

PROJECT NO.: K20.00269.PA

SPECIFICATION NO.:23010

FOR: GENERAL REQUIREMENTS FOR  
SANITARY MECHANICAL  
EQUIPMENT

**KITECH**  
**cGMP Biopharm Contract Manufacturing Facility**

Issue:	For Comment	For Design	For Design
Revision:	A	0	1
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**SECTION 23010**  
**SPECIFICATION FOR**  
**GENERAL REQUIREMENTS FOR SANITARY MECHANICAL EQUIPMENT**

**PART 1      GENERAL**

**1.01    GENERAL REQUIREMENTS**

- A. Refer to the Purchasing Documents for terms and conditions, warranty requirements, and other commercial instructions and information.
- B. This Specification together with the individual equipment Specification(s) and other Documents listed in the Purchase Order shall define the minimum requirements to be met by the Seller in the design, fabrication, furnishing, testing and delivering of the equipment ordered.
- C. This Specification covers the general requirements for various types of sanitary mechanical equipment. The Seller shall identify all items deemed to be not applicable to the type of equipment being supplied, and secure Buyer's concurrence in writing prior to proceeding.
- D. In case of conflict between this general specification and the individual equipment specification, the individual specification shall take precedence.
- E. The Seller is responsible for fulfillment of this specification as interpreted by the Buyer; therefore should there be any doubt about its intent, the Seller shall contact the Buyer or Buyer's agent for clarification.

**1.02    SUMMARY**

- A. Work Included:
  - 1. Proposals
    - a. The equipment shall be quoted as specified. The Seller may also submit, for Buyer's evaluation and approval, alternate design(s) incorporating equipment and/or materials in addition to or other than those specified providing it satisfies the performance requirements and that the quality of the proposed alternate is equivalent to those specified and the Seller can demonstrate proven successful experience.
    - b. The Seller shall list each requirement of the specifications that results in non-standard equipment.
    - c. The Seller shall specifically identify in the Proposal any exceptions to the specifications. In the event that no exceptions are listed in the Proposal, compliance with the specifications is implied.
    - d. When listing exceptions and/or alternates, the Seller shall comply with the following:
      - i Identify the specification and revision number.

- ii Identify (by section and subsection number) the criteria that cannot be met.
    - iii Summarize the reason for the exception and/or alternate.
    - iv Present a proposal for solution.
  - e. Exceptions and/or alternates agreed to during the bidding process shall be incorporated into the Procurement Specification before the Purchase Order is placed to reflect the as-purchased conditions.
- 2. Seller's Responsibility
  - a. The Seller shall bring to the Buyer's attention for resolution any conflict that may occur between the specifications and codes, standards or proven design practice.
  - b. Engineer's and/or Buyer's review of final design drawings shall in no way lessen Seller's responsibility to provide a complete operable system. In all cases, the equipment shall be capable of performing according to the functional specification. Seller shall specifically remain liable for any errors and/or omissions contained in Seller's design and shall be responsible for all costs necessary to remedy such defects in the design.
  - c. Should Engineer and/or Buyer recommend changes in design for the improvement of the equipment, and/or materials, the Seller must review and be in agreement with said changes and guarantee the integrity of such recommendations and assume all liability for any implementation thereof.
  - d. Seller shall be responsibility for the equipment performance or compliance with the applicable codes, standards, Drawings, Specifications, and Data Sheet(s) or the accuracy of shop drawings.

B. Work Not Included:

- 1. Equipment receiving and unloading.
- 2. Equipment installation.
- 3. Utilities and utilities supplied to skid boundaries where applicable.

### 1.03 RELATED DOCUMENTS

A. Reference Specifications:

- 1. Section 16001 - Specification for Electrical Requirements for Packaged Equipment.
- 2. Section 16150 - Specification for Low Voltage Induction Motors.
- 3. Section 17071 - Specification for Instrumentation for Packaged Units.
- 4. Section 18001 - Specification for General Piping Requirements.

B. References:

- 1. The following industry, association, and government codes and standards shall be followed only as applicable to the design, fabrication, assembly and testing of all equipment furnished:
  - a. AGMA – American Gear Manufacturers Association.
  - b. AISC – American Institute of Steel Construction.
  - c. ANSI - American National Standards Institute.

- d. ASA – Acoustical Society of America
  - e. ASME B&PV Code - American Society of Mechanical Engineers – Boiler & Pressure Code.
  - f. ASME BPE-1997 and BPEa-2000 (Addenda) – Bioprocessing Equipment.
  - g. ASTM - American Society for Testing and Materials.
  - h. AWS - American Welding Society.
  - i. cGMP/FDA - Current Good Manufacturing Practices of the Food and Drug Administration, United States Department of Health and Human Services. U.S. Code of Federal Regulations Title 21, sections 210 and 211.
  - j. EU Guidelines - European Commission’s Working Party on “Control of Medicines and Inspection, Guide to Good Manufacturing Practices.”
  - k. IEEE – Institute of Electrical and Electronic Engineers.
  - l. IBC - International Building Code 2000.
  - m. ISA – Instrument Society of America.
  - n. NEMA - National Electrical Manufacturers Association.
  - o. NFPA - National Fire Protection Association.
  - p. NEC - National Electric Code, Standard Number 70.
  - q. OSHA - Occupational Safety and Health Act.
  - r. UBC - Uniform Building Code; Chapter 23 - General Design Requirements.
  - s. UL - Underwriters Laboratory.
  - t. SSPC – Steel Structures Painting Council
  - u. State and local applicable codes.
- 2. Additional references may be found in individual Specifications.
  - 3. The issues and revisions of these documents in effect on the date of the Proposal shall apply.

C. Attachments:

- 1. Not Applicable.

#### 1.04 SUBMITTALS

A. With the Proposal, Seller shall furnish the following:

- 1. Complete detailed equipment information, in accordance with Section A of the Mechanical Equipment Submittal Requirements Form.
- 2. Preliminary piping and instrument diagram (P&ID) shall utilize ISA symbology, and indicate the following:
  - a. Lead sheet.
  - b. Equipment furnished with materials of construction and surface finishes.
  - c. Line sizes.
  - d. Instruments furnished.
- 3. Seller shall also submit any additional information necessary for facilitating the Proposal evaluation process.

B. Subsequent to purchase, Seller shall submit the following information for approval:

1. Documentation as required in Section B of the Mechanical Equipment Submittal Requirements Form.
  2. A representative sample piece of plate, which has been welded, ground and finished as required by the Mechanical Equipment Submittal Requirements Form. This sample shall be inspected, the microinch Ra readings recorded, and upon approval, shall form the overall basis for overall appearance etc. for the finished surface. The sample shall be cut into two pieces through the weld joint, one to be retained in the shop and one to be retained by the Buyer as an additional inspection guide. The size of the sample shall be 4 inches by 4 inches.
  3. Detailed Piping and Instrument Diagram in accordance with ISA symbology, showing the following as a minimum:
    - a. Equipment furnished.
    - b. Line sizes with materials of construction.
    - c. Lead sheet.
    - d. Instruments furnished with tag numbers and set points shown.
    - e. Valve types and sizes with fail position.
    - f. Utility requirements and flowrates.
    - g. Buyer's tie-in connection points located, numbered and type of connections.
    - h. Seller's PLC or microprocessor signals and alarms.
    - i. Seller's control panel mounted instruments.
- C. After receipt of approved drawings, and prior to factory acceptance tests and shipping, Seller shall submit information in accordance with Section C of the Mechanical Equipment Submittal Requirement Form for installation:
1. Manuals with detailed description of installation, operation, and maintenance. Manuals shall be written in the English language. Seller shall include the following in the submitted manuals:
    - a. Operating instructions for each system including step-by-step preparation of starting, shutdown, and draining.
    - b. Manufacturer's literature describing each piece of equipment furnished providing the item number (see Specification cover sheet), system number, model number, and drawing number(s).
    - c. Maintenance and repair instructions for each type of equipment including exploded views of parts, and diagrams or photographs illustrating proper changeover and set-up of the equipment. Data shall be suitable for preparation of a maintenance SOP by the Buyer.
    - d. Possible breakdowns and repairs for each type of equipment (trouble shooting guidelines, flowchart).
    - e. Control diagrams, as installed.
    - f. Detailed sequence of operation.
  2. List of nearest local suppliers of all equipment.
  3. List of recommended spare parts for one (1) year.
- D. After receipt of approved drawings, Seller shall furnish three (3) copies of all data submitted (see C above).

## E. Drawings

1. When practical, all drawings shall be to scale. Dimensions or drawings not to scale should be so stated.
2. All drawings for construction shall indicate Buyer's north arrow and shall list all related reference drawings where applicable.
3. All electrical and utility connection locations for power and control shall be dimensioned and properly identified.
4. Utility requirements shall be clearly indicated (e.g. horsepower, kW, cooling water, instrument air, etc.).
5. Outline and/or detail drawings shall show the following information as a minimum:
  - a. Overall dimensions and differential elevations.
  - b. Nozzle or inlet sizes, rating, facing, locations and flow directions.
  - c. Support mounting dimensions and location of anchor boltholes.
  - d. Clearance required for parts removal.
  - e. Identification as per Section 1.07 of this Specification and the Purchase Order.
  - f. Materials of construction and surface finish.
  - g. Breakdown of how units will be shipped, i.e. number of individual pieces, subassemblies, etc.
  - h. Leveling instructions or tolerances, special handling instruction, if any.
  - i. Weld call-outs using AWS standard symbols.
  - j. Mechanical bills of materials with the original manufacturers part numbers, and instrument tag numbers.
  - k. Operating and shipping weight of equipment including point loads at support locations.
  - l. Schematic wiring diagrams using ANSI standard notation for all electrically powered equipment.
  - m. Instrument list with recommended calibration schedule for each instrument; special calibration requirements for any instruments shall be identified.
6. Seller's equipment shall match certified drawings in all respects (dimensions, nozzle locations, anchor bolt locations, etc.). Should additional cost be incurred due to deviations between certified drawings and as-built equipment, corrective action will be taken by the Buyer and the additional cost will be back-charged to the Seller.

- F. The Seller shall furnish technical information, checked calculations, data, and drawings in accordance with the specifications. Submittals will be reviewed for general design, controlling dimensions, and compliance with the specifications and data sheets. All submittals (drawings, data sheets, test results, manuals, etc.) must be properly identified with the information:

- |                                   |  |
|-----------------------------------|--|
| 1. Buyer:                         | Kitech   |
| 2. Buyer's Agent:                 |  |
| 3. Project Name:                  | cGMP Biopharm Contract<br>Manufacturing Facility |
| 4. Project Location:              | Inchon, Korea                                    |
| 5. Equipment Number:              | (See Purchasing Documents)                       |
| 6. Equipment Description:         | (See Purchasing Documents)                       |
| 7. Buyer's Purchase Order Number: | (See Purchasing Documents)                       |
| 8. Manufacturer's Serial Number:  | (See Purchasing Documents)                       |

G. General:

1. As a minimum, Seller engineering data is defined to include drawings, data sheets, manuals, calculations, assembly and erection instructions, inspection reports, and all documents listed in the attached Specification.
2. Manufacturer's drawings, calculations, and engineering data submitted shall be in the English language. Text in the language of the manufacturer may be used provided the English translation is shown. Dual Dimensioning may be used by manufacturer. It is preferred that dimensions and engineering units be in United States dimensions as the primary system, with SI (International System of Units) system and engineering units shown in parentheses or brackets.
3. Documents shall be in reproducible form and the quality of the documents shall allow for microfilming without loss of clarity. All documents shall indicate that they have been checked or reviewed prior to submission.
4. Electronic copies of manufacturer's submittals shall be submitted in the formats below:
  - a. Drawings
    - i Preferred format: Autocad.DWG format version 14 or higher.
    - ii Acceptable alternatives: XXX.DXF
  - b. Other submittals
    - i Preferred formats: Microsoft Word and Excel for Windows.
    - ii Acceptable alternates: Adobe Acrobat, PDF files
  - c. Disk: Both of the following are acceptable:
    - i CD-ROM in Windows compatible form.
    - ii 3-1/2 inch high-density floppy diskette in Windows compatible format.
5. If during factory acceptance tests or field-testing modifications are made to the equipment, then following completion of the work, Seller shall revise all appropriate drawings to indicate "as-built" conditions. An "as-built" copy shall be provided for insertion into each installation/operation/maintenance manual and shall be clearly marked "AS BUILT."

## 1.05 QUALITY CONTROL

### A. Source:

#### 1. Inspection - General

- a. Inspection by Buyer or Buyer's representative shall not relieve the Seller's responsibility to meet the requirements of this Specification and its references.
- b. All equipment supplied by the Seller may be fully inspected and tested in the Seller's shop prior to shipment to assure satisfactory operation of the specified equipment. The Buyer representatives witnessing the tests shall have free entry to the areas where activity related to the tests are to take place. The Seller shall provide labor, general materials and utilities used in these inspections.
- c. The Buyer and/or his representative may visit or be in residence at the Seller's shop(s) to insure that established schedules are being met and to insure that quality control is being maintained at an acceptable level. Forty-eight (48) hours' notice for these visits will be given.
- d. The Seller shall provide (over an adequate period of time to fully perform the tests) labor, general materials and utilities used in these factory acceptance tests.
- e. The Seller shall give seven (7) working days notice to Buyer in advance of each Factory Acceptance Test. Three (3) weeks notice shall be given for foreign run tests. The documentation listed as required prior to factory acceptance tests will be due at this time. After reviewing the documentation, the Buyer shall confirm the test dates and protocols shall be finalized.
- f. Inspection shall include, but not be limited to the following:
  - i Adherence to Purchase Order and Change Orders.
  - ii Adherence to Specification.
  - iii Adherence to Certified Drawings.
  - iv Adherence to fabrication procedures and surface finishes as mandated by codes and/or specifications and drawings.
  - v Fabrication within tolerances.
  - vi Witness to tests to ensure compliance with procedures and requirements.
  - vii Visual inspection for overall workmanship. Visual inspection shall include, but not be limited to:
    - (a) Location, size, and straightness of supports, nozzles, and all components.
    - (b) Welds.
    - (c) Internal finish.
    - (d) External finish.
    - (e) Passivated surfaces, prior to assembly.
    - (f) Offset and out of roundness of shells to ASME criteria.
    - (g) All dimensions and orientations.
    - (h) Review of overall workmanship and all pertinent documentation.
- g. Procedures qualifications records (PQR), welders qualifications records (WQR), records of radiographic examination, certificates of magnetic



particle analysis, liquid dye penetrant, or other examinations shall be made available when applicable, during the time of inspection by Buyer or its authorized representative(s).

2. Welding Inspection
  - a. Weld inspection and acceptance criteria shall be in accordance with sections of the ASME Code.
  - b. Visual inspection of ALL visible welds will be conducted and any defective materials or welds shall be repaired or replaced and retested.
  - c. Arc strikes shall be removed by grinding, without undercutting into the base metal. The removal of any cracks caused by the arc strike shall be verified by the performance of a liquid penetrant examination.
  - d. Seller shall borescope ALL invisible welds and provide video records to Buyer.
3. Inspection of Polished Finish
  - a. The finish shall be inspected by Buyer or its authorized representative(s) using a NIST traceable calibrated profilometer supplied by the Seller.
  - b. Inspection shall be in two (2) directions - with and against the grain over a square grid 6 inches on a side as feasible.
  - c. The number of locations shall be at the Inspector's discretion.
  - d. Any defective areas revealed by the above mentioned tests are to be properly corrected and/or repaired, then rechecked by the original method indicated.
  - e. At Buyer's option, all finished welds shall be inspected using liquid dye penetrant examination per Section V of ASME Code and procedure B-1 of ASTM Standard E 165 - Practice for Liquid Penetrant examination after polishing.
    - i Any indication, linear or rounded, is a defect.
    - ii Penetrant shall be water washable type.
4. Tests
  - a. A Seller developed and Buyer approved complete performance shop testing of the unit is required prior to shipment. The Seller shall provide data in report format, to ensure that the unit is capable of operating per the required design.
  - b. Seller shall perform standard factory tests as well as any tests required by this Specification and other Specifications. Both, standard and specified tests shall be run per Buyer-approved test procedures.
  - c. Hydrostatic testing shall be performed in accordance with the ASME code and documented. Testing is recommended to be performed with deionized or distilled water for sanitary surfaces.
  - d. Testing shall include tests required by the applicable sections of the referenced specifications.
  - e. After all final tests are completed, sanitary components shall be rinsed with deionized or distilled water with discharge conductivity being measured to verify product wetted parts are clean before drying.
  - f. Slope testing shall be performed to insure drainage.
5. Factory Acceptance Tests
  - a. Equipment shall not be released for shipment until any defects found are all corrected to the Buyer's satisfaction.

- b. The Seller shall provide prior to testing a schedule of calibration to NIST traceable standards for each instrument critical for proper performance evaluation.
- 6. Factory Acceptance Testing shall include as applicable:
  - a. Slope testing to insure drainage.
  - b. Safety checks and power outage recovery.
  - c. Operational test within defined parameters including start-up, operation, and shutdown.
  - d. Instrument loop checks.
  - e. Software Development and Testing as described in Section 17071 - Specification for Instrumentation For Packaged Units.
  - f. Functionality verification of alarms, controls and indicators.
- 7. Equipment will also be subject to reinspection at the job site for damage during shipment.
- 8. Seller is responsible for any costs associated with a failed test or the Seller's lack of completeness in fabrication resulting in additional expense to the Buyer or Buyer's agent.

B. On Site:

- 1. For items of equipment for which final shop inspection has been waived, a final inspection will take place upon receipt of the equipment at the job site. The Buyer will notify the Seller within 30 days of any specification deficiencies. It shall be the Seller's responsibility to cover all costs incurred in making the equipment meet specifications. Final payment for equipment shall not be released until all deficiencies are corrected to the satisfaction of the Buyer, and signatory acceptance of the equipment has been made.
- 2. See individual mechanical specifications.

1.06 DELIVERY, STORAGE, HANDLING

A. Refer to Contract Documents.

- B. It is the Seller's responsibility to deliver the equipment to the job site and pay for all shipping costs.

1.07 CLEANING, PACKAGING, AND TAGGING

A. Cleaning

- 1. All equipment, components, and subassemblies shall be thoroughly cleaned of all water, sand, grit, weld spatter, grease, oil and other foreign materials prior to shipment.
- 2. The equipment shall first be cleaned on all internal and external surfaces with a Buyer approved procedure utilizing a detergent solution to remove fabrication deposits and general dirt.
- 3. Equipment shall be dried before packaging.

B. Packaging

1. All flanged openings shall be covered with 3/8-inch thick plywood or plastic flange protectors; threaded and clamped openings shall be protected with plastic end caps or plugs. All caps, plugs and flange covers shall be sealed with chloride-free tape to provide a dust-tight closure. Sanitary clamp wingnuts shall be tie-wrapped to prevent loosening.
2. Equipment shall be suitably skidded, crated, boxed, sealed or otherwise protected from damage during shipment. Units shall be properly braced for shipment. Instructions for bracing removal shall be submitted with shipment and readily apparent on the skid, box or crate. Correcting any damage during shipping shall be the responsibility of the Seller.
3. Unless otherwise stated in the Purchase Order, each separate shipping crate, box or skid shall be clearly and indelibly labeled with the information as shown on the purchase order.

#### C. Tagging

1. The Buyer's nameplate requirements are as follows:
  - a. Each piece of equipment shall have a 300 series stainless steel nameplate permanently attached to it in a visible location.
  - b. The nameplate shall be continuously welded to its support along all edges. It shall not be painted or covered.
  - c. The nameplate shall be mounted on 1/8-inch thick bracket of the same material as the equipment. Brackets shall provide standoff distance equal to insulation thickness or 2 inch minimum.
  - d. The nameplate shall be embossed or otherwise permanently affixed and contain the following information:
 

i	Plant Name	Kitech
ii	Project Location	Inchon, Korea
iii	Buyer's Purchase Order Number	(See Purchasing Documents)
iv	Equipment Number	(See Purchasing Documents)
v	Equipment Description	(See Purchasing Documents)
vi	Manufacturer's Name	
vii	Manufacturer's Serial Number and Model Number	
viii	Date Fabricated	
ix	Location Fabricated	

### 1.08 OPTIONS

- A. The Seller shall provide costs for each of the following options. (See Purchasing Documents and individual equipment Specification.)
  1. Seller cost for supervision of installation and start-up.
  2. Site cost for performing on-site acceptance tests.
  3. On site training. (Supply hourly rate.)

## PART 2 PRODUCT

### 2.01 PERFORMANCE CRITERIA

- A. The Seller shall guarantee that the equipment furnished is fully adequate to perform the intended service and that it conforms to the specifications and data sheet(s). The Seller shall be fully responsible for the suitability, adequacy, and safety of the design and construction of the equipment furnished by him or his OEM suppliers and sub-contractors.
- B. Seller shall guarantee that the overall noise level of each fully assembled unit shall not exceed 85-dBA sound power level when measured at 3 feet in any direction during normal operation.

## 2.02 DESIGN DETAILS

- A. See the individual equipment specification(s).
- B. Painting
  - 1. For equipment, which will be installed in a utility area (see individual equipment Specification), all unmachined external ferrous surfaces shall be painted with Seller's standard paint system. Seller shall provide details with the Proposal.
  - 2. For equipment located in the production area (see individual equipment Specification), all external ferrous surfaces shall be painted with Seller's standard FDA-acceptable epoxy paint system. After painting, the finish shall demonstrate a non-flaking or non-chalking nature.
  - 3. The paint system (surface preparation, prime and finish coat, method of application, number of coats, dry film thickness of each coat, and color) selected shall be compatible with the specified application and environment.
  - 4. Painting of pressure-containing parts shall be deferred until the specified inspection and testing of that part is completed.
- C. Lubrication
  - 1. Items requiring lubrication shall receive full charge of Buyer-approved and FDA-acceptable (for sanitary applications) lubricant prior to shipment. Seller to state type of lubrication installed and/or required.
    - a. Lubricated items must be completely sealed to avoid the lubricants from leaking out and / or allowing cleaning solutions to contact lubrication.
    - b. Lubrication chambers shall be supplied with tapped drain connection, sealed by forged or rolled bar stock plug of same material as the tapped component.
    - c. In the event lubricants provided by the Seller are to be installed in the field, Seller must state this in the Proposal and tag equipment to indicate lubrication must be added prior to operation.
- D. Special Tools
  - 1. The Seller shall submit, with approval drawings, a detailed list of special tools and devices required to install, adjust, repair, test, or operate the equipment purchased. Items which are not supplied by the Seller in the base quoted cost of the equipment shall be identified and priced separately in the Proposal.

E. Installation, Commissioning, and Start-Up

1. Seller's Proposal shall clearly state all rates and charges associated with erection or start-up. Erection or start-up services included in the base price of the equipment shall be so stated.
2. A proposed start-up plan and schedule shall be submitted with the proposal showing estimated requirements (number and type of craft-people and duration) for installation, commissioning, and start-up.
3. In the event that the Seller requires his representative on site for any purpose, the time, duration, and reasons shall be stated within the Seller's Proposal.

F. Seismic Zone

1. The project site (Inchon, Korea) is a Seismic Class A as defined by the US Army Corps of Engineers, TI 809-04, Seismic Design for Buildings, 31-Dec-1998. The design and construction of all equipment for this project shall conform to the requirements for this Seismic Class with respect to strength and stability.
2. All piping, major components and sub-components shall be adequately supported.

2.03 WELDING

A. Permissible welding processes for sanitary surfaces are:

1. Gas tungsten-arc welding (GTAW or TIG).
2. Gas metal-arc welding (GMAW or MIG). Gas metal-arc welding (GMAW) in the short-circuiting transfer mode is not permitted. Vendors requesting a variance for short-circuiting must submit the request in full detail for Buyer's approval. Under no circumstances shall the short-circuiting method be used without prior approval.

B. The welding procedures (WPS), welders, and welding operators must be certified and qualified prior to fabrication in accordance with Section IX of the ASME Code.

C. Welding of pressure or pressure contained parts shall be in accordance with the ASME Code.

D. Welding procedures for joining materials of different analyses (dissimilar metals) shall be qualified in accordance with Section IX of the ASME Code and must be submitted at the time the order is placed for Buyer's approval.

E. Surfaces to be welded shall be smooth, uniform, and free from laminations, tears, scale, slag, grease, paint and other foreign material, which adversely affect welding.

- F. Any false starts or irregularity in the welds shall be ground smooth with an abrasive, not used previously on materials other than austenitic stainless steel. Buffing or cleaning compounds and solvents must be free of any halides in their composition.
- G. Permanent backing strips are not permitted. Temporary metal weld backing strips may be used provided the backing material conforms to the nominal composition of the base metal, the backing is completely removed, the back side of the weld is ground or gouged to sound metal, and the joint is back welded.
- H. Tack welds shall be made by an ASME Code-qualified groove welder or shall be removed at the time of welding. Tack welds, which have cracked, shall be completely ground out and rewelded.
- I. Internal attachments and fittings shall be by continuous full penetration welds. The inside radius of the welds shall not be less than 1/4 inch.
- J. Internal weld seams are to be ground smooth and flush with the adjacent surface area. All internal welds are to be thoroughly blended into the surrounding areas and are to be completely free of pits, ripples, undercutting, and other surface type defects. External welds shall be ground smooth using an abrasive not previously used on materials other than austenitic stainless steel.

## 2.04 SURFACE FINISH

- A. Prior to polishing, all surfaces shall be cleaned and degreased in accordance with section 1.07 of this Specification.
- B. The mechanical polishing procedure shall incorporate the use of progressively higher grits to generate a surface finish listed in the Specification, and accomplished as follows:
  - 1. The first grit used shall be coarse enough to remove weld porosity and surface imperfections such as mandrel marks and surface voids. The final grit utilized shall be fine enough to produce the specified surface finish.
  - 2. All product-wetted internals shall be electropolished (after a mechanical polish to an Ra of  $\leq 25$  micro-inches) to a smooth reflective finish averaging a Ra of 20 micro-inches or better unless otherwise stated on the Specifications.
  - 3. The finish of all exposed external stainless steel surfaces shall be indicated on the data sheets.
- C. All surface roughness finish values shall be as measured using an NIST traceable calibrated and documented profilometer across the surface grain.
- D. Tools used for polishing shall be new and not used previously on carbon or low alloy steel materials to preclude contamination of stainless steel materials with free iron. Tools shall be properly coded for stainless use only.
- E. The use of rouges or polishing compounds on product-contact surfaces is prohibited.

- F. All welding, weld examinations, and mechanical polishing shall be completed prior to electropolishing.
- G. Electropolishing
  - 1. Seller shall electropolish stainless steel product-contact surfaces to the surface finishes as indicated. Electropolishing shall be done in accordance with Seller's Buyer-approved procedure.
  - 2. Electropolishing shall be performed after the surfaces have passed inspection as described above. Electropolishing of welds shall be performed at the same time as the base metal.
- H. Passivation: All wetted surfaces shall be chemically passivated following polishing, unless specified otherwise on the data sheet(s).
  - 1. Seller shall utilize his Buyer-approved treatment procedure.
  - 2. Treat all internal surfaces and all connected pipe including electropolished surfaces.
  - 3. Following passivation, all surfaces shall be flushed adequately to remove all traces of the treatment chemicals. Only deionized or distilled water shall be considered acceptable for flushing stainless steel surfaces. After satisfactory flushing, all surfaces shall be dried by hand, where practical, or with hot air.
  - 4. All passivation agents and method shall be approved by Buyer prior to use.

## 2.05 ELECTRICAL

- A. Motors shall be in accordance with Section 16150 - Specification for Low Voltage Induction Motors.
- B. All electrical components of the package shall be in accordance with Section 16001 - Specification for Electrical Requirements for Packaged Equipment.
- C. The Seller shall be responsible for appropriately sizing the motor. Motors, excluding service factor, shall be non-overloading at design conditions. Seller shall inform Buyer in the event that this requirement will result in an increase of more than two (2) motor frame sizes.
- D. Instruments, wiring, connections and enclosures shall be suitable for the electrical area classification identified on the data sheet(s).
- E. Seller to provide instrumentation cables between control panel and unit if separate. Seller shall also install cables in field under field services.

## 2.06 CONTROLS AND INSTRUMENTATION

- A. All instrumentation and controls shall be provided, designed, and constructed as defined and required by Section 17071 - Specification for Instrumentation Requirements for Packaged Units, unless substitutes are approved by the Buyer.

- B. The control equipment shall be located in the Seller supplied local control panel, and shall control and monitor the entire operation, unless otherwise specifies by the Buyer. Enclosure shall be rated for the area classification identified on the data sheet(s).
- C. The Seller shall provide a single relay with a set of DPDT contacts rated for 5.0 A @ 120 VAC / 24 VDC. Relay shall be used for a common trouble alarm and shall de-energize in the alarm state. Relay shall be located within the control panel.
- D. The Seller shall provide the following documentation for each relief device:
  - 1. Outline and cross section drawings showing tag number.
  - 2. Size and connection rating.
  - 3. Orifice size and set and maximum accumulation pressure.
  - 4. Serial number, ASME Code stamp, and materials of construction and surface finish (as applicable).
  - 5. Instruction manual.
  - 6. Part number designation.
  - 7. Failure mode analysis, and sizing calculations.
- E. All instruments in contact with the product shall be of sanitary design. Material of construction certificates are required for each instrument as listed in Section 1.04 above.
- F. All pneumatic users shall be provided with combination filter/pressure regulators.

## **END OF SECTION**