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NATIONAL IRANIAN OIL REFINING & DISTRIBUTION COMPANY
NATIONAL IRANIAN OIL ENGINEERING
& CONSTRUCTION COMPANY

NIOEC SP

NIOEC SPECIFICATION FOR PROCESS REQUIREMENTS OF CAUSTIC AND CHEMICAL SYSTEMS

THIRD EDITION

June 2015

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IN THE NAME OF GOD**FOREWORD**

By their very nature, technical Specifications are continuously subject to modifications and revisions. To strengthen their merit and usefulness, continuous improvements, addendum, deletion of disparate information and consequently provision of updated revisions are to be made in order to ascertain that such Specifications meet the current requirements, inclusive of Iranian Petroleum Standards (IPS) and the recognized and acceptable national and international Standards, as well as the optimal codes and practices based on the accumulated in-house know-how and plant knowledge and experiences. However, in reality, due to several reasons, not to mention the complexity of the matter, the ultimate goal of continuous direct embedment of the required changes on the relevant Specifications may be far reaching. Therefore, in the interim periods between the officially issued revisions, the required changes will appear in other documents related to the engineering and design work of the on going projects.

In response to the initiative of the Design and Engineering Directorate, and considering that the task of the execution of several important and mega projects for the realization of the new oil refineries, pipelines and oil terminals as well as improvements of the existing facilities, has been assigned to NIOEC, it was decided to update the NIOEC Specifications and to issue new official revisions.

The Design and Engineering Directorate was itself entrusted to carry out this important task, and as such by forming several special technical committees, working in close co-operation and cohesion and sharing their expertise and knowledge, the updated and revised NIOEC Specifications were successfully prepared and complied.

These Specifications are intended to be used for Oil Refineries, Distribution Depots, Oil Terminals, Pipelines and Pump Stations within NIOEC's projects, and have been proven to be of high value for such purposes. It must however be appreciated that these Specifications represent the minimum requirements and should in no way be interpreted as a restriction on the use of better procedures, engineering and design practices or materials.

We encourage and highly appreciate the users and other clear sighted and experts to send their comments on the Specifications to the Design and Engineering Director of NIOEC for evaluation and approval.

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NOTES:

- 1) THIS SHEET IS A RECORD OF ALL REVISIONS TO THIS SPECIFICATION.
- 2) WHEN APPROVED EACH REVISION SHALL BE CONSIDERED AS A PART OF THE ORIGINAL DOCUMENT.
- 3) NUMBER OF PAGES EXCLUDES THIS SHEET AND THE COVER SHEET.

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2	June, 2015	A .HAMIDI	M.H.MANSHADI	M.KAREGAR NAJAFI	A.ARMAN MOGHADAM
1	December, 2009		M.A.A.SAJEDI	M.R.FARZAM	
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INTRODUCTION

To satisfy the requirements of this NIOEC Specification, Iranian Petroleum Standard IPS-E-PR-492 (Aug. 2006) with the modifications as specified herein after shall be strictly followed.

Articles 1 through 5 of this document replace entirely the related articles in the referenced IPS Standard.

1. SCOPE

This NIOEC Specification set forth the content and the extent of the minimum process and control system requirements of "Fresh & Spent Caustic Units" and "Chemical Injection Systems".

For design of any equipment inside the subject Units / Systems, reference shall be made to the relevant NIOEC Specification.

This Specification consists of two parts as described below:

Part I: Process Requirements of Fresh & Spent Caustic Units.

Part II: Process Requirements of Chemical Injection Systems.

Deviations from this Specification will only be permitted on obtaining written approval from NIOEC.

Resolution on cases not explicitly stipulated in this Specification, or on cases where conflicts may arise among the requirements of the referenced/relevant IPS and the international standards, shall be made through written consent and approval of NIOEC.

2. REFERENCES

The following standards, codes, and specifications, to the extent specified hereinafter, shall constitute a part of this NIOEC Specification. Latest edition of the undated referenced documents and the cited edition of the dated references shall apply. The applicability of changes made to the dated references, after the cited date shall be mutually agreed upon between NIOEC and the vendor/contractor.

API (AMERICAN PETROLEUM INSTITUTE)

API Std. 650	"Welded Steel Tanks or Oil Storage"
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ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)

ASME B 16.5	"Pipe Flanges and Flanged Fittings, NPS 1/2 through NPS 24"
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IPS (IRANIAN PETROLEUM STANDARD)

IPS-E-GN-100	"Engineering Standard for Units"
IPS-E-PR-492	"Engineering Standard for Process Requirements of Caustic and Chemical Systems"

NACE (NATIONAL ASSOCIATION OF CORROSION ENGINEERS)

TPC Publication 1

"Cooling Water Treatment Manual"

NIOEC- SP (NIOEC SPECIFICATIONS)

NIOEC-SP-00-10

"NIOEC Specification for Units"

2.1. Equivalent to IPS Standards

Substitute the following IPS Standards as referred to throughout IPS-E-PR-492 to relevant NIOEC's Specifications as follows:

<u>IPS Standard</u>	<u>Relevant NIOEC Specification</u>
IPS-E-GN-100	NIOEC-SP-00-10

3. UNITS

International system of units (SI) shall be used in accordance with NIOEC-SP-00-10, unless otherwise specified.

4. DEFINITION & TERMINOLOGY**4.1. Back Pressure**

- a) The pressure on the outlet or downstream side of a flowing system.
- b) In an engine, the pressure which acts adversely against the piston, causing loss of power.

4.2. Controlled

Volume Pump

A controlled-volume pump is a reciprocating pump in which precise volume control is provided by varying effective stroke length. Such pumps also are known as proportioning, chemical injection, or metering pumps.

- 1) In a packed-plunger pump, the process fluid is in direct contact with the plunger.
- 2) In a diaphragm pump, the process fluid is isolated from the plunger by means of a hydraulically actuated flat or shaped diaphragm.

4.3. Inhibitor

A substance, the presence of which in small amounts, in a petroleum product prevents or retards undesirable chemical changes from taking place in the product, or in the condition of the equipment in which the product is used. In general, the essential function of inhibitors is to prevent or retard oxidation or corrosion.

4.4. Multiple Feed

Multiple feed is the combination of two or more pumping elements with a common driver.

4.5. Slurry

A free - flowing mixture of solids and liquid.

4.6. Softening

The process of removing calcium and magnesium ions from water.

5. SYMBOLS & ABBREVIATIONS

DN: Diameter Nominal.

DP: Differential Pressure.

F: Flow.

ID: Inside Diameter.

KO: Knock-Out.

LP: Low Pressure.

LPG: Liquefied Petroleum Gas.

NPSH: Net Positive Suction Head.

PPM: Parts Per Million.

PC: Pressure Controller.

PIC: Pressure Indicator Controller.

TC: Temperature Controller.

TI: Temperature Indicator Controller.

TPC: Technical Practices Committee.

6. ADDENDUM TO IPS-E-PR-492

This addendum revises the below listed articles of IPS-E-PR-492 as follows:

6.1. Design requirements (Addition)

6.1.2.12. In case of using caustic dissolving unit the Caustic Soda System consists of Bag Cutting Machine, Conveyor System, Caustic Soda Dissolving Pit, Caustic Soda Cooler, 50% wt Caustic Soda Storage Tank, Diluted Caustic Tank, transfer pumps and all piping required delivering the caustic soda to the Refinery users.

6.1.2.13. In case of using caustic dissolving unit the imported solid caustic soda inventory shall be sufficient for two-three months of operation.

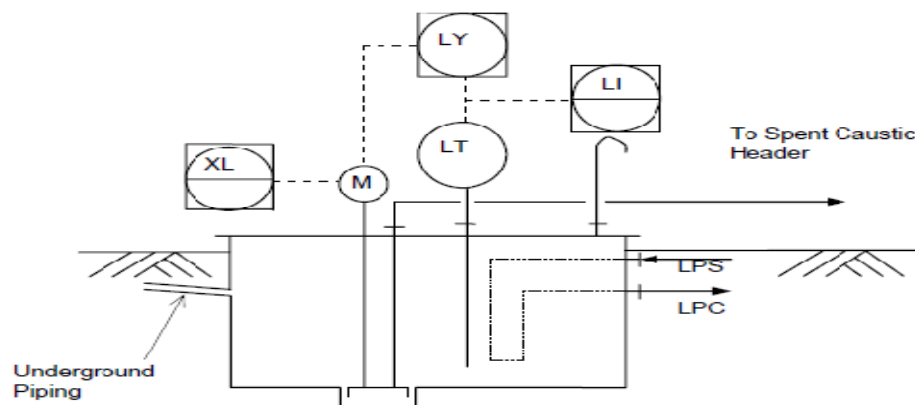
6.1.2.14. The homogenization of solution in the tank may be conducted by recirculation from pump to tank.

6.1.2.15. Caustic soda preparation and storage area shall be bonded, protected with caustic resistant lining and drained into the neutralization basin.

6.1.2.16. Safety shower and Eye-Bath shall be provided.

6.1.2.17. Caustic Sump Pit:

Caustic Sump Pit consisting of sump pit, submerged pump and underground piping shall be provided in areas where caustic solution is used during normal operation. Spent caustic drained out into sump pit is pumped up by submerged pump and routed to spent caustic header. Typical configurations of Caustic Sump Pit are as follows:



6.2. Spent Caustic Treatment and Regeneration (Addition)

The requirement of caustic regeneration system shall be studied by Contractor and agreed by NIOEC.

7. CHEMICAL INJECTION SYSTEMS (Addition)

A variety of methods are used for injecting chemicals into process systems. The most common type of equipment comprises a suitable mixing or dilution tank with an agitator for preparation of the solution. The injection pump takes suction directly from the tank and feeds the injection chemical into the process stream. Variable capacity proportioning pumps are usually specified. If several injection points have to be supplied simultaneously with the same chemical a multi-headed pump may be used, each head having a variable capacity which may be reset automatically or manually.

7.1. Dosing Facilities (All Systems) (Addition)

Local bulk chemical storage tanks should be sized on the basis of:

- Chemical consumption rates.
- Chemical availability, economical load size and delivery frequency.

Consideration shall be given to provision of containing bunds or other means of spill containment. This is particularly the case if the chemicals concerned are corrosive (e.g. acid) or toxic (e.g. biocides).

Chemical dosing pumps shall be provided with simple on-line delivery rate adjustment.

Safety showers of an approved pattern with eyewash facilities shall be readily accessible from, or specifically provided at, each chemical dosing preparation area.

Safety showers of an approved pattern with eyewash facilities shall be readily accessible from, or specifically provided at, each chemical dosing preparation area.

Where chlorine is dosed from a liquid gas unit, additional strict safety procedures shall be established. Automatic leak detectors and alarms shall be provided where there is a risk of leakage of chlorine gas (e.g. storage room and/or gas supply pipe work to chlorinator). Emergency self-contained breathing apparatus shall be readily available.

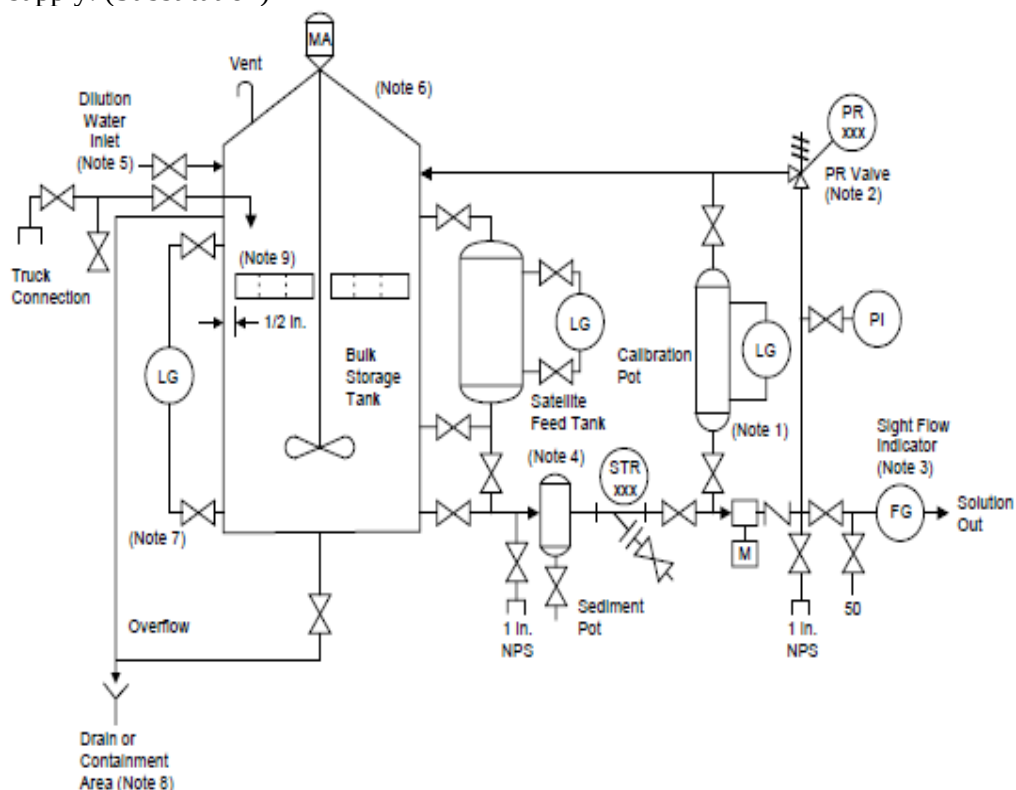
Since, many of the dosing chemicals contain components which may significantly affect site effluent discharge permits if spills occur. Adequate facilities for containment of spills shall be provided.

7.2. Miscellaneous feeders (Modification)

a) Chlorine feeders (Chlorinator) (Substitution)

Several proprietary units for dosing chlorine are available from specialist vendors. The most common type, for chlorine gas is the V-notch chlorinator, which is supplied with liquid chlorine from a cylinder or drum. Essential components include drum handling equipment, chlorine leak detectors and alarms and a water spray system which is commissioned automatically in the event of a leak being detected. The dosing equipment consists essentially of a chlorine vaporizer and regulating system for preparing a strong chlorine solution which is fed into the main stream using a suitable distributor. The equipment is installed in a weather-proof housing. The water jet eductor uses the kinetic energy of water under pressure to entrain chlorine gas, mix the two and discharge mixture to water in flow line or in a treating basin. Chlorine shall not flow if a vacuum is not produced. If hypochlorite solutions are to be used, pumps and shot feeders can be used.

7.2.7.1. Fig. 6 shows the equipment, piping and auxiliaries to be included in the Vendor's scope of supply. (Substitution)



Notes:

- (1) Gage glass or equivalent with calibrated gage board.
- (2) PR Valve to be furnished even when built-in relief valves are provided with pumps. Set pressure to be a minimum of 10% above the operating pressure at the pump discharge, or 10% above the process equipment design pressure whichever is greater.
- (3) Sight flow Indicator with flapper.
- (4) Satellite feed tank required when chemical mixing and storage are done in the same tank. The satellite tank is used when the main tank is being used for preparing new batch requiring over 4 hrs. preparation time.
- (5) Dilution water connection as required for diluting chemical strength used.
- (6) Method of chemical addition and tank top arrangement shall be selected to suit chemicals to be used and to meet local safety and environmental regulations.
- (7) Gage glass not required if tank is constructed of transparent plastic.
- (8) Drain shall be visible from dilution water inlet line.
- (9) Fixed cover and nitrogen purge, floating cover, or plastic balls required for sulfite and hydrazine.

7.3.4. Instrumentation and Control (Modification)**b) Instruments (Substitution)**

As part of his bid the vendor shall identify all recommended local indicators, control panel indications, control panel alarms and automatic shutdowns that he considers necessary to monitor the performance of the package and to provide adequate protection of the equipment.

The instrumentation shall include, but not be limited to the following:

- 1) Local level indicators on all tanks.
- 2) Low-level sensor that will initiate an alarm on the control panel.
- 3) Measurement of charge (as required).

7.3.5. Mechanical**a) Chemical tanks (Addition)**

- 4) The nett capacity of each tank shall normally be identified in the data sheets. In the absence of this information the nett capacity shall be sufficient for 30 hours operation at the maximum dosing rate.
- 5) The design and location of the tanks shall be such as to satisfy the dosing pumps NPSH requirements under all operating conditions.
- 6) All tanks shall be provided with a blanked valved drain connection. The drain shall terminate at an easily accessible location.
- 7) The filling connection on each tank shall be flanged. Any requirement for a filling funnel for filling from drums is identified in the data sheets.

b) Pumps (Addition)

- 8) A pressure relief valve should be provided downstream of each pump system even if built-in relief valves are provided with the pumps. The set pressure is to be 10% above the operating pressure at the pump discharge or 10% above the process equipment design pressure, whichever is greater.

7.6.1. SCOPE OF SUPPLY (Substitution)

The systems shall consist of, but not be limited to the following items within the battery limit showing on P&I Diagrams:

- 7.6.1.1.** One (1) packaged Chemical Feed Systems as outlined by the process and mechanical conditions hereunder. This system shall be shop assembled as much as possible and skid-mounted complete with chemical solution tank, tank level gauge, mixer, diaphragm and plunger chemical feed pump, piping, dosing device complete necessary accessories and instruments for proper operation and anchor bolts and nuts.
- 7.6.1.2.** This system shall be painted, lined, skid-mounted and pretested at Vendor's shop so that it shall be shipped to site ready to operate.
- 7.6.1.3.** The equipment supplied by Vendor shall be in compliance with the requirements of the standards/specifications mentioned in this Specification. Nevertheless, this should not prevent the Vendor from offering their equivalent standard products. However, any deviation from the specified standards/specifications should be clearly indicated and separately listed in the quotation.

- 7.6.1.4. All the equipment shall be designed, manufactured, assembled and tested in accordance with the applicable requirements of the latest editions/revisions (the one in effect at the time the requisition is issued) of codes, standards, specifications and references as mentioned throughout this Specification.
- 7.6.1.5. Where cold climate conditions apply (ambient temperatures below zero oC), Vendor shall select lining materials upon taking into account that this system suffer cold temperature in transportation and site storage during construction stage.
- 7.6.1.6. The overall design shall recognise that where the package contains dosing facilities for more than one chemical and where the chemicals require dilution there is a possibility of contamination of one chemical by another and that spillage/leakage of one chemical could affect the facilities of another. The design therefore, shall minimise the potential for contamination etc. and recognise that there may be a high level of operator involvement in the operation of the dosing facilities.
- 7.6.1.7. The vendor shall co-ordinate the design and ensure the satisfactory functioning of the complete package, i.e. tanks, dosing pumps and, if applicable, controls and other ancillaries. In cases where the vendor supplies equipment that he has not manufactured, the vendor shall ensure that the designs of these are compatible with each other and with his own equipment in all respects. The satisfactory functioning of the complete package shall form part of the vendor's guarantee.
- 7.6.1.8. The location of the package and the applicable hazardous area classification will be specified by the Purchaser. The package shall comply in all respects with the requirements of the specified classification.
- 7.6.1.9. In general, chemicals which crystallise or drop below their pour point in their undiluted state at the specified minimum ambient temperature should not be used, because they are usually transported in unheated Intermediate Bulk Containers.
- 7.6.1.10. If any chemicals become unpumpable or ineffective (either due to falling below their pour point or crystallisation point) at the specified minimum ambient temperature, the tank shall be lagged and either heat-traced or fitted with an immersion heater. The pipework and instrumentation shall be heat traced and insulated. Heating design shall not exceed a surface contact temperature that may cause thermal degradation of the treatment chemical.
- 7.6.1.11. Special considerations should be made for certain operating environments, e.g. ambient temperatures or black body temperatures in hot climates can reach in excess of 80 °C which may over time, together with strong sunlight, affect non metallic components and chemical stability. The need for additional precautions should be considered for pump electric motors. The Principal's Production Chemistry department shall be contacted to determine any specific chemical requirements. In these circumstances chemical storage tanks shall be provided with appropriate protection from direct sunlight and excessive heat build-up.

7.6.2.1. Mixing tanks (Addition)

- d) All welds in process wetted parts shall be full penetrating.

7.6.2.2. Mixers (Addition)

- c) All wetted parts shall be stainless steel.

7.6.2.3. Pumps (Substitution)

- a) Chemical injection pumps shall be positive displacement pumps and shall be in accordance with NIOEC-SP-46-03. The pumps should lie within the Manufacturer's actual field experience of operating temperature, maximum working pressure, material of construction, pump speed and pumped liquid properties. Diaphragm pumps with direct mechanical actuation shall not be used except others specified by EMPLOYER.
- b) Single-head, air driven positive displacement plunger pumps with manual capacity adjustment may be used, but electrically driven single-head pumps are preferred (especially if little or no compressed air is available).
- c) The pump Manufacturer shall specify the lowest capacity that is achievable without sacrificing pump performance. The lowest required chemical injection rate shall not be less than this minimum pump capacity.
- d) Multi-head pumps are common where space is restricted, i.e. offshore. Multi-head pumps should not be used unless the capacity can be adjusted per head to suit the requirements of each individual injection point.
- e) The pump suction line shall be equipped with a block valve, a Y-type strainer with suitably sized mesh screen for specified fluid cleanliness (unless fluid properties prevent it) and an integral drain valve. It shall also have a valved connection with hose connector for flushing
- f) The pump with suitable fluid, e.g., potable water, prior to removal. The flushing connection should also be used for connection to the calibration gauge, if required.
- g) Accessories shall include suction and discharge valves, check valve on the discharge, coupling guard, floor stand, back pressure valve and adjustable stainless steel relief valve and strainer.

7.6.2.7. Piping (Addition)

Tie-in connections to Purchaser shall be flanged per ANSI Standard. Purchaser reserves the right to change the location of the tie-in.

7.6.2.8. Electrical and Instrumentation (Addition)**7.6.2.8.1. Area Classification**

The System is to be installed outdoors (except otherwise specified) area where is hazardous area, except otherwise noted on the data sheet.

7.6.2.8.2. Electric Motors

Electric motors shall be in accordance with NIOEC Specification NIOEC-SP-3339-60-02, - Electric Motors.

7.6.2.8.3. Instruments

All instruments shall be tagged with identifying tag numbers which are assigned by Purchaser at time of drawing approval. Stainless steel nameplates shall be furnished stamped or engraved with this tag number and permanently mounted with stainless steel drive screws.

7.6.3. Guarantee (to be deleted)

7.7. Guarantee (Addition)

Vendor shall guarantee the following when the equipment is operated in accordance with the written operating instructions.

7.7.1. Equipment size and capacity under conditions given in this specification.

7.7.2. Equipment is free from fault in design, workmanship and material to fulfill satisfactorily the operating conditions specified.

7.8. Painting and Lining (Addition)

All equipment and materials shall be surface-prepared and painted up to and including finish in accordance with NIOEC Specification NIOEC-SP-80-02 "Painting", and shall be lined in accordance with NIOEC Specification NIOEC-SP-80-05 "Internal Epoxy Tank Lining" if applicable.

7.9. Noise Level (Addition)

The Vendor shall state in his enquiry the consideration included in his design to meet the noise requirements specified herein.

"In no case, the noise (sound) level of each completed equipment or package system covered by this Specification shall exceed 90 dBA measured at one meter distance from the package and/or equipment.

7.10. Loading Data (Addition)

7.10.1. The loading data supplied by the Vendor shall include enough data for the Purchaser to design and construct the supporting structures and/or concrete foundations for the equipment supplied by the Vendor, as well as the data for erection and installation purposes.

7.10.2. Loading data shall be exact, neither short nor conservative, and indicate at least the following data including dimension (m or mm) and weight (ton or kg).

- (1) Equipment skeleton showing gross dimensions and elevations for Purchaser to understand the conditions of loading.
- (2) Locations, elevations and dimensions for base plates of legs or posts.
- (3) Locations, sizes, numbers and required project lengths of anchor bolts or setting bolts.
- (4) Static weight and load in total, and per each leg or post if weight per each leg or post is different from the other.
 - a. Erection weight,
 - b. Operation dry weight (empty weight out of operation),
 - c. Operation weight.
- (5) Dynamic effects due to operation, if any, on supporting structures and/or foundations.
- (6) Wind load in total and per each leg or post if wind load per each leg or post is different from the other.
- (7) Test weight under full water test if the equipment is specified to be tested at field.

(8) Any other requirements for supporting structures and/or foundations if it is deemed necessary by the Vendor.

7.10.3. The Vendor shall also submit supporting calculations showing that the above loading data are exact, neither short nor conservative, any time when the Purchaser requests.

7.11. Inspection and Testing (Addition)

7.11.1. Inspection

Purchaser and/or NIOC's representatives shall have the right to inspect the equipment during fabrication and assembly, on 48 hours notice to Vendor. Inspection may include drawings, materials, parts, all shop processes, and assembly.

7.11.2. Shop Tests

7.11.2.1. All piped assemblies or subassemblies shall be pressure tested to at least twice the working pressure.

7.11.2.2. Performance Test

Performance Test shall be conducted at Vendor's shop with water and at the time of plant start-up with Vendor's representative at the site, if necessary. In the event equipment or auxiliaries fail to meet or exceed the specified performance, vendor shall make whatever changes are necessary to meet the specified performance.

7.12. Preparation of Shipment (Addition)

7.12.1. Temporary shipping and storage preparation:

Temporary provisions for shipping and storage (such as wrapping, crating, etc.) shall be as stated in the request for quotation and/or purchase order. Equipment will be subject to extreme temperatures and humidity during shipping and storage before installation in the permanent locations.

7.12.2. Nameplates

7.12.3. Stamped or engraved stainless steel nameplates shall be furnished and attached to each system. Nameplates shall include:

7.12.3.1. Individual system item number

7.12.3.2. Manufacturer's name and serial number or other number as applicable

7.12.3.3. Equipment size and capacity, design and operating pressure and temperature rating

7.12.3.4. Strokes per minutes (pump only)

7.13. Numbering of Equipment/Engineering Documents (Addition)

Numbering of equipment and engineering documents shall be in accordance with NIOEC-SP-00-62.

7.14. Language (Addition)

All correspondence, literature, drawings, installation manuals and any other documents related to the equipment supplied under the contract shall be in English with consistent use of metric unit (as per article 3 above). Offers in other language will not be considered.

7.15. Schedule and Progress Report (Addition)

7.15.1. The Vendor shall provide the Purchaser with a production schedule giving time of availability of production, and planned dates for testing, inspection, painting and dispatch.

7.15.2. Furthermore, the Vendor shall submit monthly progress reports to the Purchaser, which includes the following as a minimum:

- Status of detail drawings,
- Status of Purchase of materials,
- Status of production,
- Schedules of testing, inspection, and dispatch.

7.15.3. The Purchaser shall be informed of any changes in the production schedule which affect the promised delivery date.