



INTEGRATED FLOW SOLUTIONS

TECHNICAL SPECIFICATION

IFS-607A rev. 8

FOR

INDUSTRIAL GRADE ELECTRIC PROCESS HEATERS

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SCOPE

This specification defines industrial grade electric process heaters and the technical requirements for the design, fabrication, inspection, testing, cleaning, painting, packaging, and delivering of industrial grade electric process heaters complete with all associated appurtenances as specified herein, and as detailed in the associated specification sheet, piping and instrumentation diagram and general arrangement drawing.

1.1 ITEMS INCLUDED

The following shall be provided on a single pre-piped and pre-wired skid mounted assembly. Refer to the piping and instrumentation diagrams (P&IDs) for the arrangement and the quantities of the items to be furnished on each skid.

1. CSA / C UL, TEMA, ASME, and NEMA designed electric process heater bundle
2. ASME Section VIII, Div. 1 designed, certified and stamped electric process heater bundle
3. ASME Section VIII, Div. 1 designed, certified and stamped electric process heater vessel
4. NEC designed, (UL listed - optional), and locally (or remote) mounted electric process heater control panel.
5. One (1) ASME thermal pressure relief valve.
6. Inlet, outlet, vessel, and film temperature elements.
7. Four (4) lifting lugs for the entire skid assembly.
8. One (1) drain valve and one (1) vent valve.
9. Power wiring and conduit from all instruments to a skid mounted control panel.
10. Control wiring and conduit from all instruments to a skid mounted control panel.
11. AWS designed structural design information such as the support loads and anchor bolt locations, sizes and materials.
12. All documentation specified herein.
13. All required cleaning, finishing, packaging, shop testing (including providing documentation of shop testing) and inspection, handling, and shipping of all equipment.
14. Final painting per attached paint procedure.
15. Insulation per attached insulation procedure, **if required**.
16. Factory Acceptance Test (FAT) per attached FAT check list.

1.2 ITEMS NOT INCLUDED

The following items are not included in the requirements of this specification and will be provided by others.

1. Unloading, rigging, storing, and erecting the electric process heater skids.
2. Skid foundations, foundation anchor bolts and nuts, and grout.
3. Foundation dowels and shims for alignment.
4. Electrical power and control wiring to the Vendor supplied skids.
5. Insulation, **unless specified**.

1.3 FEATURES OF IFS-607A

1. NEC Article 424.73 compliant (**safety** feature)
2. Standby mode via override control and film temperature limit (**safety** feature)
3. Process outlet trip (**safety** feature)
4. Detection of welded contactors (**safety** feature)
5. Finger safe protection (**safety** feature)
6. Under-voltage trip for main circuit breaker (**safety** feature)
7. Vessel temperature trip (**safety** feature)
8. Partial ASME code stamp on heater bundle
9. Third party certificate on heater terminal housing
10. Two removable over-temperature thermocouples
11. Grade "A" magnesium oxide
12. Documented QA/QC procedure for bundle manufacturing
13. Epoxy seals with ceramic inserts
14. Power wire connection on buss bar not cold pins
15. Full SCR control panel
16. Flange mounted disconnect switch
17. Wall mounted SCRs
18. KAIC rating stated

2 CODES AND STANDARDS

The following codes and standards are referenced to the equipment specified herein. In the event of any conflict between codes and this specification, this specification shall apply.

2.1 TUBULAR EXCHANGER MANUFACTURERS ASSOCIATION, INC.

1. Standards of the Tubular Exchangers Manufacturers Association, eighth edition

2.2 AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME):

1. ASME Boiler and Pressure Vessel Code, Section II Part A, Ferrous Material.
2. ASME Boiler and Pressure Vessel Code, Section II Part B, Non Ferrous Material
3. ASME Boiler and Pressure Vessel Code, Section II Part C, Welding rods, Electrodes and Filler Metals.
4. ASME Boiler and Pressure Vessel Code, Section V, Non Destructive Examination.
5. ASME Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels, Division 1.
6. ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications.

2.3 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI):

1. ANSI – A2.4, “Standard Symbols for Welding”
2. ANSI – B16.5 – “Pipe Flanges and Flanged Fittings”
3. ANSI - B31.1, “Power Piping”
4. ANSI – B31.3, “Process Piping”

2.4 NATIONAL ASSOCIATION OF CORROSION ENGINEERS (NACE):

1. NACE – MR0175, 2002 “Standard Material Requirements.”

2.5 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA):

1. NFPA 70 “National Electric Code.”
2. NFPA 496 “Purged and Pressurized Enclosures”

2.6 STEEL STRUCTURES PAINTING COUNCIL (SSPC):

1. SSPC-PA-1, “Shop, Field and Maintenance Painting.”
2. SSPC-SP-6, “Commercial Blast Cleaning.”

2.7 AWS (AMERICAN WELDING SOCIETY)

1. AWS D1.1, Structural Welding Code, Steel

2.8 OCCUPATIONAL SAFETY AND HEALTH ACT

1. OSHA 29CFR 1910

3 SUBMITTAL

Typical submittal data required for an Industrial Grade Electric Process Heater

3.1 PERFORMANCE CURVE

3.2 TECHNICAL DESCRIPTION

3.3 TEMA STYLE DATA SHEET

3.4 MODEL NUMBER

3.5 CATALOG CUT SHEET

3.6 WEIGHTS AND DIMENSIONS

3.7 QA/QC MANUAL

3.8 WELD QUALIFICATIONS

3.9 PAINT SPECIFICATION

3.10 FACTORY ACCEPTANCE TEST PROCEDURE

4 GENERAL

All Vendors are expected to fully comply with the complete requirements of this specification. Any deviations shall be explicitly stated in the comments and clarifications section of the proposal. If no deviations are stated, then it is assumed the vendor is in full compliance.

5 DESIGN AND CONSTRUCTION FEATURES

5.1 DESIGN FEATURES:

1. The system shall be designed to perform the duties specified in the Electric Process Heater Specification Sheet, and shall include all the necessary piping and valving required to assure that the operation can be completely carried out without damage to the electric process heater and associated equipment. The Piping and Instrumentation diagram shows the arrangement and the quantities of the items to be furnished on each skid.
2. Electric Process Heaters shall be designed to the requirements as specified in the Electric Process Heater Specification Sheet. The heater duty specified in the Electric Process Heater Data Sheet is the total power required, including a safety factor for line voltage and design wattage tolerances. The allowable film temperature for 0-100% flow rate is provided in the Electric Process Heater Specification Sheet. The total power required is for reference only. It is the responsibility of the Vendor to determine the actual power, film temperature, pressure drop, and estimated bundle life and utilize these figures for sizing the electric process heater.

Recommended safety factor:

- a) General "Rule of Thumb" is 1.2 x Calculated KW
 - b) If there is safety factor built into the design flow rate is 1.1 x Calculated KW
3. Ramp rate and cool rate shall be within tolerances of controls, heater bundle, and heater vessel.
 4. Turndown ratio of flow rate shall be shown on the specification sheet. A corresponding film temperature for the lowest flow rate shall be shown on the TEMA style data sheet.

5.2 ELECTRIC PROCESS HEATER CONSTRUCTION FEATURES:

5.2.1 General:

1. The film temperature shall not exceed the **maximum specified film temperature** for all flow conditions (laminar and turbulent) and shall be shown in a performance curve for the specified application. The film temperature shall not exceed 1600°F or customer's specified maximum, whichever is lower, at all anticipated flow ranges.
2. The pressure drop shall not exceed the **specified pressure drop** from inlet flange to outlet flange.
3. The supplied duty shall consider wattage design tolerances and field voltage variations and provide a **safety factor** in the design that takes these considerations into account.

4. The estimated life of the heater bundle shall be calculated and shall be greater than or equal to > 100,000 hours or as specified.

5.2.2 Heater bundle:

1. The heater bundle shall have a closure designed to ASME Section VIII. A partial code stamp shall be provided. The heater bundle shall be hydro-tested in accordance with ASME Section VIII guidelines.
2. The heater bundle shall have an electrical terminal enclosure complete with third party certification that meets the NEMA requirements for the specified area classification.
3. The heater bundle shall have two over temperature sensing elements on the first on / last off heater circuit. Each over temperature sensing element shall be on a different heater element that is on the same first on / last off heater circuit. The heater circuit with the thermocouple shall be clearly identified inside of the terminal enclosure.
4. The over temperature sensing element shall use a compression fitting for field replacement. The over temperature sensing element shall use a field removable clamping device for attachment to the heater element sheath. Care shall be used so that the active part of the over temperature sensing element is in direct contact with the heater element sheath. The over temperature sensing element shall be capable of sensing and reporting up to 1600°F.
5. Heating element sheath material shall be Incoloy 800 (ASTM B-515 or B-407). Incoloy 840 shall not be used.
6. Only Grade "A" Magnesium Oxide shall be used inside the heater elements. Manufacturer shall have a quality control plan that will test and verify that the MgO electrical properties are maintained to established minimum levels to insure the final quality of the electrical properties of the heating element.
7. The heater element manufacturer shall demonstrate that all materials, processes, and procedures are documented and monitored for compliance in accordance with quality control procedures. Manufacturer shall have a quality program that can be included in the factory acceptance test.
8. Heater elements shall be provided with a moisture "tight" seal at the terminal ends. Minimum acceptable seals are epoxy filled. Infi-Seal™ or RTV seals shall **not** be used.
9. If elements are abrasive cut, then burrs shall be cleaned and particulates flushed out of the element before proceeding with manufacturing of the heater element.
10. Power wire connections shall be located on the buss bar and separate from the element connections. If power is connected directly to the elements, then there is a possibility that tightening the power connection could damage the cold pin.

11. Standoff terminal enclosures shall be provided if the process temperature nearest the heater head exceeds 300°F. If the heater flange temperature equals or exceeds 1000°F, then, in addition to a standoff terminal enclosure, external radiant heat shield(s) shall be provided. Internal radiant heat shield(s) shall be provided if the film temperature exceeds 1200°F under any flow conditions. Standoff terminal enclosures shall be heater-rod-in-tube type.
12. Heaters with general purpose and moisture resistant enclosures shall be UL Listed and CSA certified. Heaters with explosion resistant enclosures shall be CSA NRTL/C certified.

5.2.3 Heater vessel:

1. The heater vessel shall be designed in accordance with ASME Section VIII, Div. 1. The heater vessel shall be hydro-tested in accordance with ASME Section VIII guidelines.
2. The maximum heater vessel wall temperature shall be calculated and shown on the vendor datasheet.
3. Material selection, unless otherwise stated shall follow this chart. The design temperature is the design temperature on the heater vessel. This is the vessel body design temperature.

Carbon Steel	Design Temperature less than 750°F
304/304L Stainless Steel	Design Temperature less than 1000°F
1-¼ Chrom ½ Moly	Design Temperature less than 1150°F
304H Stainless Steel	Design Temperature greater than 1150°F

4. The inlet and outlet velocities of the heater vessel shall not exceed the ratings specified in TEMA Eighth Edition. Impingement baffles may not be used.
5. ρv^2 shall not exceed TEMA R specification.
6. Dimensional tolerances shall be in accordance with TEMA R specification.
7. Vessel corrosion allowance shall be a minimum of 1/16th of an inch.

5.2.4 Heater control panel:

1. Heater control panel shall exceed NEC Article 424.73 safety requirements for electric boilers. At least two separate means of over temperature protection shall be utilized. Zero SCR output is not an acceptable means of over temperature protection.

- Temperature control shall be with a low-select style, logic control system. The process variable is continuously fed to the process temperature controller (TC1). The sheath film temperature is continuously sent to the sheath temperature controller (TC2). A low select relay sends the lowest of the two controller outputs to the silicon controlled rectifier (SCR), which controls the power to the heater bundle.

This design offers several benefits:

- continuously senses and regulates the film temperature.
- allows the heater to operate in standby mode.
- provides an additional safety point.

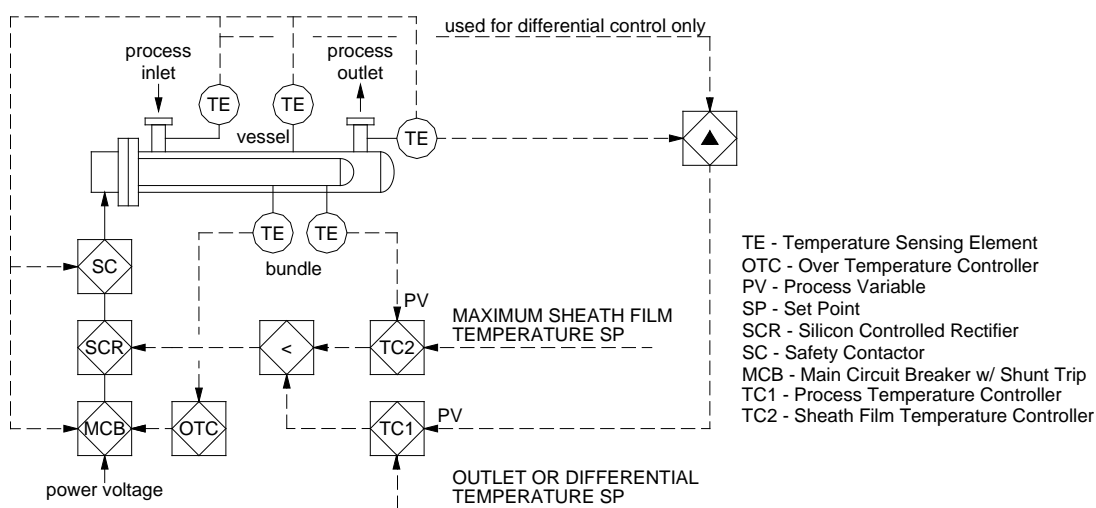


Figure 1

- TC2 controls the sheath film temperature limit. If flow were to stop the film temperature shall be controlled at this limit. The over temperature controller shall be set at a higher temperature. The high temperature limit can be determined from the heater performance curve.
- Remote reset of over-temperature controller shall **NOT** be allowed. If an over-temperature situation should occur, the operator shall be forced to go to the control panel to reset the heater. This will prevent the operator from over-riding the over-temperature control.
- Heater control panel shall be either **variable** (full SCR) control. **Synchronous** (Stepper / SCR) or **Block** (Multiple contactors only) control is not allowed unless there are independent and separate over temperature control shutdowns for the first on / last off stepper circuit and the SCR circuit. Figure 1 does not apply to blocked nor synchronous control.
- Heater control panel shall allow for continuous detection of welded magnetic contactors.
- Heater control panel shall have finger-safe protection.

8. Heater control panel shall have a main circuit breaker. The main circuit breaker shall have a under-voltage trip. The purpose of the circuit breaker is to allow one additional means to stop power to the heater bundle for safety.
9. Heater control panel shall have a **flange-mounted** disconnect switch, except for NEMA 4/7 control panel enclosures. NEMA 4/7 control panel enclosures shall use a through-the-door disconnect.
10. Heater control panel shall use wall mounted heat sinks for SCRs. Water cooling of SCRs is not allowed.
11. Heater control panel shall have inlet (for differential control), outlet, film, and vessel wall temperature sensing and display.
12. If the heater control panel has multiple circuits and an SCR short occurs, the control panel will open the magnetic contactor on that circuit and send a common alarm signal. The control panel will continue to function without the failed circuit.
13. The number one circuit shall have the over-temperature sensor. The over-temperature controller shall always be connected to the number one circuit. If the number one circuit is shorted, then power shall be disconnected by the main circuit breaker and the magnetic contactors.
14. Multiple circuit heaters shall incorporate a **Load Management** system designed such that full power is not required for high turndowns. Sequential circuit ramp-up shall not be used as a Load Management system.
15. Heater control panel shall meet or exceed the KAIC rating **specified** on the data sheet. The Vendor shall state the KAIC rating of the control panel.
16. Short circuit protection fuses shall have $I^2 T$ rating.
17. SCR shall be zero crossover fired (burst firing). The system shall have SCR short circuit detection and alarm capability.

18. Cause and Effect chart

Cause	Effect		
	Common Alarm Relay and Panel Light	Safety Magnetic Contactors Open	Trip Main Circuit Breaker
IntegraControl film temperature warning	Yes	No	No
IntegraControl vessel temperature warning	Yes	No	No
Shorted SCR (#2 thru #15)	Yes	Yes – just for the shorted SCR circuit	No
Shorted SCR #1	Yes	Yes	Yes
IntegraControl film temperature high	Yes	Yes	No
IntegraControl vessel temperature high	Yes	Yes	No
Over temperature controller high	Yes	Yes	Yes
Welded safety magnetic contactor	Yes	Yes	Yes

5.2.5 Power conduit and wiring:

1. Conduit seals shall be provided even if the area classification is non-hazardous. Seals shall be clearly marked as “UNFILLED” prior to shipment to jobsite.
2. The heater bundle shall be grounded to the heater control panel.
3. Power wiring shall be Prestolite P.G. 1258C power wire or equivalent.
4. Conduit shall be rigid, galvanized steel and UL approved.

5.2.6 Instrument conduit and wiring:

1. Conduit seals shall be provided even if the area classification is non-hazardous. Seals shall be clearly marked as “UNFILLED” prior to shipment to jobsite.

5.2.7 Options:

1. **Hydrocarbon and Water Dew Point Control (for gas applications)** – The process outlet temperature can be adjusted automatically using dew-point control. This option would allow the user to enter the desired amount of superheat at the heater outlet.
2. **Class 1, Div. 2 Control Panel** - If the heater control panel is going into a Class 1, Div. 2 area such as a fuel gas application, select this option. If the heater control panel is remote mounted in an air conditioned room or locally mounted in a non-hazardous area, do not select this option.
3. **NEMA 4X Control Panel** - Standard IntegraHeat panel rating is NEMA 4. NEMA 4X offers corrosion resistance per NEMA.
4. **NEMA 7 Control Panel** - NEMA 7 is rated for Class 1, Div. 2, Group CD and Class 1, Div. 1 Group CD hazardous areas. For large sizes, a Z-purge NEMA 4 panel is more economical, however, a Z-purge requires an air supply.
5. **65KAIC Control Panel** - Standard IntegraHeat kilo-amps interrupting capacity (KAIC) ratings are: 0-125 Amp -- 18 KAIC, 126-600 Amp - 35 KAIC, 601-800 Amp - 50 KAIC. This option will increase any IntegraHeat panel to 65 KAIC.
6. **UL508A Control Panel** - IntegraHeat control panels comply with NEC code and use UL/CSA rated components. There is no difference between a UL listed panel and a non-UL listed panel except for the UL certificate placed on the outside of the control panel. Sometimes this reduces the amount of 3rd party inspection.
7. **Ground Fault Relay** – This option would provide ground fault protection in the control panel.
8. **Local Alarm** - Occasionally someone wants a local alarm beacon and horn. Select this option if that is a requirement for your application.
9. **Meter Set** - This is a nice feature if you have to trouble shoot your electric process heater. Instead of opening the panel and taking measurements of the voltage and amperage, these meters show the current values on the outside of the front door.
10. **Control Panel Space Heater** - If the enclosure is to be mounted outdoors, this is a good option to prevent water condensation inside of the control panel on cold mornings.
11. **Heater Terminal Housing Space Heater** - This option helps prevent water condensation inside of the heater terminal housing. It is strongly recommended for electric process heaters in intermittent service.
12. **Low Flow Switch** - An IFS feature that detects a stop of process flow. This feature will cut power before an over-temperature situation occurs
13. **Pressure Switch** - An IFS feature that detects process leakage in the terminal enclosure.

14. **Stand-Off Heater Terminal Housing** - If your application is a high temperature application where the process temperature nearest the heater terminal enclosure exceeds 300° F, then select the stand off terminal housing. It will help keep the wires inside of the terminal housing below their rated temperatures. If your inlet is low temperature and near the heater flange, then a stand-off terminal housing may not be required.
15. **Vessel Insulation** - insulation is provided for personnel protection. Vessel Insulation will provide enough insulation for high temperature heating applications such that the outside of the insulation will comply with OSHA requirements of no greater than 140°F.
16. **Offshore Paint** - IntegraHeat has an industrial grade standard paint system. However, for offshore applications where salt and water are always present, a special 3-coat paint system is required.

5.3 PIPING, VALVES AND FITTINGS

1. All piping, fittings, valves and accessories shall be designed, furnished, fabricated and installed in accordance with ANSI B31.1 and B31.3.
2. All skid interface connections, with the exception of the skid drain, shall be flanged.
3. Flanged connections shall terminate in a true horizontal or vertical plane. Bolt holes shall straddle the flange centerlines.

5.4 EQUIPMENT SKID

1. The skids shall be constructed of ASTM A-36 carbon steel structural members. All skids shall be designed, fabricated and shop assembled to mount and support the electric process heaters, piping, valves, accessories, instruments and controls.
2. Each skid shall be furnished with lifting lugs to allow the skid to be safely and efficiently handled, shipped, hoisted and installed.

5.5 INSTRUMENT AND CONTROLS

1. Process and over temperature sensing elements shall be of the same type. Type 'k' ungrounded is recommended for it's corrosion resistance and the ability to sense and report temperatures up to 1600°F.
2. All instruments shall be tagged with the Purchaser's instrument tag number using a stainless steel plate. Tag number characters shall be 3/8 inch in height. Instrument tag shall be fastened to the instrument with stainless steel wire. The tag shall be attached so that it can be read after the instrument is mounted, without removing covers or accessories.
3. Vendor shall provide ISA type data sheets for all Vendor supplied instruments. Data sheets shall be provided complete, including as a minimum, Vendor, model number, design and operating data, setpoints, calibrated range, Purchaser's tag number, and service description.

4. All instrumentation and controls shall be located to provide easy access for calibration and maintenance.
5. Skid mounted instruments shall be shop wired by the Vendor to the local control panel.

5.6 ELECTRICAL REQUIREMENTS

1. One common power supply for electric process heaters will be provided and all control panel power requirements, including space heaters, will be derived from this.
2. Electrical equipment furnished by the Vendor shall include provisions for equipment installation and interconnection of power and instrumentation cabling by the Purchaser.
3. Cluster LED's shall be used on pilot lamps.

5.7 STRUCTURAL REQUIREMENTS

1. All equipment and components, including required anchorage to supporting structures and foundations, shall be designed to withstand applicable Dead, Live, Operating and Environmental (Snow, Wind and Seismic) loads in accordance with the referenced codes and standards.
2. Vendor shall provide equipment Dead, Live, Operating. Wind and Seismic loads for use by the foundation designer.
3. Snow, Wind and Seismic loads shall be determined in accordance with the codes and the site specific requirements listed in the Engineering Requisition Section V "General Information".
4. Vendor shall provide bolt locations.

6 TESTING

6.1 SHOP TESTS:

1. All components shall be checked for correct location in accordance with the applicable drawings and that they are properly mounted, secured and labeled. All wiring shall be inspected for proper insulation and that it is routed, bundled and tie-wrapped in a neat, workman-like manner and that all wiring is identified.
2. All testing results shall be submitted for the Purchaser's file
3. Factory Acceptance Testing – The factory acceptance test (FAT) shall include megger check, continuity check, power check, I/O check, loop check, and a logic check. The results of the test shall be documented on a VENDOR supplied Factory Acceptance Test (FAT) form.

7 SPARE PARTS

Along with the equipment specified, the Vendor is required to provide recommended spare parts, and individual prices for the recommended spare parts in the proposal.

8 GUARANTEES

The Vendor shall guarantee the performance of the equipment furnished to provide the power equal to or greater than that required by this specification, pressure drop equal to or less than that required by this specification, and film temperature equal to or less than that required by this specification.

9 CLEANING AND PAINTING

1. Cleaning of surfaces which are not to be painted or coated shall be done according to the Seller's recommended practice.

Standard paint for Skid and Vessel: SSPC 10 with (2) coats of Sherwin-Williams KEM® Hi-Temp Coatings No. 850 Series. Vessel paint shall be good to 850°F.

Standard paint for OEM Equipment: Vendor Standard.

2. All cleaning operations shall be conducted such that stainless steel and nickel alloys are not contaminated with lead, copper, mercury, and/or other low melting point metals; chlorides, sulfur, halogens, as well as ferritic steel materials.
3. Machined or mating surfaces as well as pipe and components shall be free of rust.
4. Abrasive blasting of non-corrosion resistant materials shall be in accordance with SSPC-SP10.
5. All internal surfaces shall be cleaned of all particulate contaminants such as sand, metal chips, weld slag, etc. Additionally, the surface shall be free of organic contaminants such as oils, paint, and preservatives as determined by a visual examination.
6. All heater surfaces are shall be dry before equipment is packaged for shipment.
7. Welded stainless steel and nickel alloys which are not solution annealed after completion of all welding, as well as hardened low- or high-ally steels, shall not be acid pickled.

10 PACKAGING AND SHIPPING

1. Electric process heater systems and all accessories shall be protected against possible damage during shipping, receiving, storing, and handling.
2. The Vendor shall ship equipment in the fewest number of sections feasible. Each section shall be securely anchored in a weatherproof crate or on a skid; cushioning shall be provided as required.

3. Each pipe opening shall be sealed with a plywood or Masonite closure, which will protect the opening, e.g. flange faces, from damage and not contaminate the internal surfaces during shipment and storage. Cloth is not an acceptable closure material. All threaded pipe ends shall be capped or plugged.
4. Each package, skid, box, and crate shall include one complete set of drawings.
5. Desiccant shall be placed in the heater terminal enclosure unless a nitrogen purge is shipped with the system.

11 MARKING AND IDENTIFICATION

1. Each package, skid, box, and crate shall be marked on the outside with the following information so that it is readily visible:
 - a. Purchasers name and address.
 - b. The Purchaser's Purchase Order number.
 - c. Any special instructions for handling.
 - d. Shipping weight, and weight lift points or the center of gravity.
 - e. The Purchaser's equipment tag number.
2. A corrosion-resistant nameplate shall be attached to each heater system in a clearly visible, easily accessible location. The nameplate shall be stamped with the following information:
 - a. Name of equipment.
 - b. Vendor's name.
 - c. Vendor's model number.
 - d. Vendor's shop order number.
 - e. Vendor's serial number.
 - f. Date of manufacture.
 - g. Purchaser's equipment tag number.
 - h. Service.
 - i. Design duty
 - j. Maximum pressure drop
 - k. Maximum film temperature
 - l. Estimated heater life
 - m. Inlet / Outlet nozzle location
3. The direction of flow shall be permanently marked on the electric process heater vessel in a location visible when in the installed position.

END OF SPECIFICATION