specifies the requirements for the designs to be used to ensure they meet necessary safety and performance standards.
- **Construction and Assembly**: Provides detailed guidelines for the construction for falling and falling objects including fixed and removable handrail, hatchway, chute, and holes.
- **Inspection**: Outlines procedures for the inspection of fall and falling objects (refer to criteria in OSHA 1910.29) to verify their integrity and compliance with the standards.
- **Safety Measures**: Emphasises the importance of safety measures to protect the operating personnel.

**OSHA1910.29 Walking-Working Surfaces – Fall protection systems and falling object protection – criteria and practices.**

- **Scope:** This section covers exposure to fall protection and falling object protection systems.
- **Design and Materials:** Specifies the requirements for the design, manufacture, and materials to be used to ensure they meet necessary safety and performance standards.
- **Construction and Assembly:** Provides detailed guidelines of guiderail systems, handrail and stair systems, platforms, ladder systems and using hoisting systems.
- **Inspection & Testing:** Outlines procedures for the inspection of fall and falling objects to verify their integrity and compliance with the standards.
- **Safety Measures:** Emphasises the importance of safety measures to protect the operating personnel.

**OSHA 1910.94 Ventilation**

- **Scope:** This section covers the general requirements for device or devices for removing dust from a space, comprising two or more of the following elements: enclosure or hood, duct work, dust collecting equipment, exhaust air or discharge stack.
- **Design and Materials:** Specifies the requirements for the design, manufacture, and materials to be used to ensure they meet necessary safety and performance standards.
- **Construction and Assembly:** Provides detailed guidelines for the construction for ventilation systems.
- **Operation and Maintenance:** Includes requirements for safe operation and maintenance of ladder systems, addressing aspects such procedures for defected ventilation system.
- **Inspecting and Testing:** Outlines procedures for the inspection and testing of ventilation systems to verify their integrity and compliance with standards.
- **Safety Measures**: Emphasises the importance of safety measures to protect the operating personnel.

**OSHA 1910.103 Hazardous Materials – Hydrogen**

- **Scope**: Gaseous Hydrogen Systems - This section applies to the installation of gaseous hydrogen system on consumer premises where the hydrogen supply to the consumer premises originates outside the consumer premises and is delivered by mobile equipment. This section does not apply to gaseous hydrogen systems having a total hydrogen content of less than 400 cubic feet, nor to hydrogen manufacturing plants or other establishments operated by the hydrogen supplier or his agent for the purpose of storing hydrogen and refilling portable containers, trailers, mobile supply trucks or tank cars.
- **Liquified Hydrogen Systems** – This section applies to the installation of liquified hydrogen systems on consumer premises. This does not apply to liquified hydrogen portable containers of less than 150 litres (39.63 gallons) capacity; nor to liquified hydrogen manufacturing plants or other establishments operated by the hydrogen supplier or his agent for the sole purpose of storing liquified hydrogen and refilling portable containers, trailers, mobile supply trucks or tank cars.
- **Design and Materials**: Specifies the requirements for the design, manufacture, and materials to be used to ensure they meet necessary safety and performance standards.
- **Construction and Assembly:** Provides detailed guidelines for the construction for hydrogen storage, piping and tubing, equipment assembly and specific requirements.
- **Inspection and Testing:** Outlines procedures for the inspection and testing of hydrogen storage systems, piping, and tubing to verify their integrity and compliance with the standards.
- **Operation and Maintenance:** Includes requirements for safe operation and maintenance of hydrogen systems.
- **Safety Measures:** Emphasises the importance of safety measures to protect the operating personnel.

**OSHA 1910.106 Hazardous Materials – Flammable Liquids**

- Scope: This standard is intended to apply to the design, construction, location, installation, and operation flammable liquids.
- Design and Materials: Specifies the requirements for the design, manufacture, and materials to be used to ensure they meet necessary safety and performance standards.
- Construction and Assembly: Provides detailed guidelines for the construction for flammable liquid storage, piping and tubing, equipment assembly and specific requirements.
- Inspection and Testing: Outlines procedures for the inspection and testing of flammable liquid storage systems, piping, and tubing to verify their integrity and compliance with the standards.
- Operation and Maintenance: Includes requirements for safe operation and maintenance of flammable liquid storage systems.
- Safety Measures: Emphasises the importance of safety measures to protect the operating personnel.

**OSHA 1910.111 Hazardous Materials – Storage and Handling of Anhydrous Ammonia**

- **Scope:** This standard is intended to apply to the design, construction, location, installation, and operation of anhydrous ammonia systems including refrigerated ammonia storage systems.
- **Design and Materials:** Specifies the requirements for the design, manufacture, and materials to be used to ensure they meet necessary safety and performance standards.
- **Construction and Assembly:** Provides detailed guidelines for the construction for anhydrous ammonia storage, piping and tubing, equipment assembly and specific requirements.
- **Inspection and Testing:** Outlines procedures for the inspection and testing of anhydrous ammonia storage systems, piping, and tubing to verify their integrity and compliance with the standards.
- **Operation and Maintenance**: Includes requirements for safe operation and maintenance of anhydrous ammonia systems.
- **Safety Measures**: Emphasises the importance of safety measures to protect the operating personnel.

**CGA G-5.5, Hydrogen Vent Systems**

- **Scope:** Guidelines for the safe design, construction, and operation of hydrogen vent systems to ensure safe hydrogen release.
- **Design and Materials:** Leak-tight and air instruction prevention. Explosion handing up to 1000kPa (145 psi). Use materials compatible with hydrogen.
- **Construction and assembly:** Materials used in the construction must be compatible with hydrogen and able to withstand the operating pressures and temperatures.
- **Inspection and testing:** Regular inspections and periodic testing are essential to verify the system's integrity and ability to handle designed pressures and flow rates.
- **Operation and Maintenance:** The vent system require routine maintenance and continuous monitoring to detect any potential issues early.
- **Safety Measures:** Flaring for significant amounts of unused hydrogen, with NASA guidelines suggesting flaring for vent rates greater than 0.2 kg/s.

**NFPA 2-2023 Hydrogen Technologies Code**

- **Scope:** The NFPA 2-2023 standard outlines guidelines for the safe use, storage, and handling of hydrogen across various applications, including production, storage, and distribution facilities.
- **Design and Materials:** The design of hydrogen systems must account for pressure, temperature, and flow rates, using materials compatible with hydrogen to maintain system integrity. Adequate ventilation is essential to prevent hydrogen gas accumulation.
- **Construction and Assembly:** Installation requirements emphasize proper setup and maintaining safe distances between hydrogen systems and other structures. Systems should be protected from adverse weather conditions.
- **Inspection and testing:** Regular inspections and periodic testing are necessary to ensure systems function correctly and safely.
- **Operation and Maintenance:** Routine maintenance and continuous monitoring help address any issues promptly.
- **Safety Measures:** Safety measures include establishing emergency procedures, implementing fire protection systems, and ensuring personnel are trained in the safe handling and operation of hydrogen systems.

**NFPA 37-2010 Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines**

- **Scope:** The NFPA 37-2010 standard provides minimum fire safety requirements for the installation and operation of stationary combustion engines and gas turbines.
- **Design and Materials:** The design of these systems must ensure safe handling of fuel and combustion processes. Materials used should be non-combustible and capable of withstanding the operational conditions of the engines.
- **Construction and Assembly:** Installation requirements include maintaining safe distances between engines and combustible structures.
- **Inspection and testing:** Regular inspections are required to ensure that the systems are functioning correctly and safely.
- **Operation and Maintenance:** Routine maintenance is essential to keep the engines in good working condition. Systems should be readily accessible for maintenance, repair, and first responders.
- **Safety Measures:** Safety measures include establishing emergency procedures for handling fire incidents and implementing fire protection systems.

**NFPA 484-2022 Standard for Combustible Metals**

- **Scope:** The NFPA 484-2022 standard provides guidelines for the safe production, processing, finishing, handling, recycling, storage, and use of all metals and alloys in forms capable of combustion or explosion.
- **Design and Materials:** Materials used should be non-combustible and capable of withstanding the operational conditions. Adequate ventilation is necessary to prevent the accumulation of combustible metal dust.
- **Construction and Assembly:** Systems should be constructed to prevent the spread of fire and explosion. Weatherproof enclosures should be used to protect systems from external ignition sources.
- **Inspection and testing:** Periodic testing should be conducted to verify compliance with safety standards, including pressure tests and leak detection.
- **Operation and Maintenance:** Systems should be readily accessible for maintenance, repair, and first responders. Continuous monitoring helps detect and address potential issues promptly.
- **Safety Measures:** Safety measures include establishing emergency procedures for handling fire and explosion incidents and implementing fire protection systems.

## 6. Vendors

**Vendors are responsible for supplying a Risk Assessment in accordance with ISO 12100 Annex B or ANSI B11, both of which are harmonised regulations.**

### Electrical

#### Generic Electrical Requirements

- Electrical Termination Details
- Compliance with our wiring policies document.
- Detailed termination points and connection types.
- Specifications for cable types, sizes, and routing.
- Standards and Codes
- Adherence to control systems
- Integration with existing control systems.
- Specifications for control panels, PLCs, and other control equipment.
- Electrical loading including voltage, current and power.
- Documentation on testing and validation required. I.e., FAT, SAT

### Mechanical

#### Generic Mechanical Requirements

- Mechanical properties of structural materials
- Detailed mass properties including the centre of gravity with all structural connection points.
- Structural connection points must be clearly marked and documented.
- Total load list
- Dead Load: Total weight of the equipment including all permanent components.
- Live Load: Variable loads such as personnel, maintenance equipment, and operational loads.
- Dynamic Loading: Detailed information on dynamic loads, including frequency modes and temperature ranges. This should cover both static and dynamic conditions.
- Vibration Control
- Isolation mounts to decouple machinery from the structure.
- Balancing of rotating components to minimize vibration.
- Structural stiffening where necessary to mitigate vibration transmission.
- Documentation on testing and validation required. I.e., FAT, SAT

## Quality and Certifications

Vendors must be certified to relevant quality standards such as ISO 9001:2015 and AS9100D4.

Compliance with industry-specific certifications and standards.

## Documentation

Detailed technical documentation including installation manuals, maintenance guides, and compliance certificates.

2D ACAD drawings & 3D CAD model(s) in native Inventor (ipt, iam, idw) files or STP. File.

Piping & Instrumentation Diagram (P&ID) drawings in ACAD.

Regular updates and support throughout the project lifecycle.

## Support and Training

Provision of on-site support during installation and commissioning.

Training for staff on operation and maintenance of the equipment.

## Altek Engineering Technical Specification

Ensure all equipment and installations comply with Altek's Engineering Technical Specification document where applicable.

Regular audits and inspections to ensure ongoing compliance.