PETROBRAS	MATERIAL REQUISITION	N°: I-RM-5250.00-22313-561-1AQ-001	
	CLIENT: REGAP - GABRIEL PASSOS REFINERY		SHEET: 1 of 15
	PROGRAM: U-0310 LOAD INCREASE		IN-5250-24-041
	AREA: U-0310 - DIESEL HYDROTREATING UNIT		
EBD REGAP/ES/PROJ	TITLE: UNSTABLE LOAD FILTER 0310-Z-03		INTERNAL
			TR/PR/EBD

REVISION INDEX

REV.	DESCRIPTION AND/OR AFFECTED PAGES
0	ORIGINAL ISSUE.
A	REGAP REVIEW. ADDED ITEM 10.1. REVISED ITENS 6,7,9,10 E 11.
B	UNCHECKED ITEMS 2.2 “MATERIALS AND SERVICES”: PRE-COMMISSIONING, SUPERVISION OF ASSEMBLY, HIRING OF PLC INTEGRATOR. ITEM 10 REVISED.

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E
DATA	05/09/2025	11/06/2026	28/10/2026			
EXECUTION	RVY2	CJR2	CJR2			
VERIFICATION	U32W	REVM	REVM			
APPROVAL	EIF5	UP70	UP70			

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1. PURPOSE OF THE REQUEST

This Material Requisition aims to provide the filtration system TAG 310-Z-03 to increase the existing filtration capacity in Unit U-310 of the PETROBRAS Gabriel Passos Refinery (REGAP).

EQUIPMENT TAG(S)	SERVICE	SPECIAL SERVICE
310-Z-03	UNSTABLE LOAD FILTER	NO

2. SCOPE OF SUPPLY

The equipment manufacturer shall supply the items marked below:

2.1- Design

- [X] Process and analytical design of the filters and filtration system
- [X] Mechanical design
- [X] Material selection
- [X] Electrical system design
- [X] Control and automation system design
- [X] Manufacturing design
- [X] Presentation of mechanical and manufacturing design for comments
- [X] Design of stairs and platforms (if required)
- [X] Sizing of anchor bolts

2.2 Materials and Services

- [X] Filter(s)
- [X] Filter element(s)
- [X] Backwash vessel(s)
- [X] Automatic valves
- [X] Manual valves
- [X] All piping and instrument interconnections within the battery limit
- [X] Relief valves (PSV) on each filter/vessel
- [X] All instrumentation required for proper system operation

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X	Junction box
X	Local electrical panel, if applicable, explosion-proof – Rating: IP-65
X	Remote control panel (PLC) installed in the CCL – Rating: IP-54 ou higher
X	Couplings and respective spark-proof guards
X	Single metal base (“skid”) with lifting lugs
X	Davit
X	Stairs and platforms for access and maintenance
X	Assembly of equipment, instruments, piping, stairs, and platforms on the metal base (“skid”)
X	Raw materials
X	Material inspection
X	Non-destructive testing
X	Equipment fabrication
X	Factory inspection and testing
X	FAT and SAT of the control panel (PLC)
X	Factory inspection and testing
X	Performance tests
X	Quality assurance
X	All instrumentation and motors suitable for the classified area
X	Stainless steel grounding lug
X	Lugs for fireproof coating supports
X	Lugs for fixing thermal insulation, stairs, platforms, and pipe supports
X	Stainless steel nameplates and their supports
X	Conditioning procedure
X	Mechanical operation test

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[X]	Heat treatment, if required
[X]	Materials for heat treatment, if required
[X]	Hydrostatic test at the factory
[X]	All materials required for factory hydrostatic testing
[X]	Blasting and primer painting (and/or intermediate and final coating, when required) of equipment, instruments, piping, motors, structure, stairs, and platforms
[X]	Accessories or spare parts (see item 3)
[X]	Packaging or preparation for transport
[X]	Performance guarantee as stated in the data sheet
[X]	Loading onto the transport vehicle
[X]	Transportation (to be quoted separately)
[ ]	Pre-commissioning (to be quoted separately)
[ ]	Supervision of assembly, including management and coordination supervision, assembly, welding, inspection, and field hydrostatic testing (to be quoted separately)
[ ]	Hiring of PLC integrator (PES) services for implementation of protection/safety logic

2.3 Items Out of Scope

[X]	Field assembly
[X]	Anchor bolts
[X]	Field hydrostatic test
[X]	Thermal insulation
[X]	Fireproof protection
[ ]	Stairs and platforms

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3. LIST OF ACCESSORIES AND/OR SPARE PARTS

The manufacturer shall supply a set of spare filter elements to be used during chemical cleaning operations.

10% of screws, nuts, and washers for the manways

200% of gaskets

4. CONDITIONS AND LOCATION FOR PROPOSAL DELIVERY

PETRONECT

5. CONDITIONS AND DELIVERY LOCATION OF THE FILTERS

REGAP – GABRIEL PASSOS REFINERY
Av. Refinaria Gabriel Passos,690
Distrito Industrial Paulo Camilo Sul – Betim MG
CEP 32669-205

6. DOCUMENTS

The documents listed below are an integral part of this Material Requisition.

DOCUMENT NO.	REV.	DESCRIPTION
FD-5250.00-22313-561-PEI-401	B	Filtro de Instáveis – 310-Z-03
EG-80-01-Regap	P	Critério de Projeto de Instrumentação
ET-0000.00-0000-972-1AL-001	E	Requisito Geral de Qualidade de Bens
ET-0000.00-0000-500-PEI-001	F	Atendimento aos Requisitos da NR-13 para Vasos de Pressão
I-ET-0000.00-0000-500-PEI-003	0	Procedure for Performing Stress Analysis by Means of Finite Element Method (FEM)
I-ET-0000.00-0000-500-PEI-004	A	Rules to Calculate Wind Loading on Equipment
I-ET-0000.00-0000-500-PEI-004	0	Maximum Allowable Loads on Pressure Vessel Nozzles

7. REFERENCE DOCUMENTS

Proposals shall fully and precisely comply with all requirements of the documents listed below, which are an integral part of this Material Requisition. Deviations or exclusions are only permitted when explicitly stated in this Material Requisition or in the attached documents. Special attention is drawn to the proposal data, which shall comply with all information contained in Standard N-266.

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DOCUMENT	REV.	TITLE
NI-2	P	ANTICORROSIVE COATING OF INDUSTRIAL EQUIPMENT
N-13	M	REVESTIMENTO ANTICORROSIVO DE EQUIPAMENTO INDUSTRIAL
N-76	J	2ª Emenda - MATERIAIS DE TUBULAÇÃO PARA INSTALAÇÕES DE REFINO E TRANSPORTE
N-133	Q	SOLDAGEM
NI-253	M	PRESSURE VESSEL DESIGN
NI-266	G	PRESENTATION OF PRESSURE VESSEL DESIGN
NI-268	H	PRESSURE VESSEL FABRICATION
NI-269	G	PRESSURE VESSEL ASSEMBLY
NI-279	G	DESIGN OF STEEL STRUCTURES
N-293	J	FABRICAÇÃO E MONTAGEM DE ESTRUTURAS METÁLICAS
N-300	D	DETALHES DE ATERRAMENTO EMPREGANDO-SE CONECTORES MECÂNICOS - REVALIDADA EM 11/2021
NI-381	M	EXECUTION OF DRAWING AND OTHER GENERAL TECHNICAL DOCUMENTS
N-550	H	PROJETO DE ISOLAMENTO TÉRMICO A ALTA TEMPERATURA
N-858	F	CONSTRUÇÃO, MONTAGEM E CONDICIONAMENTO DE INSTRUMENTAÇÃO E AUTOMAÇÃO
N-1219	H	CORES
N-1438	F	TERMINOLOGIA SOLDAGEM
N-1521	G	IDENTIFICAÇÃO DE EQUIPAMENTO INDUSTRIAL
N-1550	G	PINTURA DE ESTRUTURA METÁLICA
N-1593	H	ENSAIO NÃO DESTRUTIVO - ESTANQUEIDADE
N-1594	K	ENSAIO NÃO DESTRUTIVO - ULTRASSOM EM SOLDA
N-1595	J	1ª Emenda - ENSAIO NÃO DESTRUTIVO - RADIOGRAFIA
N-1596	J	ENSAIO NÃO DESTRUTIVO - LÍQUIDO PENETRANTE
N-1597	H	ENSAIO NÃO DESTRUTIVO VISUAL
N-1598	H	ENSAIOS NÃO DESTRUTIVOS - PARTÍCULAS MAGNÉTICAS
NI-1710	N	CODING OF TECHNICAL ENGINEERING DOCUMENTS
N-1735	H	PINTURA DE MÁQUINAS, EQUIPAMENTOS ELÉTRICOS E INSTRUMENTOS
N-1738	D	DESCONTINUIDADES DE COMPONENTES SOLDADOS, FUNDIDOS, FORJADOS E LAMINADOS
N-1862	E	PROJETO E FABRICAÇÃO DE ACESSÓRIOS INTERNOS DE VASOS, TORRES E REATORES - REVALIDADA EM 01/2024
N-1882	F	CRITÉRIOS PARA ELABORAÇÃO DE PROJETOS DE INSTRUMENTAÇÃO
N-1883	F	APRESENTAÇÃO DE PROJETO DE INSTRUMENTAÇÃO, CONTROLE E AUTOMAÇÃO
NI-2054	E	INTERNAL AND EXTERNAL ACCESSORIES FOR PRESSURE VESSELS
N-2064	D	EMISSÃO E REVISÃO DE DOCUMENTOS DE PROJETO
N-2301	F	ELABORAÇÃO DA DOCUMENTAÇÃO TÉCNICA DE SOLDAGEM
N-2314	F	ENSAIO NÃO DESTRUTIVO - ULTRASSOM EM FUNDIDO
N-2315	F	EXECUÇÃO DE ENSAIO NÃO DESTRUTIVO - ULTRASSOM EM FORJADO
N-2368	H	INSPEÇÃO, MANUTENÇÃO, CALIBRAÇÃO E TESTE DE DISPOSITIVOS DE ALÍVIO DE PRESSÃO E/OU VÁCUO
NBR-6123		FORÇAS DEVIDAS AO VENTO EM EDIFICAÇÕES: SEGUNDA EDIÇÃO 20.12.2023
NR-13	2022	NR-13 – CALDEIRAS, VASOS DE PRESSÃO, TUBULAÇÕES E TANQUES METÁLICOS DE ARMAZENAMENTO (Portaria MTP nº 4.219, de 20/12/2022)
ASME SEC.VIII DIV. 1	2025	BOILER AND PRESSURE VESSEL CODE - 2025
ASME B16.5	2025	PIPE FLANGES AND FLANGED FITTINGS - 2025
ASME B31.3	2024	PROCESS PIPING - 2024

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8. COMMENTS AND DOCUMENT APPROVAL

The filter documents shall be submitted for comments and approval.
Notes:
(1) The manufacturing of each part of the filter may only begin after the drawings and other related documents for the respective part have been returned approved without comments or with comments duly addressed.
(2) All documents shall include the filter identification in accordance with Standard N-1521.
(3) All documents shall include the filter identification, the Purchase Order number, and the Supply Authorization number corresponding to this Material Requisition.

9. REQUIRED DOCUMENTS

The required documents are listed in the table below. For quantities and deadlines for document submission, refer to the Purchase Order.
C – Physical Copy (Paper); **E** – Electronic Copy (dwg, doc, xls); **I** – Electronic Copy (PDF)

9.1 ASSEMBLED UNIT – 310-Z-03

ITEM		DESCRIPTION	QUANTITY			DEADLINE (*)			
			WITH PROPOSAL	FOR COMMENTS	CERTIFIED ORIGINALS	SUBMISSION (CONTRACT DAYS)	COMMENTS (DAYS FROM RECEIPT)	REVISION (DAYS FROM RECEIPT)	DELIVERY OF ORIGINALS (DAYS FROM APPROVAL)
9.1.1	X	Compliance declaration, as per item 10 of this Material Requisition	I						
9.1.2	X	Supply schedule	I						
9.1.3	X	Document index		I	I	20	10	10	10
9.1.4	X	Equipment catalog	I						
9.1.5	X	List of deviations from PETROBRAS specifications and related standards	I						
9.1.6	X	Load diagram on foundations with positioning of anchor bolts		I	I	45	10	10	10
9.1.7	X	Engineering flow diagram indicating scope	I	I	I	45	10	10	10

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9.1.8	X	Dimensional drawing with parts list (Proposal: preliminary drawing)	I	I	I+E	45	10	10	10
9.1.9	X	Manual valve list			I				
9.1.10	X	Piping isometric		I	I	45	10	10	10
9.1.11	X	Pipeline lists		I	I	45	10	10	10
9.1.12	X	List of special maintenance tools			I				
9.1.13	X	Mechanical operation test report		I	I	Upon completion of testing			
9.1.14	X	Performance report		I	I	Upon completion of testing			
9.1.15	X	Drawings of stairs, platforms, and pipe supports		I	I+E	45	10	10	10
9.1.16	X	Nameplate drawing		I	I+E	45	10	10	10
9.1.17	X	Packing list			I				
9.1.18	X	Shipping preparation procedure			I				
9.1.19	X	Inspection and test plan		I	I	45	10	10	10
9.1.20	X	Spare parts list for all equipment			I				
9.1.21	X	Technical documents (as per item 5.3 of N-268 – Note 2)		I	I	45	10	10	10
9.1.22	X	Manufacturing procedure for stairs and platforms (as per items 5.1.2 and 5.1.5 of NI-293) – Note 4		I	I	45	10	10	10
9.1.23	X	Field assembly procedure (as per NI-269 item 4.2) – Note 6			I				
9.1.24	X	Stress verification due to localized loads and reactions on nozzles		I	I	45	10	10	10
9.1.25	X	Displacement verification due to thermal expansion		I	I	45	10	10	10
9.1.26	X	Painting application procedure (as per N-13 item 4.2) – Note 7		I	I	45	10	10	10
9.1.27	X	Field assembly specifications (as per item 4.2 of NI-269) – Note 6		I	I	45	10	10	10
9.1.28	X	Assembly procedure for stairs and platforms (as per NI-293 item 5.1.3) – Note 5		I	I	45	10	10	10
9.1.29	X	Operation and/or Maintenance Instruction Manual – Note 3			I	I	45	10	10
9.1.30	X	Technical Manufacturing Documentation Book (as per NI-268 item 5.4) – Note 3			I				

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9.2 VESSELS

item		DESCRIPTION	QUANTITY			DEADLINE (*)			
			WITH PROPOSAL	FOR COMMENTS	CERTIFIED ORIGINALS	SUBMISSION (CONTRACT (DAYS)	COMMENTS (DAYS FROM RECEIPT)	REVISION (DAYS FROM RECEIPT)	DELIVERY OF ORIGINALS (DAYS FROM APPROVAL)
9.2.1	X	Load diagram on foundations with positioning of anchor bolts		I	I	45	10	10	10
9.2.2	X	Mechanical Design Drawing (as per item 5 of NI-266)		I	I+E	45	10	10	10
9.2.3	X	Manufacturing Design Drawing (as per item 6 of NI-266)		I	I+E	45	10	10	10
9.2.4	X	Shell, Heads, and Skirt Layout Drawing, with Location of Weld Lines, Nozzles, External and Internal Accessories		I	I+E	45	10	10	10
9.2.5	X	Nameplate		I	I+E	45	10	10	10
9.2.6	X	Spare Parts Lists			I				
9.2.7	X	Manufacturing Documents (as per NI-268 item 5.2) – Note 1		I	I	45	10	10	10
9.2.8	X	Technical Documents (as per NI-268 item 5.3) – Note 2		I	I	45	10	10	10
9.2.9	X	Mechanical Calculation Reports		I	I	45	10	10	10
9.2.10	X	Stress Verification Due to Localized Loads and Reactions on Nozzles		I	I	45	10	10	10
9.2.11	X	Painting Application Procedure *(as per N-13 item 4.2) – Note 7*		I	I	45	10	10	10
9.2.12	X	Documentation in accordance with NR-13 requirements – Note 3		I	I	45	10	10	10

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9.3 INSTRUMENTATION / ELECTRICAL

ITEM		DESCRIPTION	QUANTITY			DEADLINE (*)			
			WITH PROPOSAL	FOR COMMENTS	CERTIFIED ORIGINALS	SUBMISSION (CONTRACT DAYS)	COMMENTS (DAYS FROM RECEIPT)	REVISION (DAYS FROM RECEIPT)	DELIVERY OF ORIGINALS (DAYS FROM APPROVAL)
9.3.1	X	Instrument list *(*Shut-off valves, pressure gauges, thermometers, etc.*)*	I	I	I	45	10	10	10
9.3.2	X	Data Sheet for instruments and valves		I	I+E	45	10	10	10
9.3.3	X	Calculation Report – Control Valves		I	I	45	10	10	10
9.3.4	X	Calculation Report – Safety Valves		I	I	45	10	10	10
9.3.5	X	Calculation Report – Primary Flow Elements		I	I	45	10	10	10
9.3.6		Resonance Frequency Calculation Report according to ASME PTC 19.3							
9.3.7	X	Interconnection Diagram		I	I	45	10	10	10
9.3.8	X	Loop Diagram		I	I	45	10	10	10
9.3.9		Fieldbus Foundation Network Segment Diagram							
9.3.10		Cause and Effect Diagram							
9.3.11	X	Logic Diagram		I	I	45	10	10	10
9.3.12		H1 Segment Calculation Report							
9.3.13	X	Typical Installation Details: Electrical, Pneumatic, Process, and Assembly		I	I	45	10	10	10
9.3.14	X	Electrical Instrumentation Layout		I	I	45	10	10	10
9.3.15	X	Pneumatic Instrumentation Layout		I	I	45	10	10	10
9.3.16	X	Control Panel Assembly Drawing		I	I+E	45	10	10	10
9.3.17	X	Control System Architecture Drawing		I	I+E	45	10	10	10

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9.3.18	X	Junction Box Drawing		I	I+E	45	10	10	10
9.3.19	X	Electrical Panel Assembly Drawing		I	I+E	45	10	10	10
9.3.20	X	Installation Materials List		I	I	45	10	10	10
9.3.21	X	Material Requisition for Installation			I				
9.3.22	X	Input and Output List		I	I	45	10	10	10
9.3.23	X	Cable List		I	I	45	10	10	10
9.3.24	X	Communication / Database List		I	I	45	10	10	10
9.3.25	X	Electrical Load List		I	I	45	10	10	10
9.3.26	X	PES (PLC) Loading List		I	I	45	10	10	10
9.3.27	X	Alarm Setpoint List		I	I	45	10	10	10
9.3.28	X	INMETRO Certificates			I				
9.3.29	X	Calibration Certificates			I				
9.3.30	X	Calibration, Testing, and Maintenance Instructions			I				
9.3.31	X	Instrument Catalogs	I		I				

(*) Deadlines in business days

Notes:

1. Inspection and Test Plans, Welding Plans, and other manufacturing documents, in accordance with PETROBRAS standards N-268 (item 5.2) and N-2301, shall be submitted for approval along with the manufacturing drawings.

2. Technical documents, in accordance with PETROBRAS standards N-268 (item 5.3) and N-2301, shall be submitted to the inspector for verification at the factory before the start of the corresponding activity begins.

3. The Installation, Operation, and Maintenance Instruction Manual and the Technical Manufacturing Documentation Book *(Data Book)* shall be attached upon equipment delivery.

4. The Manufacturing Procedure for Stairs and Platforms, in accordance with PETROBRAS standard N-293 (items 5.1.2 and 5.1.5), shall be submitted for approval together with the manufacturing drawings.

5. The Field Assembly Procedure for structures, stairs, and platforms, in accordance with PETROBRAS standard NI-293 (item 5.1.3), shall be submitted for approval together with the manufacturing drawings.

6. The Field Assembly Procedure, in accordance with PETROBRAS standard NI-269 (item 4.2), shall be submitted for approval together with the manufacturing drawings.

7. The Painting Procedure, in accordance with PETROBRAS standard N-13 (item 4.2), shall be submitted for approval together with the manufacturing drawings.

8. Project documents shall be prepared electronically using the following software:

Drawings: “AUTOCAD”, latest version;

Texts: “MS-WORD”, latest version;

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Spreadsheets: “MS-EXCEL”, latest version.

9. The language to be used in the documents shall be Portuguese; English is accepted only for documents related to imported equipment, except for the Nameplate and the Operation, Installation, and Maintenance Manuals, which shall be in Portuguese.

10 TECHNICAL PROPOSAL SUBMISSION

The technical proposal must have an explicit statement that meets the requirements of all items of the respective Material Requisition (number and revision quoted) and its annexes, complemented by the Technical Clarification Circular Letters (number quoted), including the scope of supply, without any technical deviation.

Any exclusion and/or alternative to what is specified in the Purchase Specification and its annexes will only be accepted by PETROBRAS during the clarification phase, preceding the proposal presentation, through Technical Clarification Circular Letters.

The bidder shall confirm full compliance with all notes in document FD-5250.00-22313-561-PEI-401.

In addition to the Compliance Declaration requested in item 10.1 above, the bidder shall submit the following documents along with the technical proposal, in addition to those required in item 9 of this RM:

- Supply Schedule
- Catalog
- Preliminary System Flow Diagram
- Preliminary General Arrangement Drawing
- Document Index
- List of Deviations

10.1 BID EVALUATION TECHNICAL CRITERIA

The proposal shall specify the total volume of backwash consumed in filter cleaning.

Considering that the filtration system is composed of multiple individual filters, the total backwash volume shall be defined as the sum of the volumes required for the individual backwashing of all the filter units that make up the system. **The total daily volume consumed in backwashing should be limited to 3.0 (three) m³/day. Technical proposals that exceed the limit established above will not be accepted.**

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11 ADDITIONAL REQUIREMENTS

11.1 The mechanical design shall be carried out by the manufacturer, who will be responsible for the final sizing of the equipment, in accordance with the applicable Codes and Standards listed in this Material Requisition and its attachments.

11.2 Wind loads on vertical vessels shall be calculated using the Brazilian Standard NBR-6123.

11.3 Wind loads on platforms, stairs, piping, and other accessories attached to the vessel shell shall be included in the total wind load acting on the vessel. An approximate method that accounts for these loads may be used, provided it is submitted for approval.

11.4 Stress Relief Heat Treatment

For equipment requiring heat treatment, materials, welding consumables, and welding procedures shall be specified and qualified to include all necessary treatments for manufacturing, plus an additional treatment to allow for future weld repairs. This extra treatment will be performed by PETROBRAS if needed, using the same parameters (soak time, temperature, etc.) as those used during manufacturing.

11.5 The supplier is responsible for detailed engineering. In case of conflict between licensors' basic design requirements and PETROBRAS specifications, the stricter requirement shall be followed. If clarification is needed, PETROBRAS shall be consulted.

11.6 In front of manways, platforms shall ensure a clear space that allows full opening (180°) without interference from stairs or instruments.

11.7 Instruments and valves shall be suitable for classified areas. Classification: Zone 2, Group IIC, Temperature Class T3.

11.8 The system shall be mounted on a **metal skid** capable of safely supporting all components under operating conditions.

11.9 The noise level of the system shall not exceed **82 dBA**, measured at a distance of 1 meter from the equipment.

11.10 **Asbestos-containing products** will not be accepted.

11.11 The supply shall include **Data Sheets (FDs)** with all information and characteristics of the components, as well as a **unit flow diagram**.

11.12 All external surfaces of skid components shall be suitable for chemical environments, humidity, and manual cleaning without damage. Surfaces shall not allow liquid accumulation;

11.13 The skid shall be designed for handling by **cranes and/or hoists**.

11.14 Each system shall be **operationally tested** by the supplier before shipment.

11.15 The layout shall allow **easy visual inspection, access, removal, and reinstallation** of all components.

11.16 The layout shall be **ergonomically designed**; the operator shall have access to all manual valves and instrumentation. Access platforms or stairs shall be provided when necessary, and the operation panel shall be conveniently located.

11.17 The system shall allow **complete drainage**.

11.18 The supplier shall assemble all equipment, valves, piping, instrumentation, and electrical components according to the respective manufacturers' instructions.

11.19 Where possible, equipment shall be fixed to the skid using **easily removable devices**.

11.20 The skid will be installed in an **outdoor location**.

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11.21 The proposal shall clearly indicate the number of **filter housings** in the backwash system, describe the system operation, including backwash procedure, fluid used, disposal requirements, and whether a second fluid is needed for occasional cleaning of filter elements.

11.22 Backwash filters shall be operated via a **Remote Control Panel** installed in local control house. The connection between the junction box at the skid battery limit and the Remote Control Panel is **not included in the scope of supply**.

11.23. The bidder shall inform the **utility consumption** required for proper operation and cleaning of the system.

11.24 The system shall be suitable for **steam cleaning operations**.

11.25 For **anchor bolt sizing**, the following recommendations shall be followed:

- For calculation purposes, the effective area shall be the smaller of the root area (threaded part) and the corroded area (external diameter minus corrosion allowance);

- Corrosion allowance: 2.0 mm on the radius;

- Material: ASTM A-307 Gr.C (currently ASTM F-1554 Gr.36);

- Allowable stress: 1054 kgf/cm².

11.26 The use of screws, studs, and threaded rods in ASTM A193 and nuts in ASTM A194 coated with "Zn-Ni, Cadmium, Bichromate, or Galvanizing" is prohibited due to the risk of liquid metal-induced embrittlement, in which Zn or Cd from the coating diffuses into the metallurgical grain boundaries due to the low melting point, or hydrogen embrittlement, when dehydrogenation heat treatments are not performed.

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